The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
cemc.uwaterloo.ca

Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 17, 2023
(in North America and South America)

Thursday, May 18, 2023
(outside of North America and South America)

Time: 1 hour

Calculating devices are allowed, provided that they do not have any of the following features: (i) internet access, (ii) the ability to communicate with other devices, (iii) information previously stored by students (such as formulas, programs, notes, etc.), (iv) a computer algebra system, (v) dynamic geometry software.

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2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
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   There is *no penalty* for an incorrect answer.
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6. Diagrams are *not* drawn to scale. They are intended as aids only.
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The name, school and location of some top-scoring students will be published on the website, cemc.uwaterloo.ca. On this website, you will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

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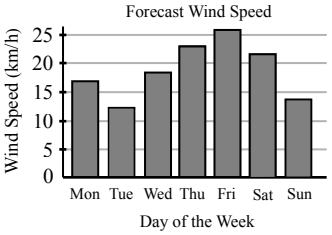
Part A: Each correct answer is worth 5.

1. Which of the following numbers is equivalent to the fraction $\frac{1}{4}$?

   (A) 0.5 **(B)** 0.25 **(C)** 4.0 **(D)** 0.14 **(E)** 2.5

2. The graph shows the forecast wind speed (in km/h) during a 7-day period. Jack can sail alone only when the forecast wind speed is less than 20 km/h. During this 7-day period, on how many days will Jack be able to sail alone?



   (A) 4 **(B)** 6 **(C)** 1
   (D) 2 **(E)** 5

3. Which of the following numbers is *not* a multiple of 15?

   (A) 150 **(B)** 25 **(C)** 30 **(D)** 45 **(E)** 60

4. If the integers $-7, 10, 9, 0, -9$ are ordered from least to greatest, what is the third integer in the list?

   (A) -7 **(B)** 10 **(C)** 9 **(D)** 0 **(E)** -9

5. If $2n = 14$, the value of $10n$ is

   (A) 14 **(B)** 140 **(C)** 70 **(D)** 28 **(E)** 56

6. Tallulah is playing a game in which she rolls a single standard die once. If the number rolled is $1, 2, 3$, or 4, then she wins. If the number rolled is 5 or 6, then she loses. What is the probability that she loses?

   (A) $\frac{1}{3}$ **(B)** $\frac{5}{6}$ **(C)** $\frac{1}{2}$ **(D)** $\frac{1}{6}$ **(E)** $\frac{11}{12}$

7. In the addition shown, P and Q are each equal to a digit. The value of $P + Q$ is

$$\begin{array}{rr} & 1\,0\,1\,3 \\ + & P\,Q\,P\,Q \\ \hline & 2\,0\,2\,3 \end{array}$$

   (A) 4 **(B)** 1 **(C)** 0
   (D) 3 **(E)** 5

8. In a salad dressing, the ratio of oil to vinegar is 3 : 1. To make the dressing more acidic, the amount of vinegar is doubled. What is the new ratio of oil to vinegar?

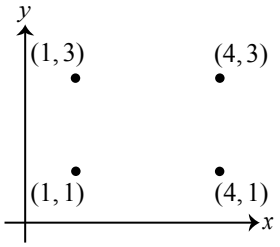
   (A) 3 : 2 **(B)** 6 : 1 **(C)** 1 : 3 **(D)** 2 : 3 **(E)** 4 : 3

9. A grocery receipt shows the cost of three items before tax is added. A 5% tax is added to the cost of the items. The total cost of the three items, including tax, is

Sponge	\$4.20
Shampoo	\$7.60
Soap	\$3.20

   (A) \$15.16 **(B)** \$15.08 **(C)** \$15.22
   (D) \$15.75 **(E)** \$15.38

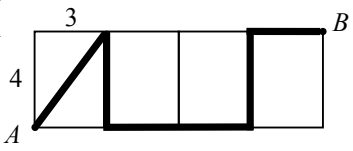
10. The vertices of a rectangle have coordinates $(1, 3)$, $(1, 1)$, $(4, 1)$, and $(4, 3)$, as shown. If the rectangle is reflected in the y-axis, which of the following points is *not* a vertex of the reflected rectangle?



(A) $(-1, 1)$ **(B)** $(-4, 1)$ **(C)** $(-3, 4)$
(D) $(-1, 3)$ **(E)** $(-4, 3)$

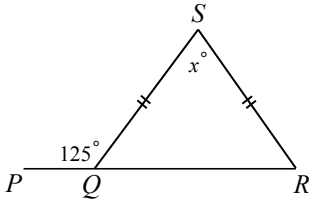
Part B: Each correct answer is worth 6.

11. The diagram is made up of four congruent rectangles with dimensions 3 by 4. What is the length of the path from A to B shown on the diagram?



(A) 22 **(B)** 21 **(C)** 19
(D) 20 **(E)** 23

12. In the diagram, PQR is a line segment, $\angle PQS = 125°$, $\angle QSR = x°$, and $SQ = SR$. What is the value of x?



(A) 60 **(B)** 70 **(C)** 80
(D) 110 **(E)** 125

13. When attempting to arrange a pile of peaches into groups of threes, there are two peaches not in a group of three. Which of the following choices could be the number of peaches in the original pile?

(A) 19 **(B)** 49 **(C)** 33 **(D)** 29 **(E)** 61

14. A list of 5 integers repeats to form the pattern:

$$4, -3, 2, -1, 0, 4, -3, 2, -1, 0, \ldots$$

What is the sum of the first 23 integers?

(A) 3 **(B)** 8 **(C)** 10 **(D)** 11 **(E)** 13

15. Bindu's bike tires have a radius of 30 cm. She rides her bike far enough that the tires rotate exactly five times. How far does Bindu's bike travel?

(A) 60π cm **(B)** 30π cm **(C)** 900π cm **(D)** 300π cm **(E)** 150π cm

16. The numbers 41, 35, 19, 9, 26, 45, 13, 28 are arranged in pairs so that the sum of the numbers in each pair is the same. The number paired with 13 is

(A) 45 **(B)** 28 **(C)** 35 **(D)** 26 **(E)** 41

17. For 30 consecutive days, the daily high temperature was recorded. On each of the first 25 days, the temperature recorded was 21°C. On each of the remaining 5 days, the temperature recorded was 15°C. For the 30 days, the mean (average) of the temperatures recorded was

(A) 17°C **(B)** 19°C **(C)** 20°C **(D)** 16°C **(E)** 18°C

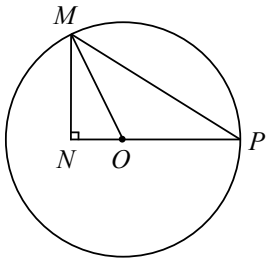
18. The product of a pair of 2-digit positive integers is 630. How many such pairs are there?
(A) 2 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6

19. At 9 a.m., Ryan had finished cutting $\frac{1}{2}$ of his lawn. At 10 a.m., he had finished cutting $\frac{7}{8}$ of his lawn. If Ryan cut his lawn at a constant rate, at what time did he finish?
(A) 10:15 a.m. **(B)** 11:20 a.m. **(C)** 10:20 a.m. **(D)** 10:30 a.m. **(E)** 11:40 a.m.

20. A 4×4 grid is to be covered with 16 square tiles. There are four tiles in each of the colours red, black, green, and yellow. Each row must contain one tile of each colour. Each pair of tiles that touch along a side or at a corner must have different colours. In how many different ways can these tiles be arranged?
(A) 256 **(B)** 24 **(C)** 120 **(D)** 576 **(E)** 64

Part C: Each correct answer is worth 8.

21. In the diagram, O is the centre of a circle with radius 87, and P and M lie on the circle. N is positioned inside the circle so that PN passes through O and is perpendicular to MN. If $MN = 63$, what is the area of $\triangle PMN$?
(A) 3370.5 **(B)** 3496.5 **(C)** 4725.0
(D) 4630.5 **(E)** 4126.5



22. It took Nasrin two hours and thirty minutes to canoe the 4.5 km into her camp. Paddling much faster, the return trip took her $\frac{1}{3}$ of the time. What was Nasrin's mean (average) speed as she paddled to camp and back?
(A) 1.25 km/h **(B)** 3.96 km/h **(C)** 1.8 km/h **(D)** 1.95 km/h **(E)** 2.7 km/h

23. Each of two cylinders sits on one of their circular faces on a flat surface. Cylinder A, with radius 6 cm and height 50 cm, is empty. Cylinder B, with radius 8 cm and height 50 cm, is full of water. After pouring some water from Cylinder B into Cylinder A, the height of the water in both cylinders is the same. What is the height of the water? (The volume of a cylinder with radius r and height h is $\pi r^2 h$.)
(A) 28.1 cm **(B)** 25.0 cm **(C)** 32.0 cm **(D)** 44.4 cm **(E)** 28.6 cm

24. The number of pairs of integers a and b with $a < b$ and $a + b < 100$ satisfying the equation $\dfrac{a}{4} + \dfrac{b}{10} = 7$ is
(A) 10 **(B)** 19 **(C)** 9 **(D)** 20 **(E)** 15

25. Given the list $2, 3, 4, 5$, there are exactly three different ways to choose three integers from the list and form a triangle whose side lengths are equal to those integers. The integers chosen could be $2, 3, 4$ or $2, 4, 5$ or $3, 4, 5$. The integers $2, 3, 5$ cannot be used as side lengths of a triangle. Given the list $4, 10, 3, n, 13$, there are exactly four different ways to choose three integers from the list and form a triangle whose side lengths are equal to those integers. If n is different from all other numbers in the list, then the sum of all possible values of n is
(A) 46 **(B)** 29 **(C)** 69 **(D)** 23 **(E)** 17

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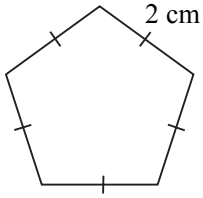
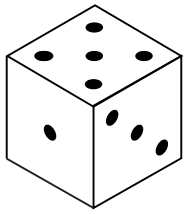
1. The regular pentagon shown has a side length of 2 cm. The perimeter of the pentagon is



(A) 2 cm **(B)** 4 cm **(C)** 6 cm
(D) 8 cm **(E)** 10 cm

2. The faces of a cube are labelled with 1, 2, 3, 4, 5, and 6 dots. Three of the faces are shown. What is the total number of dots on the other three faces?

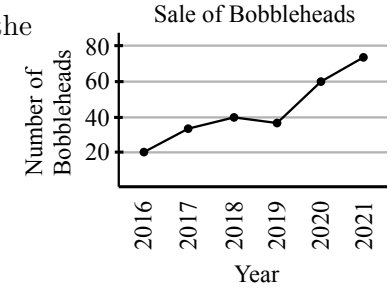


(A) 6 **(B)** 8 **(C)** 10
(D) 12 **(E)** 15

3. The equation that best represents "a number increased by five equals 15" is

(A) $n - 5 = 15$ **(B)** $n \div 5 = 15$ **(C)** $n + 5 = 15$
(D) $n + 15 = 5$ **(E)** $n \times 5 = 15$

4. The line graph shows the number of bobbleheads sold at a store each year. The sale of bobbleheads increased the most between

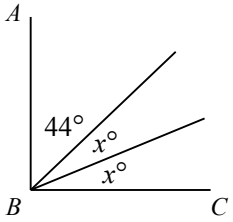


(A) 2016 and 2017
(B) 2017 and 2018
(C) 2018 and 2019
(D) 2019 and 2020
(E) 2020 and 2021

5. Starting at 72, Aryana counts down by 11s: $72, 61, 50, \ldots$. What is the last number greater than 0 that Aryana will count?

(A) 4 **(B)** 5 **(C)** 6 **(D)** 7 **(E)** 8

6. In the diagram, $\angle ABC = 90°$. The value of x is



(A) 68 **(B)** 23 **(C)** 56
(D) 28 **(E)** 26

7. Which of the following values is closest to zero?

(A) -1 **(B)** $\frac{5}{4}$ **(C)** 1^2 **(D)** $-\frac{4}{5}$ **(E)** 0.9

8. A jar contains 267 quarters. One quarter is worth \$0.25. How many quarters must be added to the jar so that the total value of the quarters is \$100.00?

(A) 33 **(B)** 53 **(C)** 103 **(D)** 133 **(E)** 153

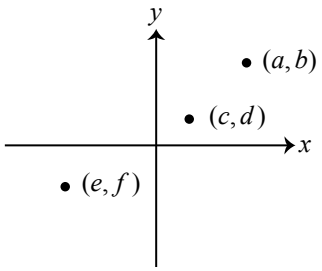
9. A package of 8 greeting cards comes with 10 envelopes. Kirra has 7 cards but no envelopes. What is the smallest number of packages that Kirra needs to buy to have more envelopes than cards?

(A) 3 **(B)** 4 **(C)** 5 **(D)** 6 **(E)** 7

10. For the points in the diagram, which statement is true?

(A) $e > c$ **(B)** $b < d$ **(C)** $f > b$

(D) $a < e$ **(E)** $a > c$



Part B: Each correct answer is worth 6.

11. The 26 letters of the English alphabet are listed in an infinite, repeating loop:
$ABCDEFGHIJKLMNOPQRSTUVWXYZABC\ldots$
What is the 258^{th} letter in this sequence?

(A) V **(B)** W **(C)** X **(D)** Y **(E)** Z

12. A public holiday is always celebrated on the third Wednesday of a certain month. In that month, the holiday cannot occur on which of the following days?

(A) 16^{th} **(B)** 22^{nd} **(C)** 18^{th} **(D)** 19^{th} **(E)** 21^{st}

13. A circular spinner is divided into three sections. An arrow is attached to the centre of the spinner. The arrow is spun once. The probability that the arrow stops on the largest section is 50%. The probability it stops on the next largest section is 1 in 3. The probability it stops on the smallest section is

(A) $\frac{1}{4}$ **(B)** $\frac{2}{5}$ **(C)** $\frac{1}{6}$ **(D)** $\frac{2}{7}$ **(E)** $\frac{3}{10}$

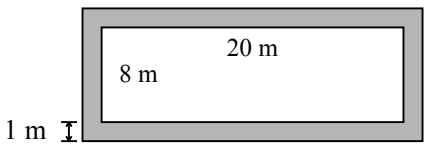
14. A positive number is divisible by both 3 and 4. The tens digit is greater than the ones digit. How many positive two-digit numbers have this property?

(A) 4 **(B)** 5 **(C)** 6 **(D)** 7 **(E)** 8

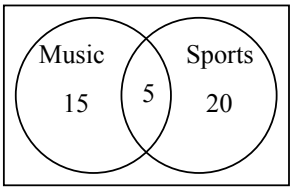
15. A rectangular pool measures 20 m by 8 m. There is a 1 m wide walkway around the outside of the pool, as shown by the shaded region. The area of the walkway is

(A) 56 m^2 **(B)** 60 m^2 **(C)** 29 m^2

(D) 52 m^2 **(E)** 50 m^2



16. The results of asking 50 students if they participate in music or sports are shown in the Venn diagram. What percentage of the 50 students do not participate in music and do not participate in sports?



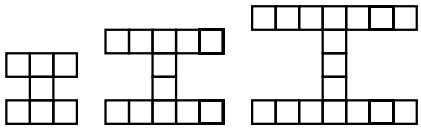
(A) 0% **(B)** 80% **(C)** 20%
(D) 70% **(E)** 40%

17. There are $\frac{2}{3}$ as many golf balls in Bin F as in Bin G. If there are a total of 150 golf balls, how many fewer golf balls are in Bin F than in Bin G?

(A) 15 **(B)** 30 **(C)** 50 **(D)** 60 **(E)** 90

18. In the sequence shown, Figure 1 is formed using 7 squares. Each figure after Figure 1 has 5 more squares than the previous figure. What figure has 2022 squares?

(A) Figure 400 **(B)** Figure 402 **(C)** Figure 404
(D) Figure 406 **(E)** Figure 408



19. Mateo's 300 km trip from Edmonton to Calgary passed through Red Deer. Mateo started in Edmonton at 7 a.m. and drove until stopping for a 40 minute break in Red Deer. Mateo arrived in Calgary at 11 a.m. Not including the break, what was his average speed for the trip?

(A) 83 km/h **(B)** 94 km/h **(C)** 90 km/h **(D)** 95 km/h **(E)** 64 km/h

20. Equilateral triangle ABC has sides of length 4. The midpoint of BC is D, and the midpoint of AD is E. The value of EC^2 is

(A) 7 **(B)** 6 **(C)** 6.25 **(D)** 8 **(E)** 10

Part C: Each correct answer is worth 8.

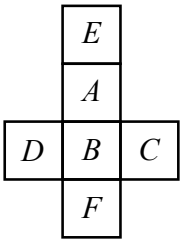
21. The positive factors of 6 are 1, 2, 3, and 6. There are two perfect squares less than 100 that have exactly five positive factors. What is the sum of these two perfect squares?

(A) 177 **(B)** 80 **(C)** 145 **(D)** 52 **(E)** 97

22. In the list p, q, r, s, t, u, v, each letter represents a positive integer. The sum of the values of each group of three consecutive letters in the list is 35. If $q + u = 15$, then $p + q + r + s + t + u + v$ is

(A) 85 **(B)** 70 **(C)** 80 **(D)** 90 **(E)** 75

23. The net shown is folded to form a cube. An ant walks from face to face on the cube, visiting each face exactly once. For example, $ABCFED$ and $ABCEFD$ are two possible orders of faces the ant visits. If the ant starts at A, how many possible orders are there?



(A) 24 **(B)** 48 **(C)** 32

(D) 30 **(E)** 40

24. The number 385 is an example of a three-digit number for which one of the digits is the sum of the other two digits. How many numbers between 100 and 999 have this property?

(A) 144 **(B)** 126 **(C)** 108 **(D)** 234 **(E)** 64

25. Student A, Student B, and Student C have been hired to help scientists develop a new flavour of juice. There are 4200 samples to test. Each sample either contains blueberry or does not. Each student is asked to taste each sample and report whether or not they think it contains blueberry. Student A reports correctly on exactly 90% of the samples containing blueberry and reports correctly on exactly 88% of the samples that do not contain blueberry. The results for all three students are shown below.

	Student A	Student B	Student C
Percentage correct on samples containing blueberry	90%	98%	$(2m)\%$
Percentage correct on samples not containing blueberry	88%	86%	$(4m)\%$

Student B reports 315 more samples as containing blueberry than Student A. For some positive integers m, the total number of samples that the three students report as containing blueberry is equal to a multiple of 5 between 8000 and 9000. The sum of all such values of m is

(A) 45 **(B)** 36 **(C)** 24 **(D)** 27 **(E)** 29

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1. The value of $999 + 999$ is

   (A) 2999 **(B)** 181 818 **(C)** 1998 **(D)** 999 999 **(E)** 198

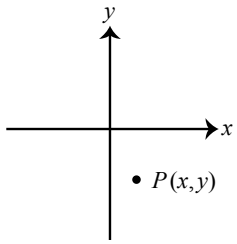
2. The perimeter of an equilateral triangle is 15 m. What is the length of each side of the triangle?

   (A) 7.5 m **(B)** 5 m **(C)** 3.75 m **(D)** 10 m **(E)** 17 m

3. What is the greatest multiple of 4 that is less than 100?

   (A) 99 **(B)** 96 **(C)** 97 **(D)** 98 **(E)** 94

4. In the graph shown, which of the following statements is true about the coordinates of the point $P(x, y)$?

   (A) The values of both x and y are positive.
   (B) The value of x is positive and the value of y is negative.
   (C) The value of x is negative and the value of y is positive.
   (D) The values of both x and y are negative.
   (E) The value of x is 0 and the value of y is negative.

5. If $x = -6$, which of the following is greatest in value?

   (A) $2 + x$ **(B)** $2 - x$ **(C)** $x - 1$ **(D)** x **(E)** $x \div 2$

6. A water fountain flows at a steady rate of 500 mL every 6 seconds. At this rate, how long will it take to fill a 250 mL bottle?

   (A) 2 s **(B)** 9 s **(C)** 3 s **(D)** 6 s **(E)** 1 s

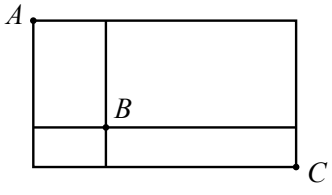
7. The number 17 is an example of a prime number that remains prime when you reverse its digits (that is, 71 is also prime). Which of the following prime numbers also has this property?

   (A) 29 **(B)** 53 **(C)** 23 **(D)** 13 **(E)** 41

8. Initially, there are 5 red beans and 9 black beans in a bag. Then, 3 red beans and 3 black beans are added to the bag. If one bean is randomly chosen from the bag, what is the probability that this bean is red?

   (A) $\frac{3}{8}$ **(B)** $\frac{2}{5}$ **(C)** $\frac{4}{5}$ **(D)** $\frac{5}{8}$ **(E)** $\frac{8}{17}$

9. An ant begins its path at A, travels only right or down, and remains on the line segments shown. The number of different paths from A to C that pass through B is

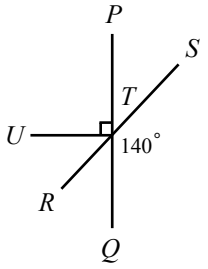
   (A) 2 **(B)** 3 **(C)** 4
   (D) 5 **(E)** 6

10. The digits of 2021 can be rearranged to form other four-digit whole numbers between 1000 and 3000. What is the largest possible differerence between two such four-digit whole numbers?

    (A) 1188 **(B)** 1098 **(C)** 1080 **(D)** 2088 **(E)** 999

Part B: Each correct answer is worth 6.

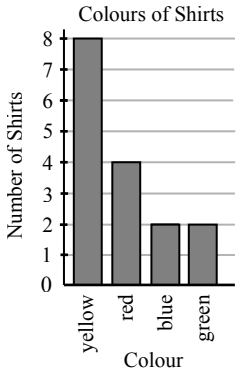
11. In the diagram, PQ and RS intersect at T. If $\angle STQ = 140°$ and $\angle PTU = 90°$, what is the measure of $\angle RTU$?

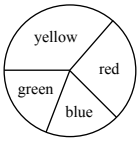


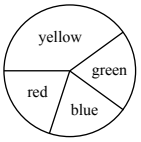
(A) 30° **(B)** 90° **(C)** 50°
(D) 40° **(E)** 140°

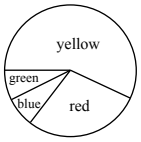
12. Which of the following is the sum of three consecutive integers?
(A) 17 **(B)** 11 **(C)** 25 **(D)** 21 **(E)** 8

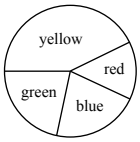
13. Which of the following circle graphs best represents the information in the bar graph shown?

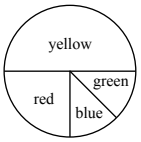


(A)


(B)


(C)


(D)


(E)


14. A whole number has exactly 6 positive factors. One of its factors is 16. Which of the following could this number be?
(A) 16 **(B)** 32 **(C)** 6 **(D)** 49 **(E)** 48

15. The measures of a triangle's three interior angles are in the ratio $1 : 4 : 7$. What are the measures of the angles?
(A) $12°, 48°, 120°$ **(B)** $10°, 40°, 70°$ **(C)** $20°, 25°, 155°$
(D) $15°, 60°, 105°$ **(E)** $14°, 56°, 110°$

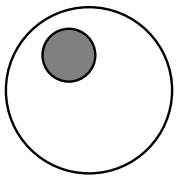
16. The seven numbers $1, 2, 5, 10, 25, 50, 100$ repeat to form the following pattern

$$1, 2, 5, 10, 25, 50, 100, 1, 2, 5, 10, 25, 50, 100, \ldots$$

What is the sum of the 18^{th} and the 75^{th} numbers in the pattern?
(A) 110 **(B)** 11 **(C)** 27 **(D)** 7 **(E)** 35

17. Gaussville's soccer team won 40% of their first 40 games. They went on to win n games in a row. At this point, they had won 50% of the total games they had played. What is the value of n?
(A) 4 **(B)** 10 **(C)** 12 **(D)** 8 **(E)** 9

18. In the diagram, the radius of the larger circle is 3 times the radius of the smaller circle. What fraction of the area of the larger circle is not shaded?



(A) $\frac{8}{9}$ **(B)** $\frac{2}{3}$ **(C)** $\frac{5}{6}$
(D) $\frac{7}{9}$ **(E)** $\frac{1}{3}$

19. Asima and Nile each think of an integer greater than 0. Each of them performs the following operations on their integer: they double it, then subtract 10, and then multiply it by 4. The sum of their results is 440. How many possibilities are there for Asima's original integer?

(A) 64 **(B)** 44 **(C)** 65 **(D)** 45 **(E)** 66

20. Ruby and Sam each roll a fair 6-sided die with the numbers $1, 2, 3, 4, 5$, and 6 on its faces. Sam subtracts the number on his roll from the number on Ruby's roll. What is the probability that the result is a negative number?

(A) $\frac{5}{18}$ **(B)** $\frac{5}{12}$ **(C)** $\frac{7}{12}$ **(D)** $\frac{1}{2}$ **(E)** $\frac{5}{6}$

Part C: Each correct answer is worth 8.

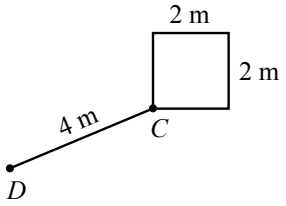
21. When evaluated, the sum of the digits of the integer equal to $10^{2021} - 2021$ is

(A) 18 194 **(B)** 18 176 **(C)** 18 167 **(D)** 18 153 **(E)** 18 185

22. The prime numbers 23 and 29 are *consecutive prime numbers* since 29 is the smallest prime number that is greater than the prime number 23. How many positive integers less than 900 can be written as a product of two or more consecutive prime numbers?

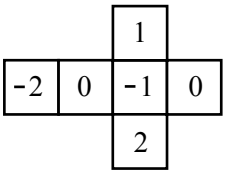
(A) 14 **(B)** 13 **(C)** 11 **(D)** 12 **(E)** 15

23. A dog's leash is 4 m long and is attached to the corner of a 2 m $\times$ 2 m square doghouse at C, as shown. The dog is attached to the other end of the leash, at D. What is the area outside of the doghouse in which the dog can play?



(A) 14π m^2 **(B)** 16π m^2 **(C)** 20π m^2
(D) 15π m^2 **(E)** 24π m^2

24. Jonas builds a large $n \times n \times n$ cube using $1 \times 1 \times 1$ cubes each having the net shown. What is the smallest value of n for which the sum of the exterior faces of the $n \times n \times n$ cube can be greater than 1500?



(A) 9 **(B)** 11 **(C)** 12
(D) 13 **(E)** 16

25. Square $PQRS$ has sides of length 8. It is split into four rectangular regions by two line segments, one parallel to PQ and another parallel to QR. There are N ways in which these lines can be drawn so that the area of each of the four rectangular regions is a positive integer. What is the remainder when N^2 is divided by 100?

(A) 9 **(B)** 61 **(C)** 1 **(D)** 41 **(E)** 36

The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 13, 2020
(in North America and South America)

Thursday, May 14, 2020
(outside of North America and South America)

Time: 1 hour

Calculating devices are allowed, provided that they do not have any of the following features: (i) internet access, (ii) the ability to communicate with other devices, (iii) information previously stored by students (such as formulas, programs, notes, etc.), (iv) a computer algebra system, (v) dynamic geometry software.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

The name, school and location of some top-scoring students will be published on the Web site, cemc.uwaterloo.ca. On this website, you will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. How many of the numbers in the list $0.03, 1.5, -0.2, 0.76$ are less than 1?

   (A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

2. The total cost of 4 one-litre cartons of milk is \$4.88. The cost of 1 one-litre carton of milk is

   (A) \$0.88 **(B)** \$1.44 **(C)** \$1.88 **(D)** \$4.22 **(E)** \$1.22

3. Which of the following is equal to a whole number?

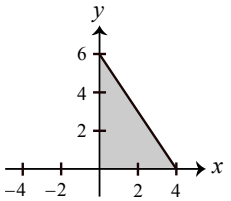
   (A) $\frac{8}{6}$ **(B)** $\frac{9}{5}$ **(C)** $\frac{10}{4}$ **(D)** $\frac{11}{3}$ **(E)** $\frac{12}{2}$

4. If $x = 4$ and $x + y = 0$, what is the value of y?

   (A) 0 **(B)** -2 **(C)** -3 **(D)** -1 **(E)** -4

5. A line segment is drawn joining the points $(0, 6)$ and $(4, 0)$, as shown. The area of the shaded triangle is

   (A) 12 **(B)** 5 **(C)** 18
   (D) 10 **(E)** 48



6. A perfect square is a whole number whose square root is also a whole number. For example, 144 is a perfect square since its square root is 12. How many perfect squares are there between 2 and 20?

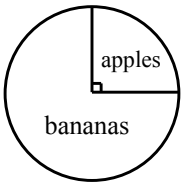
   (A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

7. Yvon has 4 different notebooks and 5 different pens. He must bring exactly one notebook and exactly one pen to his class. How many different possible combinations of notebooks and pens could he bring?

   (A) 9 **(B)** 16 **(C)** 20 **(D)** 10 **(E)** 5

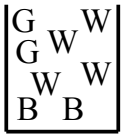
8. In the pie chart shown, 168 students chose bananas as their favourite fruit. How many students chose apples as their favourite fruit?

   (A) 42 **(B)** 56 **(C)** 48
   (D) 60 **(E)** 38



9. A bag contains letters as shown. Elina randomly chooses one of the letters from the bag. What is the probability that Elina chooses a B?

   (A) $\frac{1}{4}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{4}{3}$
   (D) $\frac{3}{4}$ **(E)** $\frac{1}{8}$



10. Vita picks a number from 1 to 10. Balil adds 5 to this number and calls his result b. Cali subtracts 5 from Vita's number and calls her result c. The value of $b - c$ is

    (A) 25 **(B)** -10 **(C)** 0 **(D)** 5 **(E)** 10

Part B: Each correct answer is worth 6.

11. Each Tuesday, a bus makes its first stop at Gauss Public Library at 1 p.m. It continues to stop at the library every 20 minutes. Its last stop is at 6 p.m. What is the total number of times that the bus stops at Gauss Public Library on a Tuesday?

(A) 16 **(B)** 14 **(C)** 10 **(D)** 20 **(E)** 18

12. In the addition shown, each of P, Q and R is a digit.

$$\begin{array}{r} PQR \\ +\quad QR \\ \hline 1012 \end{array}$$

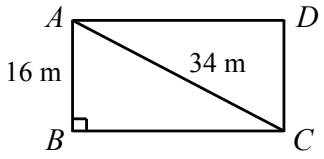
The value of $P + Q + R$ is

(A) 12 **(B)** 15 **(C)** 13 **(D)** 22 **(E)** 20

13. Emil and Olivia ran a race. Their race times totalled 1 hour 52 minutes. If Emil's time was 4 minutes less than Olivia's time, how many minutes did it take Olivia to run the race?

(A) 78 **(B)** 56 **(C)** 58 **(D)** 74 **(E)** 55

14. Rectangle $ABCD$ has side length $AB = 16$ m and diagonal length $AC = 34$ m, as shown. The perimeter of rectangle $ABCD$ is

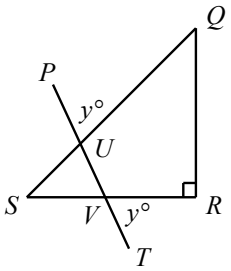


(A) 46 m **(B)** 126 m **(C)** 100 m **(D)** 92 m **(E)** 240 m

15. Francesca chooses an integer from the list $-4, -3, -2, -1, 0, 1, 2, 3, 4, 5, 6$ and then a second integer that is larger than the first. How many such pairs of integers can she choose so that the sum of the pair is 3?

(A) 8 **(B)** 5 **(C)** 4 **(D)** 7 **(E)** 6

16. In the diagram, $\triangle QRS$ is an isosceles right-angled triangle with $QR = SR$ and $\angle QRS = 90°$. Line segment PT intersects SQ at U and SR at V. If $\angle PUQ = \angle RVT = y°$, the value of y is

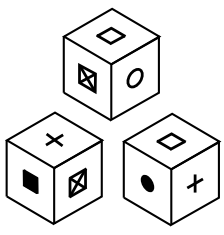


(A) 72.5 **(B)** 60 **(C)** 67.5 **(D)** 62.5 **(E)** 70

17. The point totals that Mark scored in five basketball games were $x, 11, 13, y, 12$. How many different possible medians are there for his five point totals?

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

18. Three different views of the same cube are shown. The symbol on the face opposite ● is



(A) + **(B)** ■ **(C)** ⊠ **(D)** □ **(E)** ○

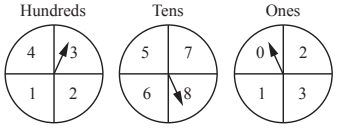
19. X is 20% of 50. 40 is 20% of Y. 40 is Z% of 50. What does $X + Y + Z$ equal?
(A) 218 **(B)** 335 **(C)** 98 **(D)** 290 **(E)** 380

20. If a and b are positive integers and $\frac{20}{19} = 1 + \dfrac{1}{1 + \frac{a}{b}}$, what is the least possible value of $a + b$?
(A) 16 **(B)** 19 **(C)** 20 **(D)** 38 **(E)** 39

Part C: Each correct answer is worth 8.

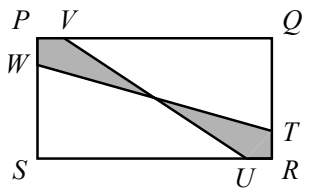
21. The ratio of green balls to yellow balls in a bag is 3 : 7. When 9 balls of each colour are removed, the ratio of green balls to yellow balls becomes 1 : 3. How many balls were originally in the bag?
(A) 60 **(B)** 90 **(C)** 100 **(D)** 70 **(E)** 80

22. Three spinners are shown. The spinners are used to determine the hundreds, tens and ones digits of a three-digit number. How many possible three-digit numbers that can be formed in this way are divisible by 6?



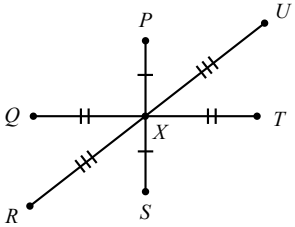
(A) 11 **(B)** 16 **(C)** 22
(D) 12 **(E)** 9

23. In the diagram, rectangle $PQRS$ has $PS = 2$ and $PQ = 4$. Points T, U, V, W are positioned so that $RT = RU = PW = PV = a$. If VU and WT pass through the centre of the rectangle, for what value of a is the shaded region $\frac{1}{8}$ the area of $PQRS$?



(A) $\frac{2}{3}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{2}{5}$
(D) $\frac{1}{3}$ **(E)** $\frac{1}{4}$

24. Every 12 minutes, Bus A completes a trip from P to X to S to X to P. Every 20 minutes, Bus B completes a trip from Q to X to T to X to Q. Every 28 minutes, Bus C completes a trip from R to X to U to X to R. At 1:00 p.m., Buses A, B and C depart from P, Q and R, respectively, each driving at a constant speed, and each turning around instantly at the endpoint of its route. Each bus runs until 11:00 p.m. At how many times between 5:00 p.m. and 10:00 p.m. will two or more buses arrive at X at the same time?



(A) 18 **(B)** 19 **(C)** 20
(D) 21 **(E)** 22

25. A sequence of positive integers with 2020 terms is called an FT sequence if each term after the second is the sum of the previous two terms. For example, if the first two terms of an FT sequence are 8 and 7, the sequence would begin $8, 7, 15, 22, 37, \ldots$. For some positive integer m, there are exactly 2415 FT sequences where the first two terms are each less than $2m$ and the number of odd-valued terms is more than twice the number of even-valued terms. What is the value of m?
(A) 21 **(B)** 69 **(C)** 115 **(D)** 35 **(E)** 105

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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 15, 2019
(in North America and South America)

Thursday, May 16, 2019
(outside of North America and South America)

Time: 1 hour

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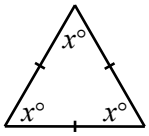
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. Ali ate half of a muffin. What percentage of the muffin did Ali eat?

   (A) 10% **(B)** 17% **(C)** 21% **(D)** 40% **(E)** 50%

2. In the triangle shown, the value of x is

   (A) 30 **(B)** 60 **(C)** 45
   (D) 90 **(E)** 55

3. Which of the following integers is closest to 0?

   (A) -1 **(B)** 2 **(C)** -3 **(D)** 4 **(E)** -5

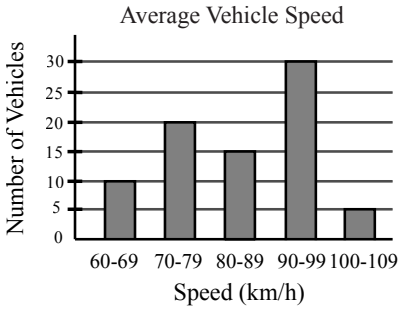
4. Which of these numbers gives a remainder of 3 when divided by 5?

   (A) 51 **(B)** 64 **(C)** 76 **(D)** 88 **(E)** 99

5. How many integers between 10 and 20 are prime numbers?

   (A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

6. Based on the graph shown, how many vehicles had an average speed of at least 80 km/h?

   (A) 45 **(B)** 15 **(C)** 35
   (D) 70 **(E)** 50

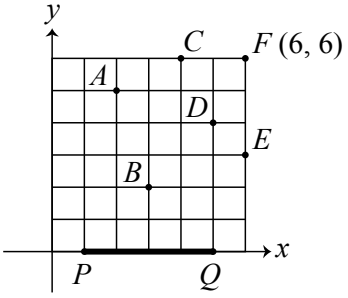
7. How many positive integers less than 100 are divisible by both 3 and 7?

   (A) 2 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6

8. The circumference of a circle is 100. The diameter of this circle is equal to

   (A) $100 \times \pi$ **(B)** $\frac{2\pi}{100}$ **(C)** $\frac{100}{\pi}$ **(D)** $2\pi \times 100$ **(E)** $\frac{\pi}{100}$

9. In the diagram, point F has coordinates $(6, 6)$. Points P and Q are two vertices of a triangle. Which of the following points can be joined to P and Q to create a triangle with an area of 6?

   (A) A **(B)** B **(C)** C
   (D) D **(E)** E

10. Canadian currency has coins with values \$2.00, \$1.00, \$0.25, \$0.10, and \$0.05. Barry has 12 coins including at least one of each of these coins. What is the smallest total amount of money that Barry could have?

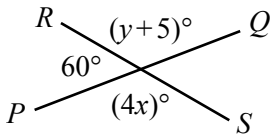
    (A) \$3.75 **(B)** \$3.90 **(C)** \$3.70 **(D)** \$3.40 **(E)** \$3.95

Part B: Each correct answer is worth 6.

11. Two of the side lengths in an isosceles triangle are 6 and 8. The perimeter of the triangle could be

(A) 18 **(B)** 14 **(C)** 22 **(D)** 16 **(E)** 24

12. Line segments PQ and RS intersect as shown. What is the value of $x + y$?

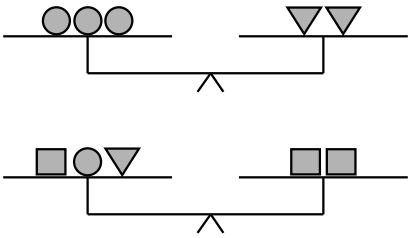


(A) 145 **(B)** 70 **(C)** 130 **(D)** 85 **(E)** 240

13. The mean (average), the median and the mode of the five numbers $12, 9, 11, 16, x$ are all equal. What is the value of x?

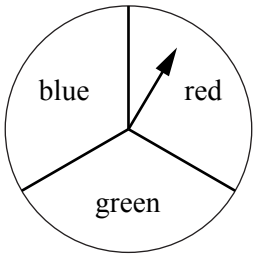
(A) 9 **(B)** 11 **(C)** 12 **(D)** 13 **(E)** 16

14. The two equal-arm scales shown are balanced. Of the following, ○▽▽▽ has the same mass as



(A) □□□
(B) ▽▽□□
(C) ○○○○
(D) ○○○□
(E) ○○○

15. A spinner is divided into 3 equal sections, as shown. An arrow is attached to the centre of the spinner. The arrow is spun twice. What is the probability that the arrow lands on the same colour twice?



(A) $\frac{1}{9}$ **(B)** $\frac{2}{3}$ **(C)** $\frac{1}{2}$ **(D)** $\frac{1}{3}$ **(E)** $\frac{2}{9}$

16. A Gauss brand light bulb will work for 24 999 hours. If it is used for exactly 2 hours every day starting on a Monday, on what day of the week will it stop working?

(A) Thursday **(B)** Friday **(C)** Saturday **(D)** Sunday **(E)** Monday

17. Each of w, x, y, and z is an integer. If $w + x = 45$, $x + y = 51$, and $y + z = 28$, what is the value of $w + z$?

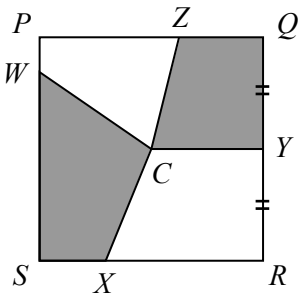
(A) 28 **(B)** 22 **(C)** 17 **(D)** 23 **(E)** 15

18. Kathy owns more cats than Alice and more dogs than Bruce. Alice owns more dogs than Kathy and fewer cats than Bruce. Which of the statements *must* be true?

(A) Bruce owns the fewest cats.
(B) Bruce owns the most cats.
(C) Kathy owns the most cats.
(D) Alice owns the most dogs.
(E) Kathy owns the fewest dogs.

19. A line segment joins the points $P(-4, 1)$ and $Q(1, -11)$. What is the length of PQ?
(A) 13 **(B)** 12 **(C)** 12.5 **(D)** 13.6 **(E)** 12.6

20. $PQRS$ is a square with side length 60 and centre C. Point W lies on PS so that $WS = 53$. Point X lies on SR so that $XR = 40$. The midpoint of QR is Y. Point Z lies on PQ. What is the length of ZQ so that the total area of the shaded regions is equal to the total area of the non-shaded regions?



(A) 21 **(B)** 15 **(C)** 23
(D) 19 **(E)** 17

Part C: Each correct answer is worth 8.

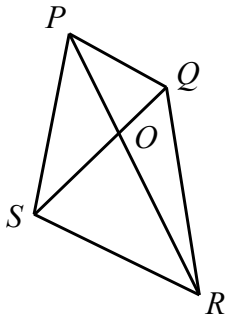
21. In Jen's baseball league, each team plays exactly 6 games against each of the other teams in the league. If a total of 396 games are played, how many teams are in the league?
(A) 12 **(B)** 16 **(C)** 15 **(D)** 13 **(E)** 9

22. Rich chooses a 4-digit positive integer. He erases one of the digits of this integer. The remaining digits, in their original order, form a 3-digit positive integer. When Rich adds this 3-digit integer to the original 4-digit integer, the result is 6031. What is the sum of the digits of the original 4-digit integer?
(A) 18 **(B)** 20 **(C)** 22 **(D)** 19 **(E)** 21

23. If n is a positive integer, the notation $n!$ (read "n factorial") is used to represent the product of the integers from 1 to n inclusive. For example, $5! = 1 \times 2 \times 3 \times 4 \times 5 = 120$. Which of the following is equal to a perfect square?
(A) $\frac{(20!)(19!)}{1}$ **(B)** $\frac{(20!)(19!)}{2}$ **(C)** $\frac{(20!)(19!)}{3}$ **(D)** $\frac{(20!)(19!)}{4}$ **(E)** $\frac{(20!)(19!)}{5}$

24. There are many ways in which the list $0, 1, 2, 3, 4, 5, 6, 7, 8, 9$ can be separated into groups. For example, this list could be separated into the four groups $0, 3, 4, 8$ and $1, 2, 7$ and 6 and $5, 9$. The sum of the numbers in each of these four groups is $15, 10, 6$, and 14, respectively. In how many ways can the list $0, 1, 2, 3, 4, 5, 6, 7, 8, 9$ be separated into at least two groups so that the sum of the numbers in each group is the same?
(A) 26 **(B)** 29 **(C)** 24 **(D)** 27 **(E)** 32

25. In quadrilateral $PQRS$, diagonals PR and SQ intersect at O inside $PQRS$, $SP = SQ = SR = 1$, and $\angle QSR = 2\angle QSP$. Marc determines the measure of the twelve angles that are the interior angles of $\triangle POS$, $\triangle POQ$, $\triangle ROS$, and $\triangle ROQ$. The measure of each of these angles, in degrees, is a positive integer, and exactly six of these integers are prime numbers. How many different quadrilaterals have these properties and are not rotations or translations of each other?



(A) 7 **(B)** 5 **(C)** 9
(D) 6 **(E)** 8

The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 16, 2018
(in North America and South America)

Thursday, May 17, 2018
(outside of North America and South America)

Time: 1 hour

Calculating devices are allowed, provided that they do not have any of the following features: (i) internet access, (ii) the ability to communicate with other devices, (iii) previously stored information such as formulas, programs, notes, etc., (iv) a computer algebra system, (v) dynamic geometry software.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

The name, school and location of some top-scoring students will be published on the Web site, cemc.uwaterloo.ca. You will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

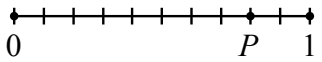
Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The cost of 1 melon is \$3. What is the cost of 6 melons?

   (A) \$12 **(B)** \$15 **(C)** \$18 **(D)** \$21 **(E)** \$24

2. In the diagram, the number line is divided into 10 equal parts. The numbers $0, 1$ and P are marked on the line. What is the value of P?



   (A) 0.2 **(B)** 0.6 **(C)** 0.7
   (D) 0.8 **(E)** 0.9

3. The value of $(2+3)^2 - (2^2+3^2)$ is

   (A) 50 **(B)** 12 **(C)** 15 **(D)** -15 **(E)** -12

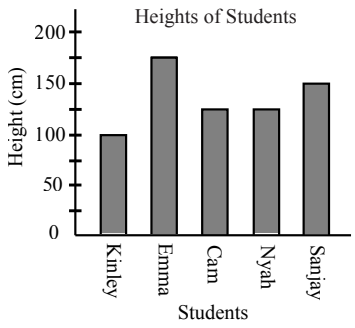
4. Lakshmi is travelling at 50 km/h. How many kilometres does she travel in 30 minutes?

   (A) 30 km **(B)** 50 km **(C)** 25 km **(D)** 150 km **(E)** 100 km

5. Evgeny has 3 roses, 2 tulips, 4 daisies, and 6 lilies. If he randomly chooses one of these flowers, what is the probability that it is a tulip?

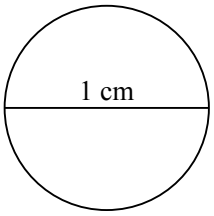
   (A) $\frac{3}{15}$ **(B)** $\frac{12}{15}$ **(C)** $\frac{6}{15}$ **(D)** $\frac{4}{15}$ **(E)** $\frac{2}{15}$

6. The heights of five students at Gleeson Middle School are shown in the graph. The range of the heights is closest to



   (A) 75 cm **(B)** 0 cm **(C)** 25 cm
   (D) 100 cm **(E)** 50 cm

7. The circle has a diameter of 1 cm, as shown. The circumference of the circle is between



   (A) 2 cm and 3 cm
   (B) 3 cm and 4 cm
   (C) 4 cm and 5 cm
   (D) 5 cm and 6 cm
   (E) 6 cm and 8 cm

8. Rich and Ben ate an entire chocolate cake. The ratio of the amount eaten by Rich to the amount eaten by Ben is $3:1$. What percentage of the cake did Ben eat?

   (A) 66% **(B)** 50% **(C)** 75% **(D)** 25% **(E)** 10%

9. The 26 letters of the alphabet are written in order, clockwise around a circle. The *ciphertext* of a message is created by replacing each letter of the message by the letter that is 4 letters clockwise from the original letter. (This is called a *Caesar cipher*.) For example, the message ZAP has ciphertext DET. What is the ciphertext of the message WIN?

   (A) ALN **(B)** ZLN **(C)** AMR **(D)** AMQ **(E)** ZMQ

10. The sum of 3 consecutive even numbers is 312. What is the largest of these 3 numbers?
(A) 54 **(B)** 106 **(C)** 86 **(D)** 108 **(E)** 102

Part B: Each correct answer is worth 6.

11. If $4x + 12 = 48$, the value of x is
(A) 12 **(B)** 32 **(C)** 15 **(D)** 6 **(E)** 9

12. There is a 3 hour time difference between Vancouver and Toronto. For example, when it is 1:00 p.m. in Vancouver, it is 4:00 p.m. in Toronto. What time is it in Vancouver when it is 6:30 p.m. in Toronto?
(A) 9:30 p.m **(B)** 2:30 p.m. **(C)** 3:30 p.m. **(D)** 8:30 p.m. **(E)** 4:30 p.m.

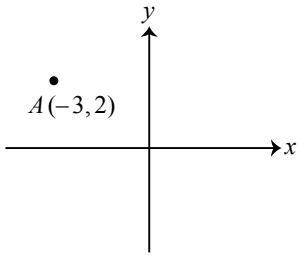
13. Mateo and Sydney win a contest. As his prize, Mateo receives \$20 every hour for one week. As her prize, Sydney receives \$400 every day for one week. What is the difference in the total amounts of money that they receive over the one week period?
(A) \$560 **(B)** \$80 **(C)** \$1120 **(D)** \$380 **(E)** \$784

14. The number 2018 has exactly two divisors that are prime numbers. The sum of these two prime numbers is
(A) 793 **(B)** 1011 **(C)** 38 **(D)** 209 **(E)** 507

15. Five classmates, Barry, Hwan, Daya, Cindy, and Ed will compete in a contest. There are no ties allowed. In how many ways can first, second and third place awards be given out?
(A) 6 **(B)** 60 **(C)** 125 **(D)** 3 **(E)** 27

16. There are several groups of six integers whose product is 1. Which of the following cannot be the sum of such a group of six integers?
(A) -6 **(B)** -2 **(C)** 0 **(D)** 2 **(E)** 6

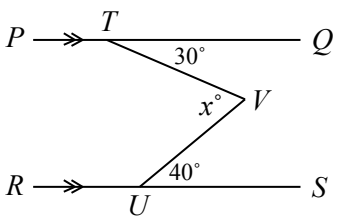
17. A translation moves point $A(-3, 2)$ to the right 5 units and up 3 units. This translation is done a total of 6 times. After these translations, the point is at (x, y). What is the value of $x + y$?
(A) 34 **(B)** 49 **(C)** 53
(D) 47 **(E)** 43



18. The volume of a rectangular prism is 30 cm^3. The length of the prism is doubled, the width is tripled, and the height is divided by four. The volume of the new prism is
(A) 31 cm^3 **(B)** 120 cm^3 **(C)** 60 cm^3 **(D)** 90 cm^3 **(E)** 45 cm^3

19. The mean (average) height of a group of children would be increased by 6 cm if 12 of the children in the group were each 8 cm taller. How many children are in the group?
(A) 16 **(B)** 14 **(C)** 21 **(D)** 26 **(E)** 9

20. Line segments PQ and RS are parallel. Points T, U, V are placed so that $\angle QTV = 30°$, $\angle SUV = 40°$, and $\angle TVU = x°$, as shown. What is the value of x?
(A) 80 **(B)** 85 **(C)** 65
(D) 70 **(E)** 75

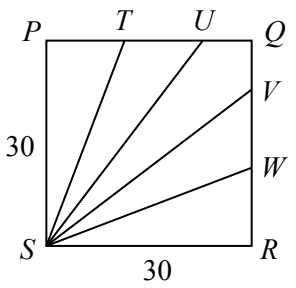


Part C: Each correct answer is worth 8.

21. A bag contains marbles of five different colours. One marble is chosen at random. The probability of choosing a brown marble is 0.3. Choosing a brown marble is three times as likely as choosing a purple marble. Choosing a green marble is equally likely as choosing a purple marble. Choosing a red marble is equally likely as choosing a yellow marble. The probability of choosing a marble that is either red or green is

(A) 0.2 **(B)** 0.25 **(C)** 0.35 **(D)** 0.4 **(E)** 0.55

22. Square $PQRS$ has side length 30, as shown. The square is divided into 5 regions of equal area: $\triangle SPT$, $\triangle STU$, $\triangle SVW$, $\triangle SWR$, and quadrilateral $SUQV$. The value of $\dfrac{SU}{ST}$ is closest to



(A) 1.17 **(B)** 1.19 **(C)** 1.21
(D) 1.23 **(E)** 1.25

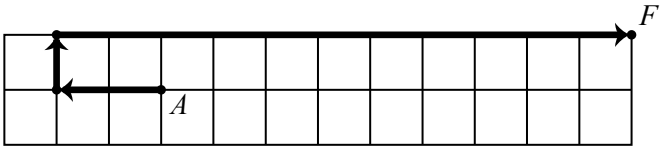
23. The smallest positive integer n for which $n(n+1)(n+2)$ is a multiple of 5 is $n = 3$. All positive integers, n, for which $n(n+1)(n+2)$ is a multiple of 5 are listed in increasing order. What is the 2018^{th} integer in the list?

(A) 3362 **(B)** 3360 **(C)** 3363 **(D)** 3361 **(E)** 3364

24. Lynne chooses four distinct digits from 1 to 9 and arranges them to form the 24 possible four-digit numbers. These 24 numbers are added together giving the result N. For all possible choices of the four distinct digits, what is the largest sum of the distinct prime factors of N?

(A) 157 **(B)** 148 **(C)** 127 **(D)** 146 **(E)** 124

25. In the 2×12 grid shown, Ashley draws paths from A to F along the gridlines.



In every path,

- there are two or more arrows arranged head to tail,
- the tail of the first arrow starts at A and the head of the last arrow ends at F,
- two consecutive arrows must be perpendicular to one another,
- no two arrows can intersect at more than one point, and
- all arrows have different lengths.

The path from A to F shown consists of arrows of three different lengths: left 2, up 1, right 11. How many different paths are there from A to F?

(A) 54 **(B)** 55 **(C)** 56 **(D)** 57 **(E)** 58

The CENTRE for EDUCATION
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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 10, 2017
(in North America and South America)

Thursday, May 11, 2017
(outside of North America and South America)

Time: 1 hour

Calculators are allowed, with the following restriction: you may not use a device that has internet access, that can communicate with other devices, or that contains previously stored information. For example, you may not use a smartphone or a tablet.

Instructions

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3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
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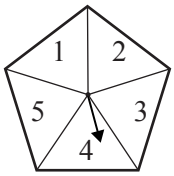
Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. Michael has \$280 in \$20 bills. How many \$20 bills does he have?
(A) 10 **(B)** 12 **(C)** 14 **(D)** 16 **(E)** 18

2. The value of $4^2 - 2^3$ is
(A) 8 **(B)** 2 **(C)** 4 **(D)** 0 **(E)** 6

3. A pentagon is divided into 5 equal sections, as shown. An arrow is attached to the centre of the pentagon. The arrow is spun once. What is the probability that the arrow stops in the section numbered 4?

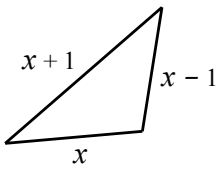


(A) $\frac{3}{5}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{4}{5}$
(D) $\frac{1}{4}$ **(E)** $\frac{1}{5}$

4. There are 160 students in grade 8 at Murray Public School. If exactly 10% of these students are on the school's chess team, how many grade 8 students are on the team?
(A) 26 **(B)** 16 **(C)** 20 **(D)** 12 **(E)** 18

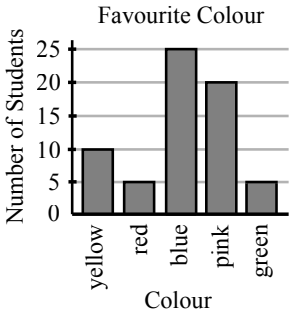
5. 44×22 is equal to
(A) 88×2 **(B)** 88×11 **(C)** 88×20 **(D)** 88×44 **(E)** 88×40

6. If the perimeter of the triangle shown is 21, what is the value of x?



(A) 3 **(B)** 7 **(C)** 8
(D) 13 **(E)** 16

7. Students were surveyed about their favourite colour and the results are displayed in the graph shown. What is the ratio of the number of students who chose pink to the number of students who chose blue?

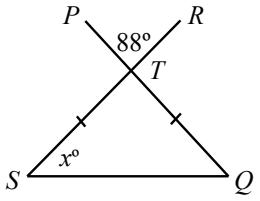


(A) 4 : 5 **(B)** 3 : 5 **(C)** 1 : 5
(D) 2 : 5 **(E)** 5 : 3

8. When a number is tripled and then decreased by 6, the result is 15. The number is
(A) 8 **(B)** 6 **(C)** 5 **(D)** 7 **(E)** 9

9. Tian measured her steps and found that it took her 625 steps to walk 500 m. If she walks 10 000 steps at this same rate, what distance will she walk?
(A) 6.4 km **(B)** 6.25 km **(C)** 7.5 km **(D)** 8 km **(E)** 7.2 km

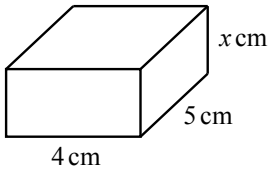
10. Line segments PQ and RS intersect at T, as shown. If $TS = TQ$ and $\angle PTR = 88°$, the value of x is



(A) 44 **(B)** 46 **(C)** 88
(D) 45 **(E)** 50

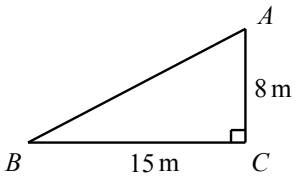
Part B: Each correct answer is worth 6.

11. The volume of the rectangular prism shown is 60 cm^3. What is the value of x?



(A) 1 **(B)** 4 **(C)** 6
(D) 3 **(E)** 2

12. In the diagram shown, David begins at A and walks in a straight line to C, and then walks in a straight line from C to B. Cindy also begins at A and walks in a straight line to B. How much farther does David walk than Cindy?



(A) 0 m **(B)** 2 m **(C)** 4 m
(D) 6 m **(E)** 7 m

13. The sum of the first 100 positive integers (that is, $1+2+3+\cdots+99+100$) equals 5050. The sum of the first 100 positive multiples of 10 (that is, $10+20+30+\cdots+990+1000$) equals

(A) 10 100 **(B)** 5950 **(C)** 50 500 **(D)** 6050 **(E)** 45 450

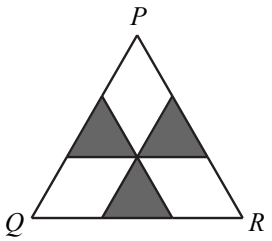
14. There are 20 pens to be given away to 4 students. Each student receives a different number of pens and each student receives at least one pen. What is the largest number of pens that a student can receive?

(A) 17 **(B)** 15 **(C)** 14 **(D)** 8 **(E)** 5

15. The number of even integers between 1 and 103 is the same as the number of odd integers between 4 and

(A) 104 **(B)** 102 **(C)** 100 **(D)** 108 **(E)** 106

16. In the diagram, $\triangle PQR$ is equilateral and has side length 6 cm. Each of the shaded triangles is equilateral and has side length 2 cm. What fraction of the area of $\triangle PQR$ is shaded?



(A) $\frac{3}{7}$ **(B)** $\frac{1}{3}$ **(C)** $\frac{1}{2}$
(D) $\frac{3}{5}$ **(E)** $\frac{2}{3}$

17. On coach Wooden's basketball team:
    - Meghan is the tallest player,
    - Meghan's height is 188 cm, and
    - Avery is the shortest player.

    When used with the information above, which of the following single statements is enough to determine Avery's height?

(A) The median of the players' heights is 170 cm
(B) The mode of the players' heights is 160 cm
(C) The mean of the players' heights is 165 cm
(D) The range of the players' heights is 33 cm
(E) There are 10 players on the team

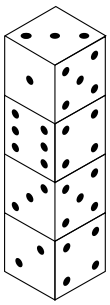
18. Brodie and Ryan are driving directly towards each other. Brodie is driving at a constant speed of 50 km/h. Ryan is driving at a constant speed of 40 km/h. If they are 120 km apart, how long will it take before they meet?
(A) 1 h 12 min **(B)** 1 h 25 min **(C)** 1 h 15 min **(D)** 1 h 33 min **(E)** 1 h 20 min

19. In a group of seven friends, the mean (average) age of three of the friends is 12 years and 3 months and the mean age of the remaining four friends is 13 years and 5 months. In months, the mean age of all seven friends is
(A) 156 **(B)** 154 **(C)** $155\frac{1}{2}$ **(D)** 157 **(E)** 155

20. In the six-digit number $1ABCDE$, each letter represents a digit. Given that $1ABCDE \times 3 = ABCDE1$, the value of $A + B + C + D + E$ is
(A) 29 **(B)** 26 **(C)** 22 **(D)** 30 **(E)** 28

Part C: Each correct answer is worth 8.

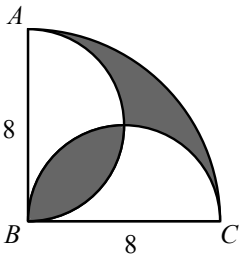
21. The number of dots on opposite faces of a regular die add to 7. Four regular dice are arranged as shown. Which of the following could be the sum of the number of dots hidden between the dice?
(A) 22 **(B)** 26 **(C)** 24
(D) 21 **(E)** 23



22. The values $2, 3, 4$, and 5 are each assigned to exactly one of the letters V, W, X, and Y to give $Y^X - W^V$ the greatest possible value. The value of $X + V$ is equal to
(A) 5 **(B)** 6 **(C)** 7 **(D)** 8 **(E)** 9

23. Mike and Alain play a game in which each player is equally likely to win. The first player to win three games becomes the champion, and no further games are played. If Mike has won the first game, what is the probability that Mike becomes the champion?
(A) $\frac{1}{4}$ **(B)** $\frac{5}{8}$ **(C)** $\frac{11}{16}$ **(D)** $\frac{3}{5}$ **(E)** $\frac{3}{4}$

24. In the diagram, ABC is a quarter of a circle with radius 8. A semi-circle with diameter AB is drawn, as shown. A second semi-circle with diameter BC is also drawn. The area of the shaded region is closest to
(A) 22.3 **(B)** 33.5 **(C)** 25.1
(D) 18.3 **(E)** 20.3



25. Brady is stacking 600 plates in a single stack. Each plate is coloured black, gold or red. Any black plates are always stacked below any gold plates, which are always stacked below any red plates. The total number of black plates is always a multiple of two, the total number of gold plates is always a multiple of three, and the total number of red plates is always a multiple of six. For example, the plates could be stacked with:

- 180 black plates below 300 gold plates below 120 red plates, or
- 450 black plates below 150 red plates, or
- 600 gold plates.

In how many different ways could Brady stack the plates?
(A) 5139 **(B)** 5142 **(C)** 5145 **(D)** 5148 **(E)** 5151

The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
cemc.uwaterloo.ca

Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 11, 2016
(in North America and South America)

Thursday, May 12, 2016
(outside of North America and South America)

Time: 1 hour

Calculators are allowed, with the following restriction: you may not use a device that has internet access, that can communicate with other devices, or that contains previously stored information. For example, you may not use a smartphone or a tablet.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
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5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

The name, school and location of some top-scoring students will be published on the Web site, cemc.uwaterloo.ca. You will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $444 - 44 - 4$ is

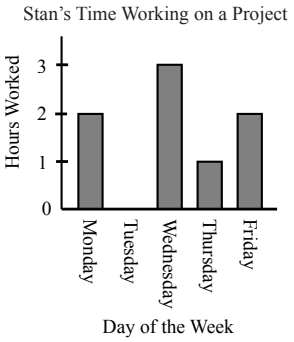
   (A) 396 **(B)** 402 **(C)** 392 **(D)** 400 **(E)** 408

2. Which of the following is equal to $\frac{4}{5}$?

   (A) 4.5 **(B)** 0.8 **(C)** 80.0 **(D)** 0.08 **(E)** 0.45

3. The graph shows the number of hours Stan worked on a school project. For how many hours in total did he work on the project?

   (A) 6 **(B)** 2 **(C)** 8 **(D)** 9 **(E)** 10

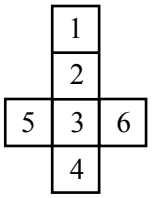


4. Three tenths plus four thousandths is equal to

   (A) 4030 **(B)** 0.0403 **(C)** 0.304 **(D)** 0.34 **(E)** 30.004

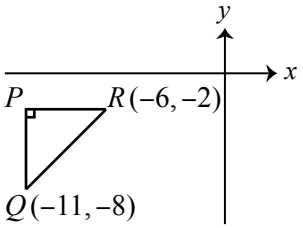
5. A cube is created by folding the figure shown. Which face is opposite the face with 1 on it?

   (A) 2 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6



6. In $\triangle PQR$ shown, side PR is horizontal and side PQ is vertical. The coordinates of P are

   (A) $(-8, -2)$ **(B)** $(-6, -8)$ **(C)** $(-11, -6)$ **(D)** $(-11, -2)$ **(E)** $(-8, -6)$



7. A rectangle with a width of 2 cm and a length of 18 cm has the same area as a square with a side length of

   (A) 6 cm **(B)** 12 cm **(C)** 9 cm **(D)** 10 cm **(E)** 8 cm

8. Gaby lists the numbers 3, 4, 5, 6, 7, 8, and 9. In her list, the ratio of the number of prime numbers to the number of composite numbers is

   (A) 3 : 4 **(B)** 5 : 2 **(C)** 2 : 5 **(D)** 3 : 7 **(E)** 1 : 6

9. 10% of 200 is equal to 20% of

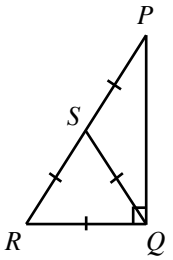
   (A) 40 **(B)** 50 **(C)** 100 **(D)** 400 **(E)** 800

10. The circumference of a circle is 100π cm. What is the radius of the circle?

    (A) 20 cm **(B)** 100 cm **(C)** 50 cm **(D)** 25 cm **(E)** 10 cm

Part B: Each correct answer is worth 6.

11. In the diagram, $\triangle PQR$ is right-angled. Point S lies on PR so that $\triangle QRS$ is equilateral and $\triangle PQS$ is isosceles with $PS = QS$. The measure of $\angle QPR$ is



(A) 35° **(B)** 37.5° **(C)** 25°
(D) 32.5° **(E)** 30°

12. Operations are placed in each ◯ so that $3 \bigcirc 5 \bigcirc 7 \bigcirc 9 = 78$. Listed from left to right, the operations are

(A) $+, \times, +$ **(B)** $+, +, \times$ **(C)** $\times, \times, -$ **(D)** $\times, \times, +$ **(E)** $\times, +, \times$

13. Ahmed chooses two different items for a snack. His choices are an apple, an orange, a banana, and a granola bar. How many different pairs of snacks could he choose?

(A) 3 **(B)** 4 **(C)** 5 **(D)** 6 **(E)** 7

14. One soccer ball and one soccer shirt together cost \$100. Two soccer balls and three soccer shirts together cost \$262. What is the cost of one soccer ball?

(A) \$38 **(B)** \$50 **(C)** \$87.30 **(D)** \$45 **(E)** \$40

15. A map has a scale of 1 : 600 000. On the map, the distance between Gausstown and Piville is 2 cm. What is the actual distance between the towns?

(A) 12 km **(B)** 1.2 km **(C)** 120 km **(D)** 1200 km **(E)** 12 000 km

16. The mean (average) of a set of six numbers is 10. If the number 25 is removed from the set, the mean of the remaining numbers is

(A) 6 **(B)** 7 **(C)** 8 **(D)** 9 **(E)** 10

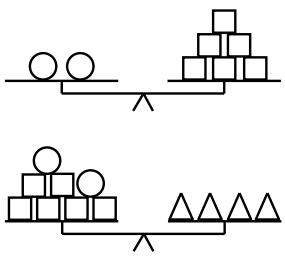
17. How many positive integers between 10 and 2016 are divisible by 3 and have all of their digits the same?

(A) 9 **(B)** 12 **(C)** 6 **(D)** 18 **(E)** 3

18. Joe filled up his car's gas tank. After travelling 165 km, $\frac{3}{8}$ of the gas in the tank was used. At this rate, approximately how much farther can the car travel before its fuel tank is completely empty?

(A) 99 km **(B)** 440 km **(C)** 605 km **(D)** 264 km **(E)** 275 km

19. The two scales shown are balanced. Which of the following is not true?

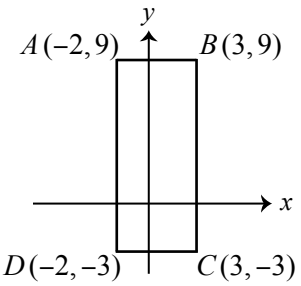


(A) ◯ = △
(B) △△ = ◯□□□
(C) ◯ = □□□
(D) ◯△ = □□□□
(E) △ = □□□

20. In the diagram, what is the length of BD?

(A) 13 **(B)** 17 **(C)** $\sqrt{205}$

(D) $\sqrt{160}$ **(E)** 15



Part C: Each correct answer is worth 8.

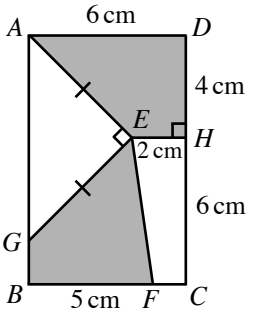
21. Two 5-digit positive integers are formed using each of the digits from 0 through 9 once. What is the smallest possible positive difference between the two integers?

(A) 469 **(B)** 269 **(C)** 247 **(D)** 229 **(E)** 249

22. In rectangle $ABCD$, what is the total area of the shaded region?

(A) 25 cm^2 **(B)** 31 cm^2 **(C)** 39 cm^2

(D) 35 cm^2 **(E)** 41 cm^2



23. Zeus starts at the origin $(0, 0)$ and can make repeated moves of one unit either up, down, left or right, but cannot make a move in the same direction twice in a row. For example, he cannot move from $(0, 0)$ to $(1, 0)$ to $(2, 0)$. What is the smallest number of moves that he can make to get to the point $(1056, 1007)$?

(A) 2112 **(B)** 2161 **(C)** 2063 **(D)** 2111 **(E)** 2113

24. What is the tens digit of 3^{2016}?

(A) 0 **(B)** 2 **(C)** 4 **(D)** 6 **(E)** 8

25. In the table, the numbers in each row form an arithmetic sequence when read from left to right. Similarly, the numbers in each column form an arithmetic sequence when read from top to bottom. What is the sum of the digits of the value of x?

(An *arithmetic sequence* is a sequence in which each term after the first is obtained from the previous term by adding a constant. For example, $3, 5, 7, 9$ are the first four terms of an arithmetic sequence.)

				18
	43			
		40		
x			26	

(A) 5 **(B)** 2 **(C)** 10

(D) 7 **(E)** 13

The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
cemc.uwaterloo.ca

Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 13, 2015
(in North America and South America)

Thursday, May 14, 2015
(outside of North America and South America)

Time: 1 hour

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Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $1000 + 200 - 10 + 1$ is

   (A) 1191 **(B)** 1190 **(C)** 1189 **(D)** 1209 **(E)** 1211

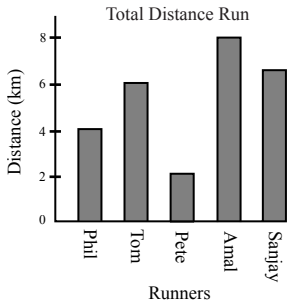
2. What time is it 45 minutes after 10:20?

   (A) 11:00 **(B)** 9:35 **(C)** 11:15 **(D)** 10:55 **(E)** 11:05

3. Which of the following is closest to 5 cm?

   (A) The length of a full size school bus
   (B) The height of a picnic table
   (C) The height of an elephant
   (D) The length of your foot
   (E) The length of your thumb

4. The graph shows the total distance that each of five runners ran during a one-hour training session. Which runner ran the median distance?



   (A) Phil **(B)** Tom **(C)** Pete
   (D) Amal **(E)** Sanjay

5. If $x + 3 = 10$, what is the value of $5x + 15$?

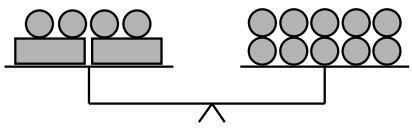
   (A) 110 **(B)** 35 **(C)** 80 **(D)** 27 **(E)** 50

6. A rectangle has a perimeter of 42 and a width of 4. What is its length?

   (A) 19 **(B)** 17 **(C)** 34
   (D) 21 **(E)** 38

7. The equal-arm scale shown is balanced.
   One ▭ has the same mass as

   (A) ○○
   (B) ○○○
   (C) ○○○○
   (D) ○○○○○
   (E) ○○○○○○



8. At the beginning of the summer, Aidan was 160 cm tall. At the end of the summer, he measured his height again and discovered that it had increased by 5%. Measured in cm, what was his height at the end of summer?

   (A) 168 **(B)** 165 **(C)** 160.8 **(D)** 172 **(E)** 170

9. If $x = 4$ and $y = 2$, which of the following expressions gives the smallest value?

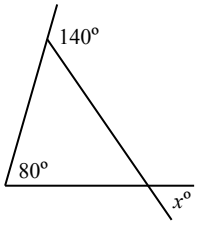
   (A) $x + y$ **(B)** xy **(C)** $x - y$ **(D)** $x \div y$ **(E)** $y \div x$

10. The number represented by $\square$ so that $\frac{1}{2} + \frac{1}{4} = \frac{\square}{12}$ is

(A) 3 **(B)** 12 **(C)** 9 **(D)** 6 **(E)** 15

Part B: Each correct answer is worth 6.

11. In the diagram, the value of x is

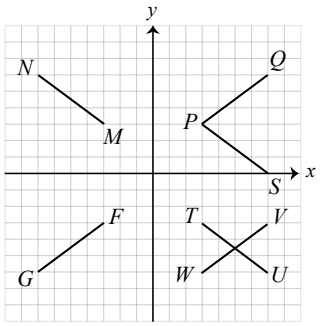


(A) 40 **(B)** 50 **(C)** 60
(D) 70 **(E)** 80

12. Zara's bicycle tire has a circumference of 1.5 m. If Zara travels 900 m on her bike, how many full rotations will her tire make?

(A) 900 **(B)** 1350 **(C)** 600 **(D)** 450 **(E)** 1200

13. In the graph shown, which of the following represents the image of the line segment PQ after a reflection across the x-axis?



(A) PS **(B)** TU **(C)** MN
(D) WV **(E)** FG

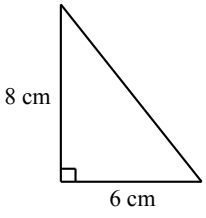
14. Carolyn has a \$5 bill, a \$10 bill, a \$20 bill, and a \$50 bill in her wallet. She closes her eyes and removes one of the four bills from her wallet. What is the probability that the total value of the three bills left in her wallet is greater than \$70?

(A) 0.5 **(B)** 0.25 **(C)** 0.75 **(D)** 1 **(E)** 0

15. Two puppies, Walter and Stanley, are growing at different but constant rates. Walter's mass is 12 kg and he is growing at a rate of 2 kg/month. Stanley's mass is 6 kg and he is growing at a rate of 2.5 kg/month. What will Stanley's mass be when it is equal to Walter's?

(A) 24 kg **(B)** 28 kg **(C)** 32 kg **(D)** 36 kg **(E)** 42 kg

16. There is a square whose perimeter is the same as the perimeter of the triangle shown. The area of that square is



(A) 12.25 cm^2 **(B)** 196 cm^2 **(C)** 49 cm^2
(D) 36 cm^2 **(E)** 144 cm^2

17. When expressed as a repeating decimal, the fraction $\frac{1}{7}$ is written as $0.142857142857\ldots$ (The 6 digits 142857 continue to repeat.) The digit in the third position to the right of the decimal point is 2. In which one of the following positions to the right of the decimal point will there also be a 2?

(A) 119^{th} **(B)** 121^{st} **(C)** 123^{rd} **(D)** 125^{th} **(E)** 126^{th}

18. The operation Δ is defined so that $a\Delta b = a \times b + a + b$. For example, $2\Delta 5 = 2 \times 5 + 2 + 5 = 17$. If $p\Delta 3 = 39$, the value of p is

(A) 13 **(B)** 12 **(C)** 9 **(D)** 10.5 **(E)** 18

19. There are 3 times as many boys as girls in a room. If 4 boys and 4 girls leave the room, then there will be 5 times as many boys as girls in the room. In total, how many boys and girls were in the room originally?

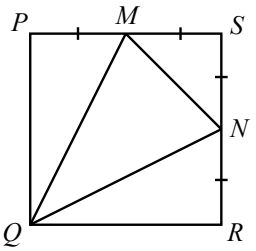
(A) 15 **(B)** 20 **(C)** 24 **(D)** 32 **(E)** 40

20. A rectangle has side lengths 3 and 4. One of its vertices is at the point $(1, 2)$. Which of the following *could not* be the coordinates of one of its other vertices?

(A) $(-3, -1)$ **(B)** $(1, -5)$ **(C)** $(5, -1)$ **(D)** $(-2, 6)$ **(E)** $(1, -1)$

Part C: Each correct answer is worth 8.

21. In square $PQRS$, M is the midpoint of PS and N is the midpoint of SR. If the area of $\triangle SMN$ is 18, then the area of $\triangle QMN$ is



(A) 36 **(B)** 72 **(C)** 90 **(D)** 48 **(E)** 54

22. Exactly 120 tickets were sold for a concert. The tickets cost \$12 each for adults, \$10 each for seniors, and \$6 each for children. The number of adult tickets sold was equal to the number of child tickets sold. Given that the total revenue from the ticket sales was \$1100, the number of senior tickets sold was

(A) 110 **(B)** 20 **(C)** 40 **(D)** 2 **(E)** 18

23. The list of integers $4, 4, x, y, 13$ has been arranged from least to greatest. How many different possible ordered pairs (x, y) are there so that the average (mean) of these 5 integers is itself an integer?

(A) 7 **(B)** 8 **(C)** 9 **(D)** 10 **(E)** 11

24. Two joggers each run at their own constant speed and in opposite directions from one another around an oval track. They meet every 36 seconds. The first jogger completes one lap of the track in a time that, when measured in seconds, is a number (not necessarily an integer) between 80 and 100. The second jogger completes one lap of the track in a time, t seconds, where t is a positive integer. The product of the smallest and largest possible integer values of t is

(A) 3705 **(B)** 3762 **(C)** 2816 **(D)** 3640 **(E)** 3696

25. The *alternating sum* of the digits of 63 195 is $6 - 3 + 1 - 9 + 5 = 0$. In general, the alternating sum of the digits of a positive integer is found by taking its leftmost digit, subtracting the next digit to the right, adding the next digit to the right, then subtracting, and so on. A positive integer is divisible by 11 exactly when the alternating sum of its digits is divisible by 11. For example, 63 195 is divisible by 11 since the alternating sum of its digits is equal to 0, and 0 is divisible by 11. Similarly, 92 807 is divisible by 11 since the alternating sum of its digits is 22, but 60 432 is not divisible by 11 since the alternating sum of its digits is 9.

Lynne forms a 7-digit integer by arranging the digits $1, 2, 3, 4, 5, 6, 7$ in random order. What is the probability that the integer is divisible by 11?

(A) $\frac{1}{35}$ **(B)** $\frac{5}{42}$ **(C)** $\frac{3}{35}$ **(D)** $\frac{1}{42}$ **(E)** $\frac{4}{35}$

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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 14, 2014
(in North America and South America)

Thursday, May 15, 2014
(outside of North America and South America)

UNIVERSITY OF WATERLOO WATERLOO MATHEMATICS Deloitte.

Time: 1 hour

Calculators are permitted.

Instructions

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Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The number 10 101 is equal to

   (A) $1000 + 100 + 1$ **(B)** $1000 + 10 + 1$ **(C)** $10\,000 + 10 + 1$
   (D) $10\,000 + 100 + 1$ **(E)** $100\,000 + 100 + 1$

2. One scoop of fish food can feed 8 goldfish. How many goldfish can 4 scoops of fish food feed?

   (A) 12 **(B)** 16 **(C)** 8 **(D)** 64 **(E)** 32

3. The value of $(2014 - 2013) \times (2013 - 2012)$ is

   (A) 0 **(B)** 1 **(C)** 2 **(D)** 2014 **(E)** -1

4. In a right-angled triangle, the measure of one angle is $55°$. The measure of the smallest angle in this triangle is

   (A) $1°$ **(B)** $25°$ **(C)** $45°$ **(D)** $35°$ **(E)** $90°$

5. Which of the following integers is closest to zero?

   (A) -1101 **(B)** 1011 **(C)** -1010 **(D)** -1001 **(E)** 1110

6. The value of y that satisfies the equation $5y - 100 = 125$ is

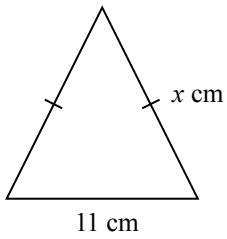
   (A) 45 **(B)** 100 **(C)** 25 **(D)** -25 **(E)** -5

7. How many prime numbers are there between 10 and 30?

   (A) 4 **(B)** 7 **(C)** 6 **(D)** 3 **(E)** 5

8. The perimeter of the isosceles triangle shown is 53 cm. The value of x is

   (A) 11 **(B)** 21 **(C)** 20
   (D) 19 **(E)** 31



9. Consider the set of fractions $\left\{\frac{3}{7}, \frac{3}{2}, \frac{6}{7}, \frac{3}{5}\right\}$. Ordered from smallest to largest, the set is

   (A) $\left\{\frac{3}{7}, \frac{3}{5}, \frac{6}{7}, \frac{3}{2}\right\}$ **(B)** $\left\{\frac{3}{2}, \frac{3}{5}, \frac{6}{7}, \frac{3}{7}\right\}$ **(C)** $\left\{\frac{3}{2}, \frac{3}{5}, \frac{3}{7}, \frac{6}{7}\right\}$
   (D) $\left\{\frac{3}{5}, \frac{3}{7}, \frac{6}{7}, \frac{3}{2}\right\}$ **(E)** $\left\{\frac{3}{7}, \frac{3}{5}, \frac{3}{2}, \frac{6}{7}\right\}$

10. The ratio of the number of girls to the number of boys in a class of 24 students is $3 : 5$. How many fewer girls than boys are in the class?

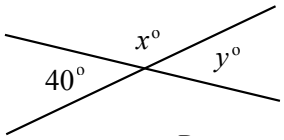
    (A) 2 **(B)** 4 **(C)** 5 **(D)** 6 **(E)** 8

Part B: Each correct answer is worth 6.

11. John was born on a Wednesday. Alison was born 72 days later. On what day of the week was Alison born?

(A) Thursday **(B)** Monday **(C)** Sunday **(D)** Saturday **(E)** Friday

12. If two straight lines intersect as shown, then $x - y$ is



(A) 0 **(B)** 40 **(C)** 80
(D) 60 **(E)** 100

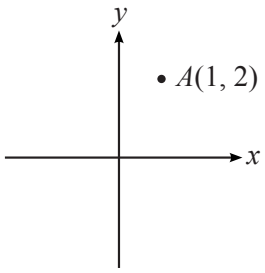
13. In which set of scores is the median greater than the mean?

(A) $10, 20, 40, 40, 40$ **(B)** $40, 50, 60, 70, 80$ **(C)** $20, 20, 20, 50, 80$
(D) $10, 20, 30, 100, 200$ **(E)** $50, 50, 50, 50, 100$

14. Betty is making a sundae. She must randomly choose one flavour of ice cream (chocolate or vanilla or strawberry), one syrup (butterscotch or fudge) and one topping (cherry or banana or pineapple). What is the probability that she will choose a sundae with vanilla ice cream, fudge syrup and banana topping?

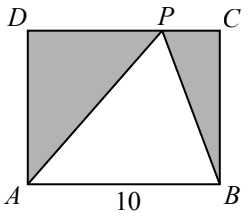
(A) $\frac{1}{18}$ **(B)** $\frac{1}{6}$ **(C)** $\frac{1}{8}$ **(D)** $\frac{1}{9}$ **(E)** $\frac{1}{12}$

15. The point $A(1, 2)$ is reflected in the y-axis. The new coordinates are



(A) $(1, 2)$ **(B)** $(-1, 2)$ **(C)** $(-1, -2)$
(D) $(1, -2)$ **(E)** $(1, -1)$

16. In the diagram, $ABCD$ is a rectangle. If the area of triangle ABP is 40, then the area of the shaded region is



(A) 20 **(B)** 40 **(C)** 60
(D) 50 **(E)** 80

17. On a science test, Janine got 80% of the 10 multiple choice questions correct and 70% of the 30 short answer questions correct. What percentage of the 40 questions on the test did she answer correctly?

(A) 74% **(B)** 72.5% **(C)** 76% **(D)** 73% **(E)** 73.5%

18. A rectangle whose side lengths are whole numbers has area 48 cm^2. The perimeter of this rectangle is 32 cm. Measured in cm, the positive difference between the length and the width of the rectangle is

(A) 47 **(B)** 2 **(C)** 22 **(D)** 8 **(E)** 13

19. A bicycle at Store P costs \$200. The regular price of the same bicycle at Store Q is 15% more than it is at Store P. The bicycle is on sale at Store Q for 10% off of the regular price. What is the sale price of the bicycle at Store Q?

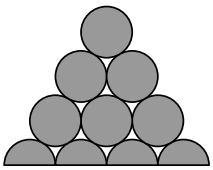
(A) \$230.00 **(B)** \$201.50 **(C)** \$199.00 **(D)** \$207.00 **(E)** \$210.00

20. Of the five answers shown, which is the largest amount of postage you *cannot* make using only 5¢ and 8¢ stamps?

(A) 19¢ **(B)** 22¢ **(C)** 27¢ **(D)** 39¢ **(E)** 43¢

Part C: Each correct answer is worth 8.

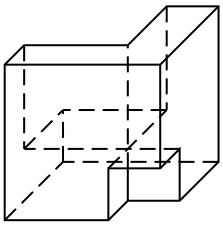
21. The diagram shown consists of circles with radius 1 cm and semi-circles with radius 1 cm. The total shaded area, in cm^2, is



(A) 10π **(B)** 9.5π **(C)** 9π

(D) 8.5π **(E)** 8π

22. Beginning with a 3 cm by 3 cm by 3 cm cube, a 1 cm by 1 cm by 1 cm cube is cut from one corner and a 2 cm by 2 cm by 2 cm cube is cut from the opposite corner, as shown. In cm^2, what is the surface area of the resulting solid?



(A) 42 **(B)** 45 **(C)** 48

(D) 51 **(E)** 54

23. The sum of the first 100 positive integers is 5050. That is, $1+2+\cdots+99+100 = 5050$. What is the sum of the first 100 positive *odd* integers?

(A) 5050 **(B)** 10 000 **(C)** 10 050 **(D)** 10 100 **(E)** 10 150

24. Grids are formed using 1×1 squares. The grid shown to the right contains squares of sizes 1×1, 2×2, 3×3, and 4×4, for a total of exactly 30 squares. Which of the following grids contains exactly 24 squares?

(A)  **(B)**  **(C)** 

(D)  **(E)** 

25. Residents were surveyed in order to determine which flowers to plant in the new Public Garden. A total of N people participated in the survey. Exactly $\frac{9}{14}$ of those surveyed said that the colour of the flower was important. Exactly $\frac{7}{12}$ of those surveyed said that the smell of the flower was important. In total, 753 people said that both the colour and smell were important. How many possible values are there for N?

(A) 22 **(B)** 23 **(C)** 21 **(D)** 24 **(E)** 25

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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 15, 2013
(in North America and South America)

Thursday, May 16, 2013
(outside of North America and South America)

UNIVERSITY OF WATERLOO WATERLOO MATHEMATICS Deloitte.

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

The name, school and location of some top-scoring students will be published on the Web site, http://www.cemc.uwaterloo.ca. You will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $10^2 + 10 + 1$ is

   (A) 101 **(B)** 1035 **(C)** 1011 **(D)** 111 **(E)** 31

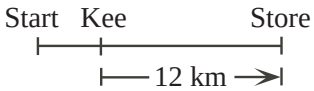
2. The value of $15 - 3 - 15$ is

   (A) -18 **(B)** -15 **(C)** 3 **(D)** -3 **(E)** -33

3. The smallest number in the set $\left\{\frac{1}{2}, \frac{2}{3}, \frac{1}{4}, \frac{5}{6}, \frac{7}{12}\right\}$ is

   (A) $\frac{1}{2}$ **(B)** $\frac{2}{3}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{5}{6}$ **(E)** $\frac{7}{12}$

4. Ahmed is going to the store. One quarter of the way to the store, he stops to talk with Kee. He then continues for 12 km and reaches the store. How many kilometres does he travel altogether?



   (A) 15 **(B)** 16 **(C)** 24
   (D) 48 **(E)** 20

5. Jarek multiplies a number by 3 and gets an answer of 90. If instead, he divides the number by 3, what answer does he get?

   (A) 5 **(B)** 10 **(C)** 30 **(D)** 60 **(E)** 270

6. What number goes in the box so that $10 \times 20 \times 30 \times 40 \times 50 = 100 \times 2 \times 300 \times 4 \times \square$?

   (A) 0.5 **(B)** 5 **(C)** 50 **(D)** 500 **(E)** 5000

7. Each letter of the English alphabet is written on a separate tile and placed in a bag. Alonso draws one letter at random from the bag. What is the probability that Alonso draws a letter that is in his name?

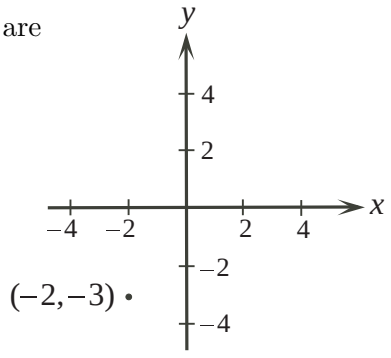
   (A) $\frac{1}{26}$ **(B)** $\frac{4}{26}$ **(C)** $\frac{5}{26}$ **(D)** $\frac{2}{26}$ **(E)** $\frac{3}{26}$

8. Mathy Manuel's autograph was once worth \$100. The autograph then dropped 30% in value. If it then increased by 40%, its value would be

   (A) \$98 **(B)** \$48 **(C)** \$100 **(D)** \$78 **(E)** \$90

9. The point $(-2, -3)$ is reflected in the x-axis. What are the coordinates of its image after the reflection?

   (A) $(2, -3)$ **(B)** $(3, -2)$ **(C)** $(2, 3)$
   (D) $(-3, -2)$ **(E)** $(-2, 3)$



10. The ratio of the value of four nickels (5¢ coins) to the value of six dimes (10¢ coins) to the value of two quarters (25¢ coins) can be written as

(A) 4 : 6 : 2 **(B)** 2 : 6 : 5 **(C)** 2 : 3 : 1 **(D)** 6 : 4 : 2 **(E)** 1 : 2 : 3

Part B: Each correct answer is worth 6.

11. If $x = 4$ and $3x + 2y = 30$, what is the value of y?

(A) 18 **(B)** 6 **(C)** 3 **(D)** 4 **(E)** 9

12. The value of $(2^3)^2 - 4^3$ is

(A) 0 **(B)** -8 **(C)** 4 **(D)** 10 **(E)** 12

13. The Summer Olympics are held once every 4 years. During an 18 year period, what is the largest number of Summer Olympics that could be held?

(A) 3 **(B)** 4 **(C)** 5 **(D)** 6 **(E)** 7

14. A cube has a surface area of $54\,\text{cm}^2$. The volume of the cube, in cm^3, is

(A) 81 **(B)** 343 **(C)** 18 **(D)** 27 **(E)** 729

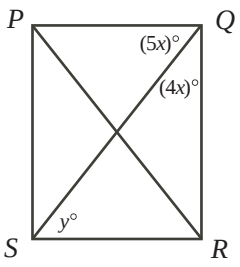
15. When 10 000 is divided by 13, the remainder is 3. Which one of the following numbers also gives a remainder of 3 when divided by 13?

(A) 9997 **(B)** 10 003 **(C)** 10 013 **(D)** 10 010 **(E)** 10 016

16. A family has 3 children. It is equally likely that a child is a boy as it is that a child is a girl. What is the probability that the 3 children are all girls?

(A) $\frac{2}{3}$ **(B)** $\frac{1}{4}$ **(C)** $\frac{1}{2}$ **(D)** $\frac{1}{3}$ **(E)** $\frac{1}{8}$

17. $PQRS$ is a rectangle with diagonals PR and QS, as shown. The value of y is



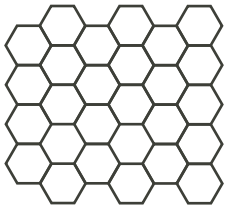
(A) 30 **(B)** 40 **(C)** 45

(D) 50 **(E)** 60

18. Sally is asked to multiply $\frac{2}{3}$ and $1\frac{1}{2}$. Jane is asked to add them. The difference between Sally's answer and Jane's answer is

(A) $\frac{4}{15}$ **(B)** $1\frac{1}{6}$ **(C)** 0 **(D)** $1\frac{3}{5}$ **(E)** $\frac{5}{6}$

19. Serena colours the hexagons on the tiling shown. If two hexagons share a side, she colours them with different colours. What is the least number of colours that she can use to colour all of the hexagons?



(A) 4 **(B)** 6 **(C)** 7

(D) 2 **(E)** 3

20. Christina and Frieda want to buy the same book. Christina has $\frac{3}{4}$ of the money needed to buy the book and Frieda has half of the money needed to buy the book. If the book was \$3 cheaper, then together they would have exactly enough money to buy 2 copies of the book. What is the original price of the book?

(A) \$4 **(B)** \$16 **(C)** \$12 **(D)** \$10 **(E)** \$8

Part C: Each correct answer is worth 8.

21. An *arithmetic sequence* is a sequence in which each term after the first is obtained by adding a constant to the previous term. For example, $2, 4, 6, 8$ and $1, 4, 7, 10$ are arithmetic sequences.

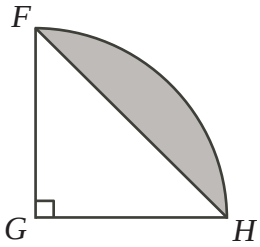
In the grid shown, the numbers in each row must form an arithmetic sequence and the numbers in each column must form an arithmetic sequence. The value of x is

5			
			1211
		1013	
23	x		

(A) 17 **(B)** 619 **(C)** 515

(D) 446 **(E)** 793

22. In right-angled, isosceles triangle FGH, $FH = \sqrt{8}$. Arc FH is part of the circumference of a circle with centre G and radius GH, as shown. The area of the shaded region is



(A) $\pi - 2$ **(B)** $4\pi - 2$ **(C)** $4\pi - \frac{1}{2}\sqrt{8}$

(D) $4\pi - 4$ **(E)** $\pi - \sqrt{8}$

23. Greg, Charlize, and Azarah run at different but constant speeds. Each pair ran a race on a track that measured 100 m from start to finish. In the first race, when Azarah crossed the finish line, Charlize was 20 m behind. In the second race, when Charlize crossed the finish line, Greg was 10 m behind. In the third race, when Azarah crossed the finish line, how many metres was Greg behind?

(A) 20 **(B)** 25 **(C)** 28 **(D)** 32 **(E)** 40

24. In any triangle, the length of the longest side is less than half of the perimeter. All triangles with perimeter 57 and integer side lengths x, y, z, such that $x < y < z$ are constructed. How many such triangles are there?

(A) 68 **(B)** 61 **(C)** 75 **(D)** 56 **(E)** 27

25. At the beginning of the winter, there were at least 66 students registered in a ski class. After the class started, eleven boys transferred into this class and thirteen girls transferred out. The ratio of boys to girls in the class was then 1 : 1. Which of the following is not a possible ratio of boys to girls before the transfers?

(A) 4 : 7 **(B)** 1 : 2 **(C)** 9 : 13 **(D)** 5 : 11 **(E)** 3 : 5

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Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

Wednesday, May 16, 2012
(in North America and South America)

Thursday, May 17, 2012
(outside of North America and South America)

STRONGER COMMUNITIES TOGETHER™

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
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Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. $3 \times (3 + 3) \div 3$ equals

   (A) 6 **(B)** 3 **(C)** 2 **(D)** 12 **(E)** 9

2. A six-sided die has the numbers one to six on its sides. What is the probability of rolling a five?

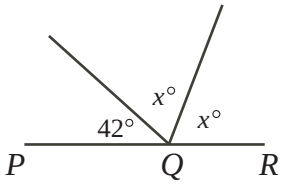
   (A) $\frac{2}{6}$ **(B)** $\frac{1}{6}$ **(C)** $\frac{5}{6}$ **(D)** $\frac{3}{6}$ **(E)** $\frac{4}{6}$

3. Fifty-six hundredths is

   (A) 0.056 **(B)** 5.6 **(C)** 0.0056 **(D)** 0.56 **(E)** 56.0

4. Points P, Q, R lie in a straight line. The value of x is

   (A) 69 **(B)** 138 **(C)** 75
   (D) 64 **(E)** 54



5. How many more coins does it take to make one dollar (100¢) using only nickels (5¢ coins) than it takes to make one dollar using only dimes (10¢ coins)?

   (A) 15 **(B)** 10 **(C)** 25 **(D)** 5 **(E)** 20

6. Ronald buys a pizza cut into 12 equal parts. He then cuts each part into 2 equal pieces. If he eats 3 of these pieces, what fraction of the pizza does he eat?

   (A) $\frac{1}{24}$ **(B)** $\frac{1}{2}$ **(C)** $\frac{3}{8}$ **(D)** $\frac{1}{6}$ **(E)** $\frac{1}{8}$

7. A rectangular sheet of paper measures 25 cm by 9 cm. The dimensions of a square sheet of paper with the same area are

   (A) 15 cm by 15 cm **(B)** 8 cm by 8 cm **(C)** 34 cm by 34 cm
   (D) 17 cm by 17 cm **(E)** 16 cm by 16 cm

8. The number 0.2012 is between

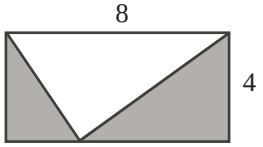
   (A) 0 and $\frac{1}{10}$ **(B)** $\frac{1}{10}$ and $\frac{1}{5}$ **(C)** $\frac{1}{5}$ and $\frac{1}{4}$ **(D)** $\frac{1}{4}$ and $\frac{1}{3}$ **(E)** $\frac{1}{3}$ and $\frac{1}{2}$

9. When $x = 2$, the value of $3^x - x^3$ is

   (A) -2 **(B)** 0 **(C)** 3 **(D)** 1 **(E)** 9

10. The rectangle shown has side lengths of 8 and 4. The area of the shaded region is

    (A) 32 **(B)** 16 **(C)** 64
    (D) 12 **(E)** 4



Part B: Each correct answer is worth 6.

11. A pyramid has a square base. How many edges does the pyramid have?

(A) 8 **(B)** 6 **(C)** 12 **(D)** 5 **(E)** 3

12. If snow falls at a rate of 1 mm every 6 minutes, then how many *hours* will it take for 1 m of snow to fall?

(A) 33 **(B)** 60 **(C)** 26 **(D)** 10 **(E)** 100

13. Three numbers have a mean (average) of 7. The mode of these three numbers is 9. What is the smallest of these three numbers?

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

14. Half of the square root of a number is 1. The number is

(A) 2 **(B)** 4 **(C)** 8 **(D)** 9 **(E)** 16

15. Yelena recites P, Q, R, S, T, U repeatedly (e.g. $P, Q, R, S, T, U, P, Q, R, \ldots$). Zeno recites $1, 2, 3, 4$ repeatedly (e.g. $1, 2, 3, 4, 1, 2, \ldots$). If Yelena and Zeno begin at the same time and recite at the same rate, which combination will *not* be said?

(A) $T1$ **(B)** $U2$ **(C)** $Q4$ **(D)** $R2$ **(E)** $T3$

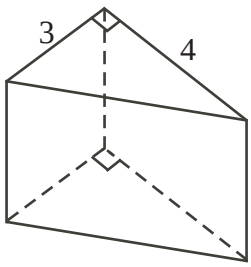
16. A parking lot has 25% more cars than trucks. The ratio of cars to trucks is

(A) 4 : 3 **(B)** 4 : 1 **(C)** 9 : 5 **(D)** 5 : 4 **(E)** 3 : 1

17. The digits 2, 4, 6 and 8 are each used once to create two 2-digit numbers. What is the smallest possible difference between the two 2-digit numbers?

(A) 24 **(B)** 14 **(C)** 18 **(D)** 12 **(E)** 22

18. A triangular prism has a volume of 120 cm^3. Two edges of the triangular faces measure 3 cm and 4 cm as shown. The height of the prism, in cm, is



(A) 12 **(B)** 20 **(C)** 10 **(D)** 16 **(E)** 8

19. At the Gaussland Olympics there are 480 student participants.
Each student is participating in 4 different events.
Each event has 20 students participating and is supervised by 1 adult coach.
There are 16 adult coaches and each coach supervises the same number of events.
How many events does each coach supervise?

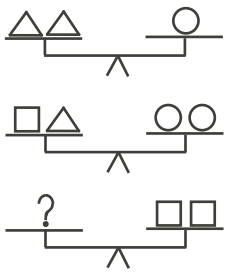
(A) 12 **(B)** 8 **(C)** 6 **(D)** 16 **(E)** 15

20. Luke has red marbles and blue marbles in a bag. If he chooses a marble at random, the probability that he will choose a blue marble is $\frac{2}{5}$. Luke adds 5 blue marbles to the bag and removes 5 red marbles. If he chooses a marble at random, the probability that he will choose a blue marble is now $\frac{3}{5}$. How many marbles are in the bag?

(A) 20 **(B)** 10 **(C)** 45 **(D)** 50 **(E)** 25

Part C: Each correct answer is worth 8.

21. All three scales shown are balanced.
One possible replacement for the ? is



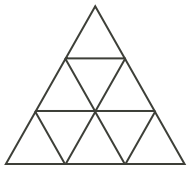
(A) ○△ **(B)** ○△△ **(C)** ○○△
(D) ○○△△ **(E)** ○○○△

22. In downtown Gaussville, there are three buildings with different heights: The Euclid (E), The Newton (N) and The Galileo (G). Only one of the statements below is true.

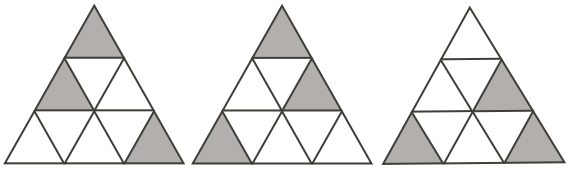
1. The Newton is not the shortest.
2. The Euclid is the tallest.
3. The Galileo is not the tallest.

Ordered from *shortest to tallest* in height, the buildings are
(A) N, G, E **(B)** G, E, N **(C)** E, N, G **(D)** N, E, G **(E)** E, G, N

23. Different patterns can be created by shading exactly three of the nine small triangles shown, no two of which can share a side.



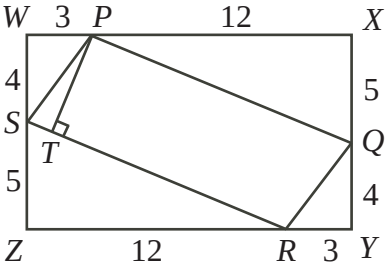
Patterns that can be matched by rotations or by reflections are considered the same. For example, the following patterns are considered the same.



How many *different* patterns can be created?
(A) 8 **(B)** 9 **(C)** 10 **(D)** 11 **(E)** 12

24. Stones are numbered $1, 2, 3, 4, 5, 6, 7, 8, 9, 10$. Three groups of stones can be selected so that the sum of each group is 11. For example, one arrangement is $\{1, 10\}$, $\{2, 3, 6\}$, $\{4, 7\}$. Including the example, how many arrangements are possible?
(A) 13 **(B)** 16 **(C)** 11 **(D)** 12 **(E)** 15

25. In the rectangle $WXYZ$, the parallelogram $PQRS$ is formed as shown. The segment PT is perpendicular to SR. The length of ST is



(A) $\frac{13}{12}$ **(B)** $\frac{13}{5}$ **(C)** $\frac{12}{13}$
(D) $\frac{16}{13}$ **(E)** 1

The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
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Gauss Contest

(Grade 8)

(The Grade 7 Contest is on the reverse side)

Wednesday, May 11, 2011

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

Please see our Web site: http://www.cemc.uwaterloo.ca. The Gauss Report will list the names of some top-scoring students. You will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

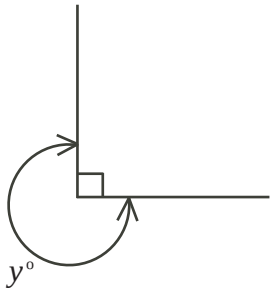
Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. If $\frac{8}{12} = \frac{\square}{3}$, then the value represented by $\square$ is
   (A) 24 **(B)** 1 **(C)** 12 **(D)** 2 **(E)** 4

2. Ground beef sells for \$5.00 per kg. How much does 12 kg of ground beef cost?
   (A) \$5.00 **(B)** \$12.00 **(C)** \$60.00 **(D)** \$17.00 **(E)** \$2.40

3. In the diagram, the value of y is
   (A) 60 **(B)** 100 **(C)** 120
   (D) 180 **(E)** 270



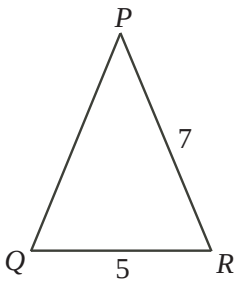
4. The largest number in the list $\left\{\frac{3}{10}, \frac{9}{20}, \frac{12}{25}, \frac{27}{50}, \frac{49}{100}\right\}$ is
   (A) $\frac{3}{10}$ **(B)** $\frac{9}{20}$ **(C)** $\frac{12}{25}$ **(D)** $\frac{27}{50}$ **(E)** $\frac{49}{100}$

5. A bag contains 15 balls. Exactly 3 of these balls are red. Alex reaches into the bag and randomly selects one of the balls. What is the probability that the ball that Alex selects is red?
   (A) $\frac{1}{5}$ **(B)** $\frac{4}{5}$ **(C)** $\frac{1}{15}$ **(D)** $\frac{1}{4}$ **(E)** $\frac{14}{15}$

6. If Clara doubles a number and then adds 3, the result is 23. The original number is
   (A) 13 **(B)** 10 **(C)** 49 **(D)** 17 **(E)** 20

7. A recipe calls for $4\frac{1}{2}$ cups of flour. If you only make half of the recipe, then how many cups of flour do you need?
   (A) $2\frac{1}{2}$ **(B)** $2\frac{1}{4}$ **(C)** 9 **(D)** 2 **(E)** $2\frac{3}{4}$

8. In the diagram, $\angle PQR = \angle PRQ$. If $QR = 5$ and $PR = 7$, then the perimeter of $\triangle PQR$ is
   (A) 12 **(B)** 14 **(C)** 17
   (D) 18 **(E)** 19



9. There are 15 girls in a class of 27 students. The ratio of boys to girls in this class is
   (A) 4 : 5 **(B)** 5 : 3 **(C)** 3 : 4 **(D)** 4 : 9 **(E)** 9 : 5

10. Five children had dinner. Chris ate more than Max. Brandon ate less than Kayla. Kayla ate less than Max but more than Tanya. Which child ate the second most?
    (A) Brandon **(B)** Chris **(C)** Kayla **(D)** Max **(E)** Tanya

Part B: Each correct answer is worth 6.

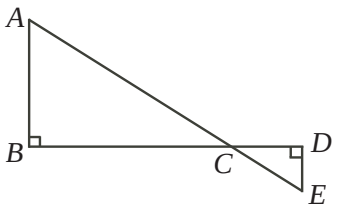
11. Which of the following expressions is equal to 5?
(A) $(2 \times 3)^2$ **(B)** $3 + 2^2$ **(C)** $2^3 - 1$
(D) $3^2 - 2^2$ **(E)** $(3 + 2)^2$

12. Nick charges \$7 for travel costs and then \$10 per hour for babysitting. Which expression always represents the number of dollars that Nick charges for y hours of babysitting?
(A) $10y + 7$ **(B)** $y + 7$ **(C)** $17y - 7$ **(D)** $10y - 7$ **(E)** $17y$

13. Kalob's window measures 50 cm × 80 cm. Which of the following measurements would give an area that is exactly double the area of his window?
(A) 25 cm × 160 cm **(B)** 40 cm × 100 cm **(C)** 50 cm × 160 cm
(D) 100 cm × 160 cm **(E)** 50 cm × 120 cm

14. March 3, 2009 or 3/3/09 was called a "square root day" because the day and the month are both the square root of the last two digits of the year. The number of square root days between January 1, 2012 and December 31, 2099 is
(A) 2 **(B)** 3 **(C)** 4 **(D)** 5 **(E)** 6

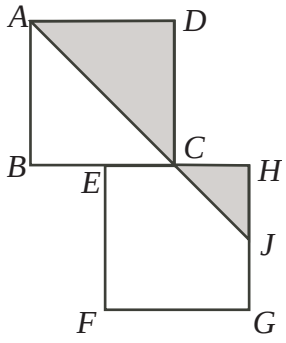
15. In the diagram, AE and BD are straight lines that intersect at C. If $BD = 16$, $AB = 9$, $CE = 5$, and $DE = 3$, then the length of AC is
(A) 11 **(B)** 12 **(C)** 15
(D) 17 **(E)** 16



16. Beatrix is twice the height of Violet, and Violet is $\frac{2}{3}$ the height of Georgia. What fraction of Georgia's height is Beatrix's height?
(A) $\frac{9}{7}$ **(B)** $\frac{2}{3}$ **(C)** $\frac{4}{3}$ **(D)** $\frac{5}{4}$ **(E)** $\frac{3}{2}$

17. If x is a number between 0 and 1, which of the following represents the smallest value?
(A) x **(B)** x^2 **(C)** $2x$ **(D)** $\sqrt{x}$ **(E)** $\frac{1}{x}$

18. Squares $ABCD$ and $EFGH$ are equal in area. Vertices B, E, C, and H lie on the same straight line. Diagonal AC is extended to J, the midpoint of GH. The fraction of the two squares that is shaded is
(A) $\frac{5}{8}$ **(B)** $\frac{1}{3}$ **(C)** $\frac{2}{5}$
(D) $\frac{5}{16}$ **(E)** $\frac{3}{8}$



19. How many positive integers less than 400 can be created using only the digits 1, 2 or 3, with repetition of digits allowed?
(A) 30 **(B)** 33 **(C)** 36 **(D)** 39 **(E)** 42

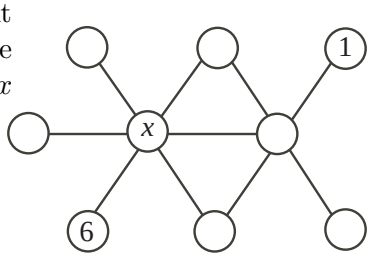
20. The heights of 12 boys and 10 girls in a class are recorded. The average height of all 22 students in the class is 103 cm. If the average height of the boys is 108 cm, then the average height of the girls is
(A) 96 cm **(B)** 97 cm **(C)** 98 cm **(D)** 99 cm **(E)** 100 cm

Part C: Each correct answer is worth 8.

21. A collection of coins includes only pennies (1¢), nickels (5¢), dimes (10¢) and quarters (25¢). Using the coins in this collection, it is possible to create any amount of money less than one dollar (100¢). What is the smallest possible number of coins in the collection?

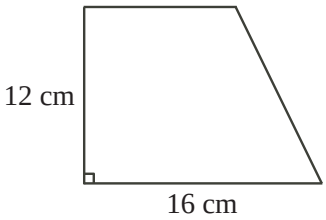
(A) 10 **(B)** 7 **(C)** 11 **(D)** 13 **(E)** 12

22. In the diagram, each of the integers 1 through 9 is to be placed in one circle so that the integers in every straight row of three joined circles add to 18. The 6 and 1 have been filled in. The value of the number represented by x is



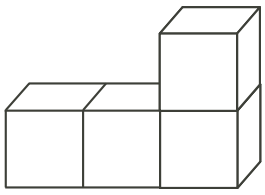
(A) 4 **(B)** 5 **(C)** 7
(D) 8 **(E)** 3

23. The trapezoid shown has a height of length 12 cm, a base of length 16 cm, and an area of 162 cm^2. The perimeter of the trapezoid is



(A) 51 cm **(B)** 52 cm **(C)** $49.\overline{6}$ cm
(D) 50 cm **(E)** 56 cm

24. Ada has a set of identical cubes. She makes solids by gluing together 4 of these cubes. When cube faces are glued together, they must coincide. Each of the 4 cubes must have a face that coincides with a face of at least one of the other 3 cubes. One such solid is shown. The number of unique solids that Ada can make using 4 cubes is



(A) 5 **(B)** 6 **(C)** 7
(D) 8 **(E)** 10

25. Daryl first writes the perfect squares as a sequence

$$1, 4, 9, 16, 25, 36, 49, 64, 81, 100, \ldots$$

After the number 1, he then alternates by making two terms negative followed by leaving two terms positive. Daryl's new sequence is

$$1, -4, -9, 16, 25, -36, -49, 64, 81, -100, \ldots$$

What is the sum of the first 2011 terms in this new sequence?

(A) $-4\,042\,109$ **(B)** $-4\,047\,638$ **(C)** $-4\,038\,094$
(D) $-4\,044\,121$ **(E)** $-4\,046\,132$

Canadian Mathematics Competition

An activity of the Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(The Grade 7 Contest is on the reverse side)

Wednesday, May 12, 2010

Time: 1 hour

Calculators are permitted.

Instructions

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Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

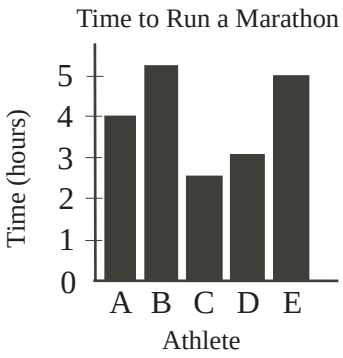
Part A: Each correct answer is worth 5.

1. $2 + 3 \times 4 + 10$ equals

   (A) 24 **(B)** 60 **(C)** 70 **(D)** 19 **(E)** 34

2. The graph shows the length of time it took five athletes to run a marathon. Who won the race?

   (A) Athlete A **(B)** Athlete B **(C)** Athlete C
   (D) Athlete D **(E)** Athlete E



3. If $x = 2$ and $y = 1$, the value of $2x - 3y$ equals

   (A) 11 **(B)** 1 **(C)** 4 **(D)** 5 **(E)** 3

4. If $44 \times 25 = \square \times 100$, the number that should replace the $\square$ is

   (A) 11 **(B)** 176 **(C)** 0.0909 **(D)** 56.8181 **(E)** 40

5. The area of a rectangle is 12. Each of its side lengths is a whole number. What is the smallest possible perimeter of this rectangle?

   (A) 24 **(B)** 48 **(C)** 26 **(D)** 14 **(E)** 16

6. Which is the largest sum?

   (A) $\frac{1}{4} + \frac{1}{5}$ **(B)** $\frac{1}{4} + \frac{1}{6}$ **(C)** $\frac{1}{4} + \frac{1}{3}$ **(D)** $\frac{1}{4} + \frac{1}{8}$ **(E)** $\frac{1}{4} + \frac{1}{7}$

7. Greg bought a 300 gram container of sunflower seeds. He found that 15 seeds weighed about 1 gram. Approximately how many sunflower seeds are in the container?

   (A) 600 **(B)** 4500 **(C)** 60 000 **(D)** 45 000 **(E)** 6000

8. The time on a digital clock is 10:25. In minutes, what is the shortest length of time until all the digits on the clock will be equal to one another?

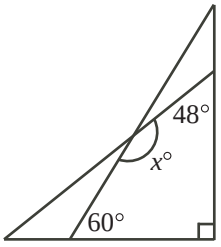
   (A) 36 **(B)** 107 **(C)** 86 **(D)** 46 **(E)** 187

9. Chris was given $\frac{1}{3}$ of the 84 cookies in the cookie jar. He ate $\frac{3}{4}$ of the cookies that he was given. How many cookies did Chris eat?

   (A) 36 **(B)** 48 **(C)** 35 **(D)** 28 **(E)** 21

10. In the diagram, the value of x is

    (A) 72 **(B)** 158 **(C)** 108
    (D) 138 **(E)** 162



Part B: Each correct answer is worth 6.

11. If the mean (average) of five consecutive integers is 21, the smallest of the five integers is

(A) 17 **(B)** 21 **(C)** 1 **(D)** 18 **(E)** 19

12. The number of white balls and red balls in a jar is in the ratio of 3 : 2.
If there are 9 white balls, how many red balls are there?

(A) 5 **(B)** 8 **(C)** 2 **(D)** 6 **(E)** 3

13. The value of $\left(\frac{11}{12}\right)^2$ is

(A) between $1\frac{1}{2}$ and 2 **(B)** between $\frac{1}{2}$ and 1 **(C)** greater than 2
(D) between 0 and $\frac{1}{2}$ **(E)** between 1 and $1\frac{1}{2}$

14. Gina plays 5 games as a hockey goalie. The table shows the number of shots on her net and her saves for each game. What percentage of the total shots did she save?

(A) 52 **(B)** 65 **(C)** 80
(D) 82 **(E)** 85

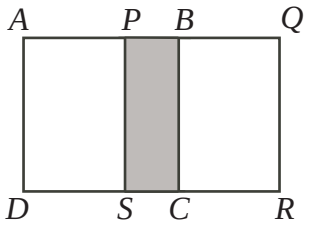
Game	Shots	Saves
1	10	7
2	13	9
3	7	6
4	11	9
5	24	21

15. If four *different* numbers are chosen from 5, 6, 7, 8, 9 to replace the □'s below, what is the smallest possible sum of the two 2-digit numbers?

$$\begin{array}{r} \square\ \square \\ +\ \square\ \square \\ \hline \end{array}$$

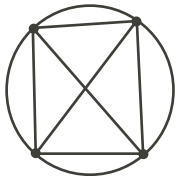
(A) 123 **(B)** 125 **(C)** 126 **(D)** 134 **(E)** 161

16. Two identical squares, $ABCD$ and $PQRS$, have side length 12. They overlap to form the 12 by 20 rectangle $AQRD$ shown. What is the area of the shaded rectangle $PBCS$?



(A) 24 **(B)** 36 **(C)** 48
(D) 72 **(E)** 96

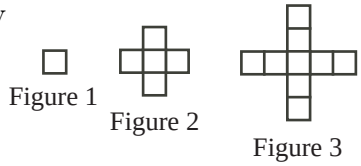
17. Distinct points are placed on a circle. Each pair of points is joined with a line segment. An example with 4 points and 6 line segments is shown. If 8 distinct points are placed on a circle, how many line segments would there be?



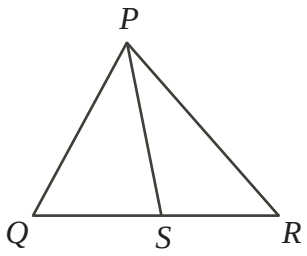
(A) 27 **(B)** 36 **(C)** 21
(D) 56 **(E)** 28

18. A bicycle travels at a constant speed of 15 km/h. A bus starts 195 km behind the bicycle and catches up to the bicycle in 3 hours. What is the average speed of the bus in km/h?
(A) 65 **(B)** 80 **(C)** 70 **(D)** 60 **(E)** 50

19. In the sequence shown, each figure after the first is formed by adding 4 squares to the previous figure. How many squares form Figure 2010?
(A) 8037 **(B)** 8040 **(C)** 8043
(D) 6030 **(E)** 6026

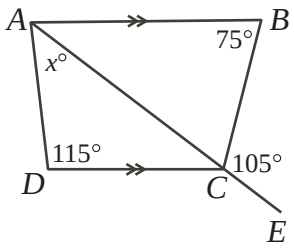


20. In $\triangle PQR$, a line segment is drawn from P to point S on side QR. If $\triangle PQS$ and $\triangle PRS$ have the same area, which of the following statements *must* be true?
(A) $PQ = PR$ **(B)** $PS = PQ$ **(C)** $QR = PS$
(D) $QS = SR$ **(E)** $PQ = QR$



Part C: Each correct answer is worth 8.

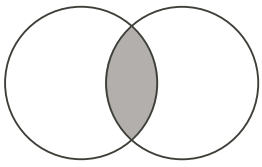
21. In the diagram, AB is parallel to DC and ACE is a straight line. The value of x is
(A) 35 **(B)** 30 **(C)** 40
(D) 45 **(E)** 50



22. The values of r, s, t, and u are 2, 3, 4, and 5, but not necessarily in that order. What is the largest possible value of $r \times s + u \times r + t \times r$?
(A) 24 **(B)** 45 **(C)** 33 **(D)** 40 **(E)** 49

23. To shovel all of the snow on his driveway, Kevin needs 12 hours. Individually, Dave needs 8 hours to shovel all of Kevin's snow, John needs 6 hours to shovel all of Kevin's snow, and Allison needs 4 hours to shovel all of Kevin's snow. If Kevin, Dave, John, and Allison all work together, how many minutes do they need to shovel all of Kevin's snow?
(A) 108 **(B)** 120 **(C)** 84 **(D)** 96 **(E)** 90

24. Two circles each have radius 10 cm. They overlap so that each contains exactly 25% of the other's circumference, as shown. The area of the shaded region is closest to
(A) 57.08 cm^2 **(B)** 55.24 cm^2 **(C)** 51.83 cm^2
(D) 54.17 cm^2 **(E)** 53.21 cm^2



25. In a sequence of 10 terms, the first term is 1, the second term is x, and each term after the second is the sum of the previous two terms. For example, if $x = 11$, the sequence would be $1, 11, 12, 23, 35, 58, 93, 151, 244, 395$. For some values of x, the number 463 appears in the sequence. If x is a positive integer, what is the sum of all the values of x for which 463 appears in the sequence?
(A) 1156 **(B)** 1296 **(C)** 1248 **(D)** 1528 **(E)** 1283

Canadian Mathematics Competition

An activity of the Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(The Grade 7 Contest is on the reverse side)

Wednesday, May 13, 2009

Time: 1 hour

Calculators are permitted.

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Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $1 + 3^2$ is

   (A) 16 **(B)** 10 **(C)** 8 **(D)** 6 **(E)** 5

2. The value of $-10 + (-12)$ is

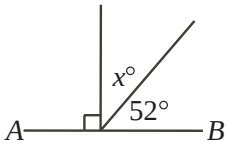
   (A) 2 **(B)** 22 **(C)** -2 **(D)** -22 **(E)** 120

3. Jack has a 3 litre jug of water. What is the maximum number of 0.5 litre bottles that he can completely fill?

   (A) 3 **(B)** 1.5 **(C)** 6 **(D)** 12 **(E)** 15

4. In the diagram, AB is a line segment. The value of x is

   (A) 128 **(B)** 38 **(C)** 48
   (D) 142 **(E)** 308

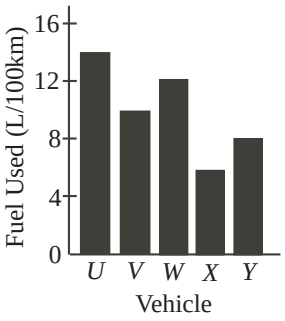


5. Rounded to 2 decimal places, $\frac{7}{9}$ is

   (A) 0.70 **(B)** 0.77 **(C)** 0.78 **(D)** 0.79 **(E)** 0.80

6. The graph shows the fuel used per 100 km of driving for five different vehicles. Which vehicle would travel the farthest using 50 litres of fuel?

   (A) U **(B)** V **(C)** W
   (D) X **(E)** Y



7. Kayla went to the fair with \$100. She spent $\frac{1}{4}$ of her \$100 on rides and $\frac{1}{10}$ of her \$100 on food. How much money did she spend?

   (A) \$65 **(B)** \$32.50 **(C)** \$2.50 **(D)** \$50 **(E)** \$35

8. The number of faces (F), vertices (V) and edges (E) of a polyhedron are related by the equation $F + V - E = 2$. If a polyhedron has 6 faces and 8 vertices, how many edges does it have?

   (A) 12 **(B)** 14 **(C)** 16 **(D)** 18 **(E)** 10

9. If Jeff picks one letter randomly from the alphabet, what is the probability that the letter is in the word 'probability'?

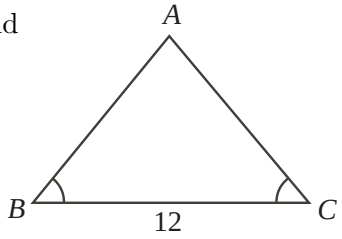
   (A) $\frac{9}{26}$ **(B)** $\frac{15}{26}$ **(C)** $\frac{10}{26}$ **(D)** $\frac{17}{26}$ **(E)** $\frac{8}{26}$

10. If two numbers differ by 2 and their sum is 20, the larger number is

    (A) 11 **(B)** 10 **(C)** 9 **(D)** 12 **(E)** 8

Part B: Each correct answer is worth 6.

11. The perimeter of $\triangle ABC$ is 32. If $\angle ABC = \angle ACB$ and $BC = 12$, the length of AB is



(A) 20 **(B)** 12 **(C)** 10 **(D)** 8 **(E)** 16

12. A temperature measured in degrees Celsius (C) can be converted to degrees Fahrenheit (F) using the formula $F = \frac{9}{5}C + 32$. If the temperature is 10 degrees Celsius, what is the temperature in degrees Fahrenheit?

(A) -26.4 **(B)** -12.2 **(C)** 75.6 **(D)** 50.0 **(E)** 43.8

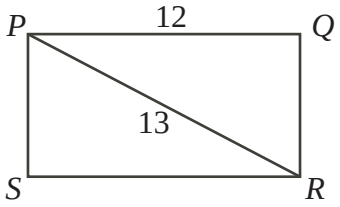
13. In how many ways can 101 be expressed as the sum of two integers, both greater than zero, with the second integer greater than the first?

(A) 50 **(B)** 51 **(C)** 101 **(D)** 102 **(E)** 25

14. Vanessa set a school record for most points in a single basketball game when her team scored 48 points. The six other players on her team averaged 3.5 points each. How many points did Vanessa score to set her school record?

(A) 21 **(B)** 25 **(C)** 32 **(D)** 17 **(E)** 27

15. In rectangle $PQRS$, $PQ = 12$ and $PR = 13$. The area of rectangle $PQRS$ is



(A) 30 **(B)** 60 **(C)** 36 **(D)** 78 **(E)** 72

16. When it is 3:00 p.m. in Victoria, it is 6:00 p.m. in Timmins. Stefan's flight departed at 6:00 a.m. local Victoria time and arrived at 4:00 p.m. local Timmins time. How long, in hours, was his flight?

(A) 5 **(B)** 9 **(C)** 13 **(D)** 7 **(E)** 8

17. A jar contains quarters (worth \$0.25 each), nickels (worth \$0.05 each) and pennies (worth \$0.01 each). The value of the quarters is \$10.00. The value of the nickels is \$10.00. The value of the pennies is \$10.00. If Judith randomly chooses one coin from the jar, what is the probability that it is a quarter?

(A) $\frac{25}{31}$ **(B)** $\frac{1}{31}$ **(C)** $\frac{1}{3}$ **(D)** $\frac{5}{248}$ **(E)** $\frac{1}{30}$

18. In a class of 40 students, 18 said they liked apple pie, 15 said they liked chocolate cake and 12 said they did not like either. How many students in the class liked both?

(A) 15 **(B)** 10 **(C)** 3 **(D)** 7 **(E)** 5

19. In the addition shown, P, Q and R each represent a single digit, and the sum is 2009. The value of $P + Q + R$ is

$$\begin{array}{rr} & PQP \\ + & RQQQ \\ \hline & 2009 \end{array}$$

(A) 9 **(B)** 10 **(C)** 11 **(D)** 12 **(E)** 13

20. A piece of string fits exactly once around the perimeter of a square whose area is 144. Rounded to the nearest whole number, the area of the largest circle that can be formed from the piece of string is

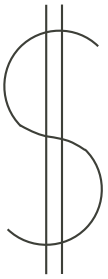
(A) 144 **(B)** 733 **(C)** 113 **(D)** 452 **(E)** 183

Part C: Each correct answer is worth 8.

21. The product of four *different* positive integers is 360. What is the maximum possible sum of these four integers?

(A) 68 **(B)** 66 **(C)** 52 **(D)** 39 **(E)** 24

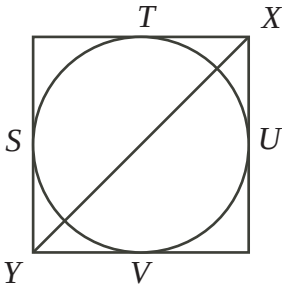
22. A dollar sign is formed by drawing two parallel vertical lines through the letter S, as shown. These lines cut the letter S into 7 pieces. What is the minimum total number of parallel vertical lines that are needed to cut the letter S into exactly 154 pieces?



(A) 23 **(B)** 44 **(C)** 22

(D) 51 **(E)** 70

23. In the diagram, the circle is *inscribed* in the square. This means that the circle and the square share points S, T, U, and V, and the width of the square is exactly equal to the diameter of the circle. Rounded to the nearest tenth, what percentage of line segment XY is outside the circle?

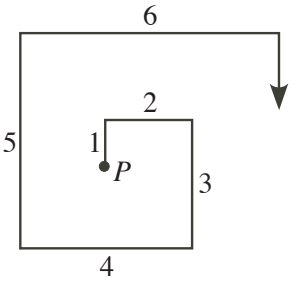


(A) 29.3 **(B)** 28.3 **(C)** 33.3

(D) 25.0 **(E)** 16.7

24. Starting at point P, Breenah constructs a straight sided spiral so that:

- all angles are 90°
- after starting with a line segment of length 1, each side is 1 longer than the previous side.



After completing the side with length 21, Breenah's distance from her original starting point P will be between

(A) 13 and 14 **(B)** 14 and 15 **(C)** 15 and 16

(D) 16 and 17 **(E)** 17 and 18

25. A list of six positive integers p, q, r, s, t, u satisfies $p < q < r < s < t < u$. There are exactly 15 pairs of numbers that can be formed by choosing two different numbers from this list. The sums of these 15 pairs of numbers are:

$$25, 30, 38, 41, 49, 52, 54, 63, 68, 76, 79, 90, 95, 103, 117.$$

Which sum equals $r + s$?

(A) 52 **(B)** 54 **(C)** 63 **(D)** 68 **(E)** 76

Canadian Mathematics Competition

An activity of the Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(The Grade 7 Contest is on the reverse side)

Wednesday, May 14, 2008

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

Please see our Web site: http://www.cemc.uwaterloo.ca. The Gauss Report will list the names of some top-scoring students. You will also be able to find copies of past Contests and excellent resources for enrichment, problem solving and contest preparation.

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $8 \times (6 - 4) + 2$ is

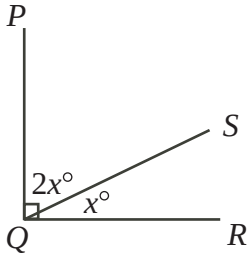
   (A) 46 **(B)** 20 **(C)** 18 **(D)** 12 **(E)** 56

2. A regular polygon has perimeter 108 cm and each side has length 12 cm. How many sides does this polygon have?

   (A) 6 **(B)** 7 **(C)** 8 **(D)** 9 **(E)** 10

3. In the diagram, $\angle PQR = 90°$. The value of x is

   (A) 30 **(B)** 60 **(C)** 90
   (D) 10 **(E)** 45



4. The value of $(1 + 2)^2 - (1^2 + 2^2)$ is

   (A) 14 **(B)** 4 **(C)** 2 **(D)** 12 **(E)** 1

5. When the numbers $0.28, -0.2, 2.8, -8.2$ are listed in increasing order, the correct order is

   (A) -8.2 , -0.2 , 0.28, 2.8
   (B) 2.8 , 0.28, -0.2 , -8.2
   (C) -8.2 , -0.2 , 2.8 , 0.28
   (D) 2.8 , 0.28, -8.2 , -0.2
   (E) -0.2 , -8.2 , 0.28, 2.8

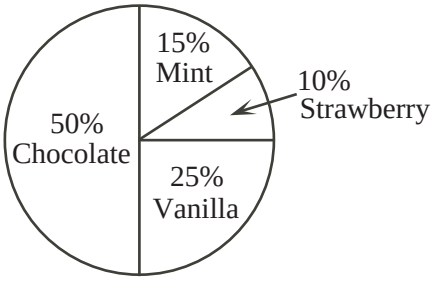
6. In the table, what number should be placed in the box?

   (A) 27 **(B)** 247 **(C)** 79
   (D) 19 **(E)** 129

n	$n^3 + n - 1$
1	1
2	9
3	29
4	67
5	

7. The circle graph shows the favourite ice cream flavours of those surveyed. What fraction of people surveyed selected either chocolate or strawberry as their favourite flavour of ice cream?

   (A) $\frac{3}{5}$ **(B)** $\frac{1}{3}$ **(C)** $\frac{2}{3}$
   (D) $\frac{3}{4}$ **(E)** $\frac{5}{8}$



8. A number is multiplied by 5 and then 9 is subtracted from the result, giving 51. What is the original number?

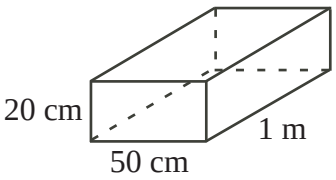
   (A) 210 **(B)** 8.4 **(C)** 65 **(D)** 12 **(E)** 15

9. Danny weighs 40 kg. Steven weighs 20% more than Danny. Steven's weight is
(A) 50 kg **(B)** 60 kg **(C)** 48 kg **(D)** 32 kg **(E)** 72 kg

10. The numbers 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13 are written on separate cards and placed face down on a table. A card is chosen at random and flipped over. What is the probability that the number on this card is a prime number?
(A) $\frac{2}{11}$ **(B)** $\frac{4}{11}$ **(C)** $\frac{6}{11}$ **(D)** $\frac{3}{11}$ **(E)** $\frac{5}{11}$

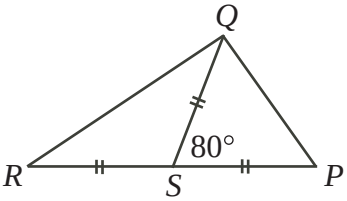
Part B: Each correct answer is worth 6.

11. In the diagram, the rectangular solid has side lengths 1 m, 20 cm and 50 cm. The volume of the solid, in cubic centimetres, is
(A) 170 **(B)** 7000 **(C)** 1 000 000
(D) 100 000 **(E)** 10 000



12. As a fund raiser, Gaussville Elementary School bought 8-slice pizzas for \$6.85 each. The school bought 55 pizzas and sold every slice. If each slice sold for \$1, the school's profit was
(A) \$55.00 **(B)** \$57.75 **(C)** \$60.50 **(D)** \$63.25 **(E)** \$66.00

13. In the diagram, RSP is a straight line and $\angle QSP = 80°$. The measure of $\angle PQR$ is
(A) 120° **(B)** 90° **(C)** 80°
(D) 60° **(E)** 75°



14. Amos is reading a 400 page book. On Monday, he reads 40 pages. On each day after the first, the number of pages that he reads is 20 more than on the previous day. Amos finishes the book on
(A) Friday **(B)** Saturday **(C)** Sunday **(D)** Monday **(E)** Thursday

15. Abby has 23 coins. The coins have a total value of \$4.55. If she has only quarters (worth 25 cents each) and nickels (worth 5 cents each), how many quarters does she have?
(A) 15 **(B)** 17 **(C)** 18 **(D)** 16 **(E)** 21

16. A 4×4 square grid can be entirely covered by three non-overlapping pieces made from 1×1 squares. If the first two pieces are  and  , the third piece is

(A)  **(B)**  **(C)**  **(D)**  **(E)** 

17. The decimal expansion of $\frac{2}{13}$ is the repeating decimal $0.\overline{153846}$. What digit occurs in the 2008th place after the decimal point?
(A) 8 **(B)** 6 **(C)** 5 **(D)** 4 **(E)** 3

18. Andrea has finished the third day of a six-day canoe trip. If she has completed $\frac{3}{7}$ of the trip's total distance of 168 km, how many km per day must she average for the remainder of her trip?
(A) 29 **(B)** 24 **(C)** 27 **(D)** 32 **(E)** 26

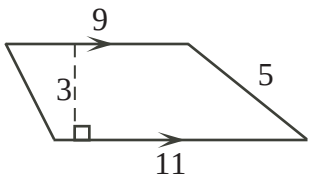
19. In the addition of three-digit numbers shown, the letters x and y represent different digits.

$$\begin{array}{cccc} & 3 & x & y \\ + & y & x & 3 \\ \hline 1 & x & 1 & x \end{array}$$

The value of $y - x$ is

(A) 3 **(B)** -5 **(C)** 7 **(D)** -7 **(E)** 2

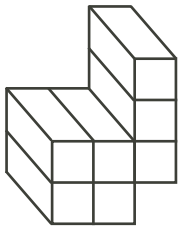
20. What is the area of the figure shown?



(A) 45 **(B)** 55 **(C)** 27 **(D)** 30 **(E)** 33

Part C: Each correct answer is worth 8.

21. In the diagram, the object is made up of seven $1 \times 1 \times 2$ solids. What is the total surface area of the object?



(A) 42 **(B)** 40 **(C)** 38 **(D)** 48 **(E)** 70

22. A 3×3 grid is filled with the digits 1, 2 and 3 so that each number appears once in in each row and column. Two different examples are

1	2	3
3	1	2
2	3	1

and

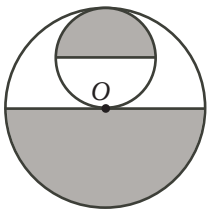
3	2	1
2	1	3
1	3	2

.

How many different ways are there of filling the grid?

(A) 14 **(B)** 12 **(C)** 10 **(D)** 8 **(E)** 6

23. In the diagram, each circle is divided into two equal areas and O is the centre of the larger circle. The area of the larger circle is 64π. The total area of the shaded regions is



(A) 34π **(B)** 36π **(C)** 44π **(D)** 40π **(E)** 33π

24. The sum of all of the digits of the integers from 98 to 101 is

$$9 + 8 + 9 + 9 + 1 + 0 + 0 + 1 + 0 + 1 = 38$$

The sum of all of the digits of the integers from 1 to 2008 is

(A) 30 054 **(B)** 27 018 **(C)** 28 036 **(D)** 30 036 **(E)** 28 054

25. Chantelle had two candles, one of which was 32 cm longer than the other.
She lit the longer one at 3 p.m. and lit the shorter one at 7 p.m.
At 9 p.m., they were both the same length.
The longer one was completely burned out at 10 p.m. and the shorter one was completely burned at midnight.
The two candles burned at different, but constant, rates.
What was the sum of the original lengths of the two candles?

(A) 42 cm **(B)** 48 cm **(C)** 60 cm **(D)** 80 cm **(E)** 52 cm

Canadian Mathematics Competition

An activity of the Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(The Grade 7 Contest is on the reverse side)

Wednesday, May 16, 2007

Time: 1 hour

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Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $(4 \times 12) - (4 + 12)$ is

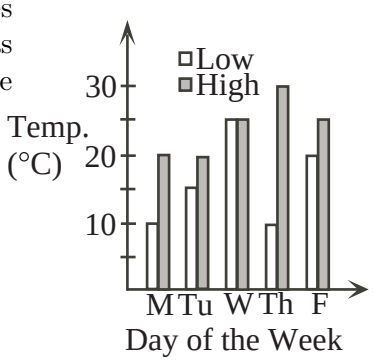
   (A) 8 **(B)** 16 **(C)** 20 **(D)** 24 **(E)** 32

2. The sum $\frac{3}{10} + \frac{3}{1000}$ is equal to

   (A) 0.33 **(B)** 0.303 **(C)** 0.033 **(D)** 0.0303 **(E)** 0.0033

3. The graph shows the daily high and low temperatures last week in Waterloo. On which day of the week was the difference between the high and low temperatures the greatest?

   (A) Monday **(B)** Tuesday **(C)** Wednesday **(D)** Thursday **(E)** Friday

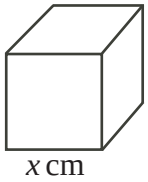


4. A cube having the digits 1, 2, 3, 4, 5, 6 on its six faces is tossed. What is the probability that the number on the top face is 5 or 6?

   (A) $\frac{5}{6}$ **(B)** $\frac{1}{5}$ **(C)** $\frac{1}{3}$ **(D)** $\frac{11}{36}$ **(E)** $\frac{2}{5}$

5. In the diagram, the cube has a volume of 8 cm^3. What is the value of x?

   (A) 2 **(B)** 8 **(C)** 4 **(D)** 6 **(E)** 3



6. The cost of a 3 minute cell phone call is \$0.18. At the same rate per minute, what is the cost of a 10 minute call?

   (A) \$0.30 **(B)** \$0.60 **(C)** \$1.80 **(D)** \$5.40 **(E)** \$6.00

7. What is the equivalent of 200 metres in kilometres?

   (A) 0.2 **(B)** 0.02 **(C)** 2 **(D)** 20 **(E)** 200 000

8. The Gauss family has three boys aged 7, a girl aged 14, and a boy aged 15. What is the mean (average) of the ages of the children?

   (A) 9 **(B)** 7 **(C)** 11 **(D)** 14 **(E)** 10

9. If $x = 5$ and $y = x + 3$ and $z = 3y + 1$, the value of z is

   (A) 7 **(B)** 25 **(C)** 12 **(D)** 46 **(E)** 19

10. The number 519 is formed using the digits 5, 1 and 9. The three digits of this number are rearranged to form the largest possible and then the smallest possible three digit numbers. What is the difference between these largest and smallest numbers?

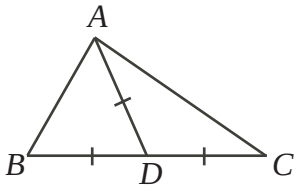
(A) 332 **(B)** 432 **(C)** 792 **(D)** 756 **(E)** 720

Part B: Each correct answer is worth 6.

11. Lily is 90 cm tall. If Anika is $\frac{4}{3}$ of the height of Lily, and Sadaf is $\frac{5}{4}$ of the height of Anika, how tall is Sadaf?

(A) 180 cm **(B)** 70 cm **(C)** 96 cm **(D)** 120 cm **(E)** 150 cm

12. In the diagram, $AD = BD = CD$ and $\angle BCA = 40°$. The size of $\angle BAC$ is



(A) 80° **(B)** 120° **(C)** 60°
(D) 90° **(E)** 100°

13. Cayli must choose one activity from each of the following groups: art, sports, and music. If there are 2 art choices, 3 sports choices, and 4 music choices, how many possible combinations of art, sports, and music choices can Cayli make?

(A) 9 **(B)** 24 **(C)** 12 **(D)** 14 **(E)** 20

14. At the 2007 Math Olympics, Team Canada won 17 out of a possible 100 medals. Which one of the following is closest to the fraction of medals that they won?

(A) $\frac{1}{4}$ **(B)** $\frac{1}{5}$ **(C)** $\frac{1}{6}$ **(D)** $\frac{1}{7}$ **(E)** $\frac{1}{8}$

15. Sally picks four consecutive positive integers. She divides each integer by four, and then adds the remainders together. The sum of the remainders is

(A) 6 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

16. When the radius of a circle is tripled, how are the area and circumference of the circle affected?

(A) The area is 9 times as large and the circumference is 3 times as large.
(B) The area is 3 times as large and the circumference is 9 times as large.
(C) The area is 3 times as large and the circumference is 6 times as large.
(D) The area is 6 times as large and the circumference is 3 times as large.
(E) The area is 3 times as large and the circumference is 3 times as large.

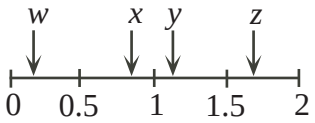
17. In Math Idol, there was a total of 5 219 000 votes cast for four potential Idols. The winner received 22 000 more votes than the 2nd place contestant, 30 000 more than the 3rd place contestant, and 73 000 more than the 4th place contestant. How many votes did the winner receive?

(A) 1 273 500 **(B)** 1 263 000 **(C)** 1 306 000 **(D)** 1 336 000 **(E)** 1 346 500

18. The number n is doubled and then has y added to it. The result is then divided by 2 and has the original number n subtracted from it. The final result is

(A) n **(B)** y **(C)** $n + y$ **(D)** $\frac{n+y}{2}$ **(E)** $\frac{y}{2}$

19. In the diagram, w, x, y, and z represent numbers in the intervals indicated. Which fraction represents the largest value?



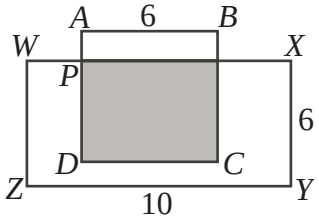
(A) $\frac{x}{w}$ **(B)** $\frac{y}{x}$ **(C)** $\frac{y}{w}$ **(D)** $\frac{z}{x}$ **(E)** $\frac{z}{w}$

20. Lorri took a 240 km trip to Waterloo. On her way there, her average speed was 120 km/h. She was stopped for speeding, so on her way home her average speed was 80 km/h. What was her average speed, in km/h, for the entire round-trip?

(A) 90 **(B)** 96 **(C)** 108 **(D)** 102 **(E)** 110

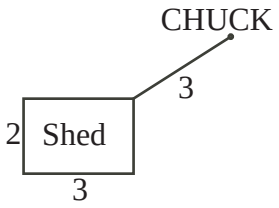
Part C: Each correct answer is worth 8.

21. In the diagram, $ABCD$ is a square with side length 6, and $WXYZ$ is a rectangle with $ZY = 10$ and $XY = 6$. Also, AD and WX are perpendicular. If the shaded area is equal to half of the area of $WXYZ$, the length of AP is



(A) 1 **(B)** 1.5 **(C)** 4 **(D)** 2 **(E)** 2.5

22. Chuck the llama is tied to the corner of a 2 m by 3 m shed on a 3 m leash. How much area does Chuck have in which to play if he can go only around the outside of the shed?

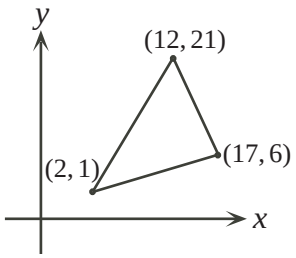


(A) 7π m^2 **(B)** 9π m^2 **(C)** $\frac{27}{4}\pi$ m^2 **(D)** 4π m^2 **(E)** 5π m^2

23. There are various ways to make \$207 using only \$2 coins and \$5 bills. One such way is using one \$2 coin and forty-one \$5 bills. Including this way, in how many different ways can \$207 be made using only \$2 coins and \$5 bills?

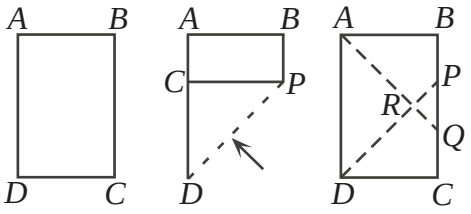
(A) 9 **(B)** 10 **(C)** 19 **(D)** 41 **(E)** 21

24. A lattice point is a point (x, y), with x and y both integers. For example, $(2, 3)$ is a lattice point but $(4, \frac{1}{3})$ is not. In the diagram, how many lattice points lie on the perimeter of the triangle?



(A) 16 **(B)** 18 **(C)** 20 **(D)** 23 **(E)** 30

25. A rectangular piece of paper $ABCD$ is folded so that edge CD lies along edge AD, making a crease DP. It is unfolded, and then folded again so that edge AB lies along edge AD, making a second crease AQ. The two creases meet at R, forming triangles PQR and ADR, as shown. If $AB = 5$ cm and $AD = 8$ cm, the area of quadrilateral $DRQC$, in cm^2, is



(A) 10.5 **(B)** 10 **(C)** 11 **(D)** 11.5 **(E)** 12

Canadian Mathematics Competition

An activity of the Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(The Grade 7 Contest is on the reverse side)

Wednesday, May 10, 2006

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the contest booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be sure that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have made your choice, enter the appropriate letter for that question on your answer sheet.
5. Scoring: Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

Please see our website http://www.cemc.uwaterloo.ca for copies of past Contests and for information on publications which are excellent resources for enrichment, problem solving and contest preparation.

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $30 - 5^2$ is

   (A) 20 **(B)** 55 **(C)** 625 **(D)** 400 **(E)** 5

2. Which of the following numbers *does not* divide exactly into 98?

   (A) 2 **(B)** 4 **(C)** 7 **(D)** 14 **(E)** 49

3. Janne buys a camera which costs \$200.00 without tax. If she pays 15% tax on this purchase, how much tax does she pay?

   (A) \$30.00 **(B)** \$18.00 **(C)** \$20.00 **(D)** \$15.00 **(E)** \$45.00

4. If $1 + 1.1 + 1.11 + \square = 4.44$, what number should be put in the box to make the equation true?

   (A) 3.33 **(B)** 1.23 **(C)** 0.12 **(D)** 2.13 **(E)** 3.21

5. There are 2 red, 5 yellow and 4 blue balls in a bag. If a ball is chosen at random from the bag, without looking, the probability of choosing a yellow ball is

   (A) $\frac{2}{11}$ **(B)** $\frac{5}{11}$ **(C)** $\frac{4}{11}$ **(D)** $\frac{6}{11}$ **(E)** $\frac{7}{11}$

6. How many prime numbers are there between 20 and 30?

   (A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

7. The volume of a rectangular block is 120 cm^3. If the area of its base is 24 cm^2, what is its height?

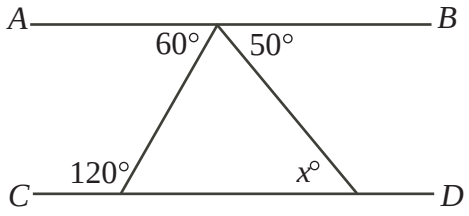
   (A) 5 cm **(B)** 15 cm **(C)** 0.2 cm **(D)** 0.6 cm **(E)** 1 cm

8. On the "slow" setting, a fan rotates 100 times in 1 minute. The rate of rotation doubles on the "medium" setting, and doubles again on the "high" setting. How many times will the fan rotate in 15 minutes on the "high" setting?

   (A) 3000 **(B)** 1500 **(C)** 6000 **(D)** 4500 **(E)** 60 000

9. In the diagram, AB and CD are straight lines. The value of x is

   (A) 50 **(B)** 60 **(C)** 70 **(D)** 130 **(E)** 230



10. The Gauss Candy Company has 8362 lollipops to package. They place exactly 12 lollipops in each package. How many lollipops remain after the maximum possible number of packages are filled?

    (A) 2 **(B)** 4 **(C)** 6 **(D)** 8 **(E)** 10

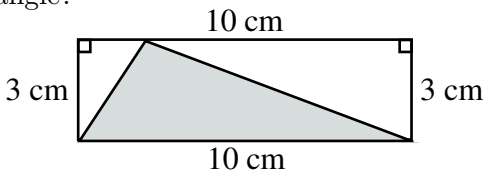
Part B: Each correct answer is worth 6.

11. The sound of thunder travels away from a lightning flash at 331 m/s. Joe sees a lightning flash, and then hears the thunder 12 seconds later. To the nearest tenth of a kilometre, how far away is Joe from the lightning flash?

(A) 3.0 **(B)** 3.5 **(C)** 4.0 **(D)** 4.5 **(E)** 5.0

12. In the diagram, what is the area of the shaded triangle?

(A) 6.5 cm^2 **(B)** 7.5 cm^2 **(C)** 15 cm^2
(D) 13 cm^2 **(E)** 22.5 cm^2



13. Last year, Kiril's age was a multiple of 7.
This year, Kiril's age is a multiple of 5.
In how many years will Kiril be 26 years old?

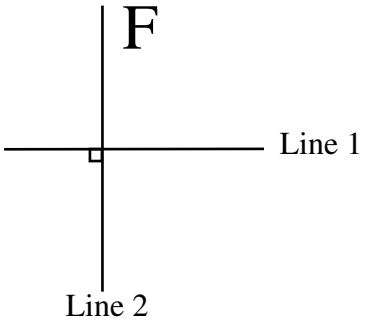
(A) 11 **(B)** 21 **(C)** 4 **(D)** 18 **(E)** 16

14. In a sequence of numbers, the first term is 500. Each new term is determined by dividing the previous term by 2 and then adding 10. For example, the second term is 260. What is the fourth term in the sequence?

(A) 75 **(B)** 65 **(C)** 70 **(D)** 60 **(E)** 80

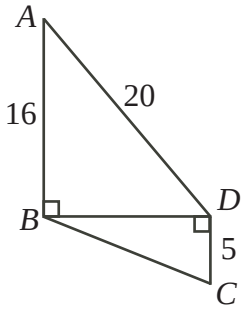
15. The letter F is reflected in Line 1. The image is then reflected in Line 2. The shape that results is

(A) F **(B)** Ⅎ **(C)** ⅁
(D) ⅁ **(E)** Ⅎ



16. In the diagram, what is the length of BC?

(A) 13 **(B)** 12 **(C)** 20
(D) 16 **(E)** 17



17. If $10^x - 10 = 9990$, then x is equal to

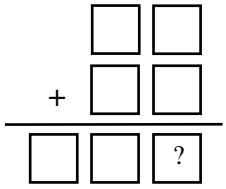
(A) 3 **(B)** 5 **(C)** 6 **(D)** 4 **(E)** 9

18. A square has perimeter 24. A rectangle has the same area as the square. If the width of the rectangle is 4, what is the perimeter of the rectangle?

(A) 26 **(B)** 36 **(C)** 16 **(D)** 32 **(E)** 24

19. Bethany, Chun, Dominic, and Emily go to the movies. They choose a row with four consecutive empty seats. If Dominic and Emily must sit beside each other, in how many different ways can the four friends sit?
(A) 6 **(B)** 5 **(C)** 12 **(D)** 30 **(E)** 3

20. In the addition of two 2-digit numbers, each blank space, including those in the answer, is to be filled with one of the digits 0, 1, 2, 3, 4, 5, 6, each used exactly once. The units digit of the sum is



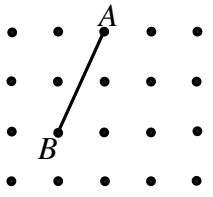
(A) 2 **(B)** 3 **(C)** 4
(D) 5 **(E)** 6

Part C: Each correct answer is worth 8.

21. Nathalie has some quarters, dimes and nickels. The ratio of the number of quarters to the number of dimes to the number of nickels that she has is 9 : 3 : 1. The total value of these coins is \$18.20. How many coins does Nathalie have?
(A) 130 **(B)** 117 **(C)** 98 **(D)** 91 **(E)** 140

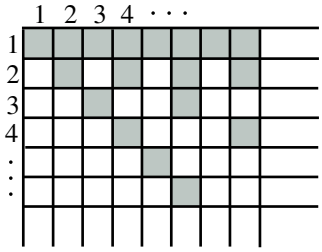
22. The 8 people at a party shook hands exactly once with each of the others before the ninth person arrived. The ninth person then shook hands with some of these 8 people. A total of 32 handshakes took place. With how many people did the ninth person shake hands?
(A) 3 **(B)** 4 **(C)** 5 **(D)** 6 **(E)** 7

23. In the diagram, the points are evenly spaced vertically and horizontally. A segment AB is drawn using two of the points, as shown. Point C is chosen to be one of the remaining 18 points. For how many of these 18 possible points is triangle ABC isosceles?



(A) 6 **(B)** 4 **(C)** 5
(D) 2 **(E)** 3

24. In the diagram, the grid has 150 rows and 150 columns, numbered from 1 to 150. In row 1, every box is shaded. In row 2, every second box is shaded. In row 3, every third box is shaded. The shading continues in this way, so that every nth box in row n is shaded. Which *column* has the greatest number of shaded boxes?



(A) 144 **(B)** 120 **(C)** 150
(D) 96 **(E)** 100

25. In the diagram, the numbers from 1 to 25 are to be arranged in the 5 by 5 grid so that each number, except 1 and 2, is the sum of two of its neighbours. (Numbers in the grid are *neighbours* if their squares touch along a side or at a corner. For example, the "1" has 8 neighbours.) Some of the numbers have already been filled in. Which number must replace the "?" when the grid is completed?

			20	21
	6	5	4	
23	7	1	3	?
	9	8	2	
25	24			22

(A) 15 **(B)** 12 **(C)** 14
(D) 11 **(E)** 13

Canadian Mathematics Competition

An activity of the Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 11, 2005

Time: 1 hour

Calculators are permitted.

Instructions

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Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $\frac{1}{4} + \frac{3}{8}$ is

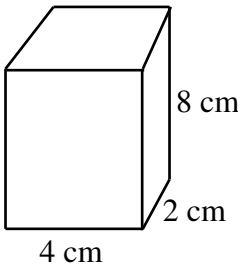
   (A) $\frac{5}{16}$ **(B)** $\frac{5}{8}$ **(C)** $\frac{1}{3}$ **(D)** $\frac{3}{4}$ **(E)** $\frac{7}{8}$

2. The value of $(-3)(-4)(-1)$ is

   (A) -12 **(B)** -8 **(C)** 8 **(D)** 11 **(E)** 12

3. In the diagram, the volume of the rectangular prism is

   (A) 72 cm^3 **(B)** 48 cm^3 **(C)** 64 cm^3
   (D) 24 cm^3 **(E)** 14 cm^3



4. The average (mean) of the numbers 6, 8, 9, 11, and 16 is

   (A) 8 **(B)** 9 **(C)** 10 **(D)** 11 **(E)** 7

5. 10% of 10 multiplied by 20% of 20 equals

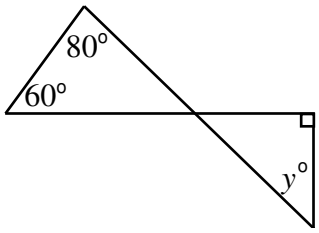
   (A) 40 000 **(B)** 0.4 **(C)** 400 **(D)** 40 **(E)** 4

6. If $8210 = 8.21 \times 10^{\square}$, then the value that should go in the $\square$ is

   (A) 1 **(B)** 2 **(C)** 3 **(D)** 4 **(E)** 5

7. In the diagram, the value of y is

   (A) 40 **(B)** 60 **(C)** 45
   (D) 50 **(E)** 80



8. How many integers between 1 and 60 contain the digit 3 at least once?

   (A) 6 **(B)** 10 **(C)** 14 **(D)** 15 **(E)** 20

9. In 2003, the average monthly rainfall in Mathborough was 41.5 mm. In 2004, the average monthly rainfall in Mathborough was 2 mm more than in 2003. The total amount of rain that fell in Mathborough in 2004 was

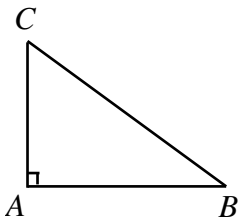
   (A) 500 mm **(B)** 522 mm **(C)** 496 mm **(D)** 498 mm **(E)** 1700 mm

10. Daniel rode his bicycle at a constant speed. After 40 minutes, he cycled 24 km. How far did he cycle in 30 minutes?

    (A) 12 km **(B)** 14 km **(C)** 16 km **(D)** 18 km **(E)** 20 km

Part B: Each correct answer is worth 6.

11. In the diagram, $AB = 25$ cm, $AC = 20$ cm and $\angle A = 90°$. What is the area of triangle ABC?

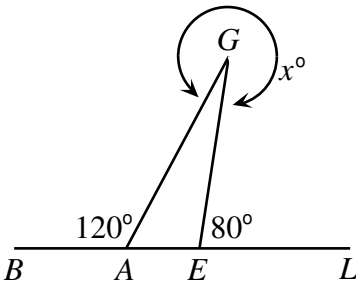


(A) 500 cm^2 **(B)** 300 cm^2 **(C)** 60 cm^2
(D) 150 cm^2 **(E)** 250 cm^2

12. What is the largest possible value for the sum of five consecutive even numbers, if 10 and 12 are included amongst the five numbers?

(A) 90 **(B)** 50 **(C)** 40 **(D)** 60 **(E)** 70

13. Four points B, A, E, L are on a straight line, as shown. G is a point off the line so that $\angle BAG = 120°$ and $\angle GEL = 80°$. If the reflex angle at G is $x°$, then x equals



(A) 340 **(B)** 200 **(C)** 300
(D) 240 **(E)** 310

14. Which of these values is the largest?

(A) $\dfrac{4}{2-\frac{1}{4}}$ **(B)** $\dfrac{4}{2+\frac{1}{4}}$ **(C)** $\dfrac{4}{2-\frac{1}{3}}$ **(D)** $\dfrac{4}{2+\frac{1}{3}}$ **(E)** $\dfrac{4}{2-\frac{1}{2}}$

15. Which equation represents the relationship between the values of x and y in the table?

x	y
1	1.5
2	3
3	4.5
4	6

(A) $y = x + 0.5$
(B) $y = 1.5x$
(C) $y = 0.5x + 1$
(D) $y = 2x - 0.5$
(E) $y = x^2 + 0.5$

16. A student may pay \$1.50 for a single bus ticket or \$5.75 for a package of 5 tickets. If a student requires 40 tickets, how much does she save by buying all of the tickets in packages of 5 rather than buying 40 single tickets?

(A) \$54.25 **(B)** \$34.00 **(C)** \$14.00 **(D)** \$8.25 **(E)** \$4.25

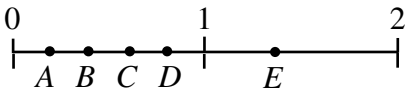
17. If a is an even integer and b is an odd integer, which of the following could represent an odd integer?

(A) ab **(B)** $a + 2b$ **(C)** $2a - 2b$ **(D)** $a + b + 1$ **(E)** $a - b$

18. If $N = 2^5 \times 3^2 \times 7 \times \square$ and 100 divides evenly into N, which of the following numbers could be placed in the box?

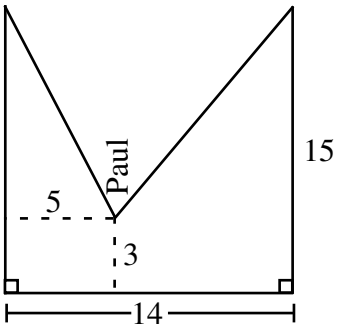
(A) 5 **(B)** 20 **(C)** 75 **(D)** 36 **(E)** 120

19. The points A, B, C, D, and E represent values along the number line, as shown. A, B, C, and D are between 0 and 1, and E is between 1 and 2. Which point best represents the value of $B \times C$?



(A) A **(B)** B **(C)** C
(D) D **(E)** E

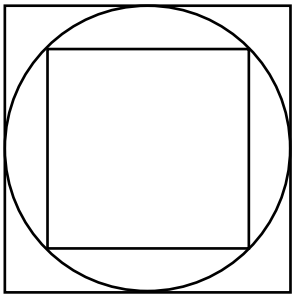
20. A "slackrope walker" is much like a tightrope walker except that the rope on which he performs is not pulled tight. Paul, a slackrope walker, has a rope tied to two 15 m high poles which are 14 m apart. When he is standing on the rope 5 m away from one of the poles, he is 3 m above the ground. How long is the rope?



(A) 28 m **(B)** 30 m **(C)** 27 m
(D) 26 m **(E)** 29 m

Part C: Each correct answer is worth 8.

21. In the diagram, a circle is inscribed in a large square and a smaller square is inscribed in the circle. If the area of the large square is 36, the area of the smaller square is



(A) 15 **(B)** 12 **(C)** 9
(D) 24 **(E)** 18

22. Fifty students were surveyed about their participation in hockey and baseball. The results of the survey were:

33 students played hockey

24 students played baseball

8 students played neither hockey nor baseball

How many of the students surveyed played both hockey and baseball?
(A) 1 **(B)** 7 **(C)** 9 **(D)** 15 **(E)** 16

23. A wheel with radius 1 m is rolled in a straight line through one complete revolution on a flat horizontal surface. How many metres did the centre of the wheel travel horizontally from its starting location?
(A) 4π **(B)** 2 **(C)** 2π **(D)** π **(E)** 1

24. Pete is given three *positive* integers and is told to add the first two, and then multiply the result by the third. Instead, he multiplies the first two and adds the third to that result. Surprisingly, he still gets the correct answer of 14. How many different values could the first number have been?
(A) 5 **(B)** 4 **(C)** 6 **(D)** 3 **(E)** 7

25. A purse contains a collection of quarters, dimes, nickels, and pennies. The average value of the coins in the purse is 17 cents. If a penny is removed from the purse, the average value of the coins becomes 18 cents. How many nickels are in the purse?
(A) 2 **(B)** 5 **(C)** 0 **(D)** 1 **(E)** 8

Canadian Mathematics Competition

An activity of The Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 12, 2004

Time: 1 hour

Calculators are permitted.

Instructions

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Grade 8

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

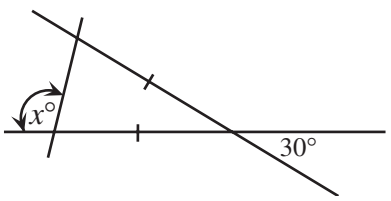
1. What is the value of 25% of 2004?
(**A**) 1002 (**B**) 501 (**C**) 50 100 (**D**) 2505 (**E**) 1503

2. The value of $\frac{1}{2}+\frac{3}{4}-\frac{5}{8}$ is
(**A**) $\frac{9}{14}$ (**B**) 0 (**C**) $\frac{5}{8}$ (**D**) $\frac{1}{4}$ (**E**) $\frac{7}{8}$

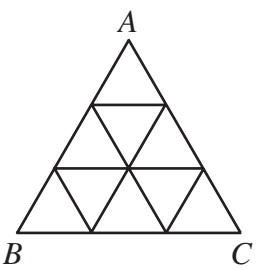
3. If $800\,670 = 8\times10^{x}+6\times10^{y}+7\times10^{z}$, where x, y and z are whole numbers, then $x+y+z$ equals
(**A**) 11 (**B**) 8 (**C**) 6 (**D**) 3 (**E**) 5

4. $\frac{7863}{13} = 604+\frac{\square}{13}$. The number represented by $\square$ is
(**A**) 11 (**B**) 8 (**C**) 9 (**D**) 3 (**E**) 10

5. In the diagram, the value of x is
(**A**) 30 (**B**) 75 (**C**) 100
(**D**) 105 (**E**) 150



6. ΔABC is constructed from nine small, equilateral triangles, as shown. If the perimeter of each of the nine small triangles is 6 cm, then the perimeter of ΔABC, in cm, is
(**A**) 18 (**B**) 24 (**C**) 27
(**D**) 36 (**E**) 54



7. If $x=-4$ and $y=4$, which of the following expressions gives the largest answer?
(**A**) $\frac{x}{y}$ (**B**) $y-1$ (**C**) $x-1$ (**D**) $-xy$ (**E**) $x+y$

8. Two fair coins are tossed at the same time. What is the probability they will both land as "HEADS"?
(**A**) 0 (**B**) 1 (**C**) $\frac{1}{2}$ (**D**) $\frac{1}{3}$ (**E**) $\frac{1}{4}$

9. The water surface of Lake Superior is at an elevation of 180 m *above* sea level. The lowest point of the lake floor is 220 m *below* sea level. What is the actual depth of the lake at this point?
(**A**) 40 m (**B**) 300 m (**C**) 380 m (**D**) 400 m (**E**) 500 m

10. Two positive integers have a sum of 11. The greatest possible product of these two positive integers is
(**A**) 11 (**B**) 18 (**C**) 28 (**D**) 35 (**E**) 30

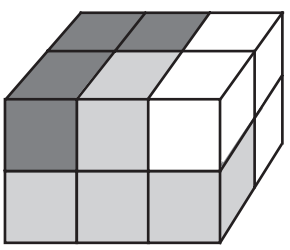
Part B: Each correct answer is worth 6.

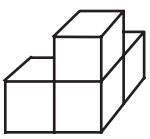
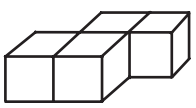
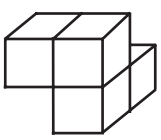
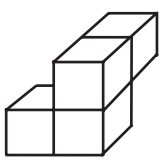
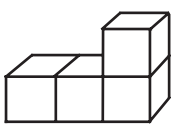
11. Ruth walks at a constant speed of 5 km/h. How many minutes will it take her to walk 1.5 km?
(**A**) 20 (**B**) 24 (**C**) 18 (**D**) 15 (**E**) 7.5

12. When the numbers $\sqrt{36}$, 35.2, 35.19, and 5^2 are arranged from smallest to largest, the correct ordering is
(**A**) 5^2, 35.19, 35.2,$\sqrt{36}$
(**B**) 35.19, 35.2, 5^2 ,$\sqrt{36}$
(**C**) 5^2 ,$\sqrt{36}$, 35.19, 35.2
(**D**) $\sqrt{36}$,5^2 , 35.19, 35.2
(**E**) $\sqrt{36}$, 5^2, 35.2, 35.19

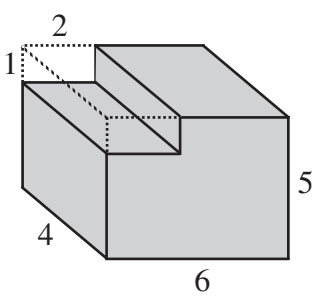
13. There are 13 trees on one side of the street on Trina's way from her house to school. Today, on her way to school, Trina put a chalk mark on every other tree, starting with the first she passed. When she goes home from school, she will put a chalk mark on every third tree, again starting with the first one she passes. By the time Trina arrives at home, how many of the 13 trees will *not* have a chalk mark on them?
(**A**) 6 (**B**) 4 (**C**) 8 (**D**) 2 (**E**) 7

14. A rectangular wooden prism is made up of three pieces, each consisting of four cubes of wood glued together. Which of the pieces below has the same shape as the black piece?



(**A**) 
(**B**) 
(**C**) 
(**D**) 
(**E**) 

15. In the diagram, the volume of the shaded solid is
(**A**) 8 (**B**) 112 (**C**) 113
(**D**) 120 (**E**) 128



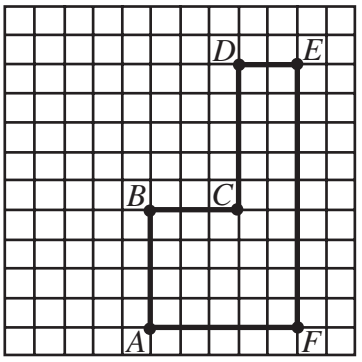
16. A two-digit number is divisible by 8, 12 and 18. The number is between
(**A**) 10 and 19 (**B**) 20 and 39 (**C**) 40 and 59 (**D**) 60 and 79 (**E**) 80 and 99

17. If $2^a = 8$ and $a = 3c$, then c equals
(**A**) 0 (**B**) $\frac{3}{4}$ (**C**) 1 (**D**) $\frac{4}{3}$ (**E**) 6

18. The scores of eight students on a quiz are 6, 7, 7, 8, 8, 8, 9, and 10. Which score should be removed to leave seven scores with the same mode and range as the original eight scores, but with a higher average (mean)?
(**A**) 6 (**B**) 7 (**C**) 8 (**D**) 9 (**E**) 10

19. Chloe has made a code out of the alphabet by assigning a numerical value to each letter. She then assigns a numerical value to a word by adding up the numerical values of the letters in the word. Using her code, the numerical value of BAT is 6. Also, her code gives numerical values of 8 to CAT and 12 to CAR. Using her code, what is the numerical value of BAR?
(**A**) 10 (**B**) 14 (**C**) 18 (**D**) 12 (**E**) 20

20. In the diagram, which of the following is the largest?
(**A**) AE (**B**) $CD + CF$ (**C**) $AC + CF$
(**D**) FD (**E**) $AC + CE$

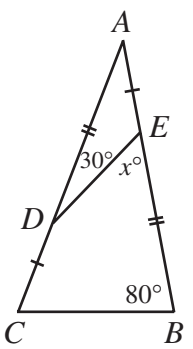


Part C: Each correct answer is worth 8.

21. On Tony's map, the distance from Saint John, NB to St. John's, NL is 21 cm. The actual distance between these two cities is 1050 km. What is the scale of Tony's map?
(**A**) 1:50 000 (**B**) 1:200 000 (**C**) 1:500 000 (**D**) 1:2 000 000 (**E**) 1:5 000 000

22. Water is poured from a full 1.5 L bottle into an empty glass until both the glass and the bottle are $\frac{3}{4}$ full. What is the volume of the glass?
(**A**) 0.5 L (**B**) 0.75 L (**C**) 1.125 L (**D**) 0.6 L (**E**) 0.4 L

23. In the diagram, the value of x is
(**A**) 40 (**B**) 45 (**C**) 50
(**D**) 55 (**E**) 60



24. Let x be the three-digit number with digits ABC and y be the three-digit number with digits CBA. The digits A and C are not 0. If $x - y = 495$, how many possibilities are there for x?
(**A**) 50 (**B**) 40 (**C**) 24 (**D**) 36 (**E**) 32

25. A large block, which has dimensions n by 11 by 10, is made up of a number of unit cubes and one 2 by 1 by 1 block. There are exactly 2362 positions in which the 2 by 1 by 1 block can be placed. What is the value of n?
(**A**) 7 (**B**) 8 (**C**) 9 (**D**) 10 (**E**) 11

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Canadian Mathematics Competition

An activity of The Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 14, 2003

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the examination booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be certain that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have decided on your choice, enter the appropriate letter on your answer sheet for that question.
5. Scoring:
   Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor tells you to start, you will have *sixty* minutes of working time.

Grade 8

Scoring:	There is *no penalty* for an incorrect answer. Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

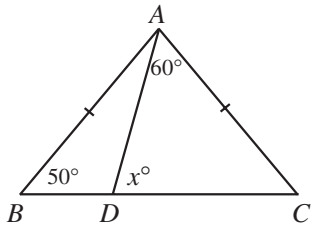
1. The value of $1.000 + 0.101 + 0.011 + 0.001$ is
(**A**) 1.112 (**B**) 1.113 (**C**) 1.111 (**D**) 1.1111 (**E**) 1.101

2. The value of $1+2+3-4+5+6+7-8+9+10+11-12$ is
(**A**) 30 (**B**) 42 (**C**) 54 (**D**) 65 (**E**) 78

3. At a school fundraiser, \$3109 was raised. The money was shared equally among 25 charities. The amount received by each charity from the school was
(**A**) \$12.76 (**B**) \$84.36 (**C**) \$111.04 (**D**) \$150.76 (**E**) \$124.36

4. The square of the square root of 17 is
(**A**) 4.1 (**B**) 16.8 (**C**) 17 (**D**) 282.6 (**E**) 289

5. In the diagram, triangle ABC is isosceles, with $AB = AC$. If $\angle ABC = 50^\circ$ and $\angle DAC = 60^\circ$, the value of x is
(**A**) 70 (**B**) 50 (**C**) 80
(**D**) 60 (**E**) 30



6. What number, when doubled and then increased by 13, equals 89?
(**A**) 51 (**B**) 43 (**C**) 28 (**D**) 38 (**E**) 76

7. The table to the right shows the high and low temperatures recorded in Gaussville last week. On what day was the temperature range the greatest?
(**A**) Monday (**B**) Tuesday (**C**) Wednesday
(**D**) Thursday (**E**) Friday

Day	High Temperature (°C)	Low Temperature (°C)
Monday	5	– 3
Tuesday	0	–10
Wednesday	– 2	–11
Thursday	– 8	–13
Friday	– 7	– 9

8. When the numbers $\sqrt{5}$, 2.1, $\frac{7}{3}$, $2.0\overline{5}$, $2\frac{1}{5}$ are arranged in order from smallest to largest, the middle number is
(**A**) $\sqrt{5}$ (**B**) 2.1 (**C**) $\frac{7}{3}$ (**D**) $2.0\overline{5}$ (**E**) $2\frac{1}{5}$

9. There are 30 students in Mr. McRoberts' Grade 8 class. One-third of the students are girls. Three-quarters of the boys play basketball. The number of boys in the class who play basketball is
(**A**) 3 (**B**) 22 (**C**) 10 (**D**) 20 (**E**) 15

10. A different digit is inserted into each of the two boxes to make the equation

$$15.2 + 1.52 + 0.15\square + \square.128 = 20$$

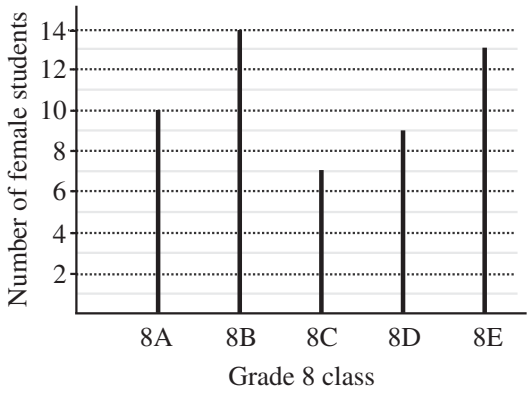
true. The sum of the digits in the two boxes is

(**A**) 5 (**B**) 6 (**C**) 7 (**D**) 8 (**E**) 9

Part B: Each correct answer is worth 6.

11. The graph shows the number of female students in five Grade 8 classes labelled 8A through 8E. The average (mean) number of female students in these five classes is

(**A**) 10.0 (**B**) 10.7 (**C**) 10.4
(**D**) 10.3 (**E**) 10.6



12. A photo measuring 20 cm by 25 cm is enlarged to make a photo measuring 25 cm by 30 cm. The percentage increase in area is

(**A**) 250% (**B**) 50% (**C**) 80% (**D**) 37.5% (**E**) 25%

13. The angles of a triangle are in the ratio 2 : 3 : 4. The largest angle in the triangle is

(**A**) 100° (**B**) 60° (**C**) 80° (**D**) 90° (**E**) 160°

14. George wrote seven tests and each was marked out of 100. No two of his marks were the same. He recorded the seven marks to do a statistical analysis. He accidentally recorded his highest mark *higher* than it actually was. How many of the following are altered because of his mistake?

- Mean
- Median
- Minimum test score
- Range

(**A**) 0 (**B**) 1 (**C**) 2 (**D**) 3 (**E**) 4

15. A sand pit is constructed in the shape of a rectangular prism 10 m long, 50 cm deep and 2 m wide. If the pit is already half-full, how much more sand, in m^3, is needed to completely fill the pit?

(**A**) 6 (**B**) 5 (**C**) 20 (**D**) 7.5 (**E**) 10

16. The value of $\dfrac{1}{1+\dfrac{1}{1+\frac{1}{2}}}$ is

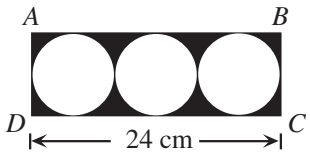
(**A**) $\frac{3}{5}$ (**B**) $\frac{5}{3}$ (**C**) $\frac{1}{3}$ (**D**) 3 (**E**) $\frac{3}{2}$

17. Triangle ABC has vertices at $A(1, 0)$, $B(21, 0)$ and $C(21, 21)$. The perimeter of the triangle is

(**A**) 70 (**B**) 42 (**C**) 64 (**D**) 72 (**E**) 63

18. How many numbers from the set $\{-5,-4,-3,-2,-1,\ 0,\ 1,\ 2,\ 3\}$ satisfy the inequality $-3x^2 < -14$?
(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

19. In the diagram, *ABCD* is a rectangle, and three circles are positioned as shown. The area of the shaded region, rounded to the nearest cm^2, is
(**A**) 41 (**B**) 43 (**C**) 47
(**D**) 36 (**E**) 45



20. The letters G, A, U, S, and S are written on five tiles, one letter per tile. If Amy selects two tiles at random, what is the probability she gets two S's?
(**A**) $\frac{3}{5}$ (**B**) $\frac{2}{5}$ (**C**) $\frac{1}{8}$ (**D**) $\frac{1}{10}$ (**E**) $\frac{1}{20}$

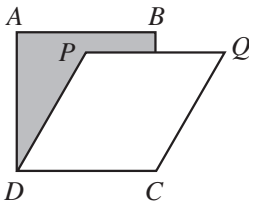
Part C: Each correct answer is worth 8.

21. The sum of four consecutive whole numbers is a multiple of 5. Which of the following statements about these four numbers is always true?
(**A**) The sum of the numbers ends in a 5.
(**B**) The largest number ends in a 9.
(**C**) The smallest number is odd.
(**D**) None of the numbers are multiples of 5.
(**E**) One of the numbers ends in a 3.

22. Carmina has a total of \$3.60 in nickels and dimes. If her dimes were nickels and her nickels were dimes, then she would have \$5.40. How many nickels and dimes does Carmina have?
(**A**) 56 (**B**) 57 (**C**) 58 (**D**) 60 (**E**) 61

23. In her backyard garden, Gabriella has 12 tomato plants in a row. As she walks along the row, she notices that each plant in the row has one more tomato than the plant before. If she counts 186 tomatoes in total, how many tomatoes are there on the last plant in the row?
(**A**) 15 (**B**) 16 (**C**) 20 (**D**) 21 (**E**) 22

24. In the diagram, *ABCD* is a square with area $25\ \text{cm}^2$. If *PQCD* is a rhombus with area $20\ \text{cm}^2$, the area of the shaded region, in cm^2, is
(**A**) 12 (**B**) 10 (**C**) 11
(**D**) 12.5 (**E**) 9



25. In the diagram, a positive integer is to be placed in each of the nine boxes so that the products of the numbers in each row, column, and diagonal are equal. Some of the entries are already filled in. The number of possible values for *N* is
(**A**) 4 (**B**) 15 (**C**) 9
(**D**) 6 (**E**) 12

N		24
	12	
6		

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Canadian
Mathematics
Competition

An activity of The Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 15, 2002

Time: 1 hour

Calculators are permitted.

Instructions

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   Each unanswered question is worth 2, to a maximum of 10 unanswered questions.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor tells you to start, you will have *sixty* minutes of working time.

Grade 8

Scoring:	There is *no penalty* for an incorrect answer. Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

Part A: Each correct answer is worth 5.

1. The value of $\frac{1}{2}+\frac{1}{4}$ is

   (A) 1 **(B)** $\frac{1}{8}$ **(C)** $\frac{1}{6}$ **(D)** $\frac{2}{6}$ **(E)** $\frac{3}{4}$

2. The expression $6\times1000+5\times100+6\times1$ is equivalent to

   (A) 656 **(B)** 6506 **(C)** 6056 **(D)** 60 506 **(E)** 6560

3. The value of $3^2-(4\times2)$ is

   (A) 4 **(B)** 17 **(C)** 1 **(D)** –2 **(E)** 0

4. An integer is divided by 7 and the remainder is 4. An example of such an integer is

   (A) 14 **(B)** 15 **(C)** 16 **(D)** 17 **(E)** 18

5. Which of the following expressions is equal to an odd integer?

   (A) $3(5)+1$ **(B)** $2(3+5)$ **(C)** $3(3+5)$ **(D)** $3+5+1$ **(E)** $\frac{3+5}{2}$

6. Qaddama is 6 years older than Jack. Jack is 3 years younger than Doug. If Qaddama is 19 years old, how old is Doug?

   (A) 17 **(B)** 16 **(C)** 10 **(D)** 18 **(E)** 15

7. The volume of a rectangular box is 144 cm^3. If its length is 12 cm and its width is 6 cm, what is its height?

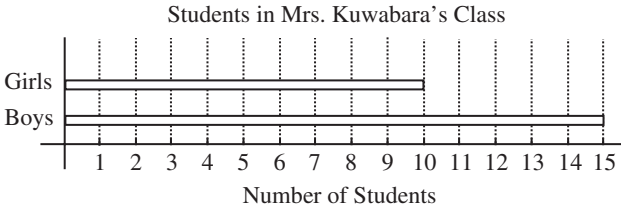
   (A) 126 cm **(B)** 72 cm **(C)** 4 cm **(D)** 8 cm **(E)** 2 cm

8. In a jar, the ratio of the number of oatmeal cookies to the number of chocolate chip cookies is 5:2. If there are 20 oatmeal cookies, the number of chocolate chip cookies in the jar is

   (A) 28 **(B)** 50 **(C)** 8 **(D)** 12 **(E)** 18

9. The bar graph below shows the numbers of boys and girls in Mrs. Kuwabara's class. The percentage of students in the class who are girls is

   (A) 40% **(B)** 15% **(C)** 25% **(D)** 10% **(E)** 60%



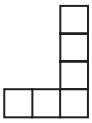
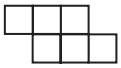
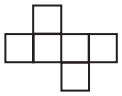
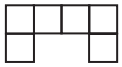
10. Which of the following statements is **not** true?

    (A) A quadrilateral has four sides.
    (B) The sum of the angles in a triangle is 180°.
    (C) A rectangle has four 90° angles.
    (D) A triangle can have two 90° angles.
    (E) A rectangle is a quadrilateral.

Part B: Each correct answer is worth 6.

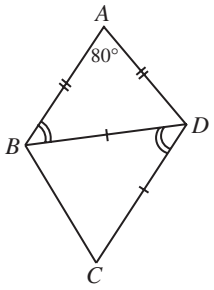
11. A palindrome is a positive integer whose digits are the same when read forwards or backwards. For example, 2002 is a palindrome. What is the smallest number which can be added to 2002 to produce a larger palindrome?
(**A**) 11 (**B**) 110 (**C**) 108 (**D**) 18 (**E**) 1001

12. Which of the following can be folded along the lines to form a cube?

(**A**)  (**B**)  (**C**)  (**D**)  (**E**) 

13. If $a+b=12$, $b+c=16$, and $c=7$, what is the value of a?
(**A**) 1 (**B**) 5 (**C**) 9 (**D**) 7 (**E**) 3

14. In the diagram, $\angle ABD = \angle BDC$ and $\angle DAB = 80°$. Also, $AB = AD$ and $DB = DC$. The measure of $\angle BCD$ is
(**A**) 65° (**B**) 50° (**C**) 80°
(**D**) 60° (**E**) 70°



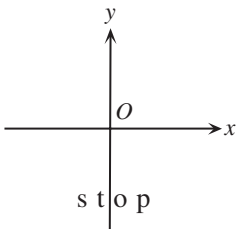
15. A perfect number is an integer that is equal to the sum of all of its positive divisors, except itself. For example, 28 is a perfect number because $28 = 1+2+4+7+14$. Which of the following is a perfect number?
(**A**) 10 (**B**) 13 (**C**) 6 (**D**) 8 (**E**) 9

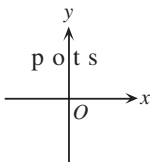
16. Three pennies are flipped. What is the probability that they all land with heads up?
(**A**) $\frac{1}{8}$ (**B**) $\frac{1}{6}$ (**C**) $\frac{1}{4}$ (**D**) $\frac{1}{3}$ (**E**) $\frac{1}{2}$

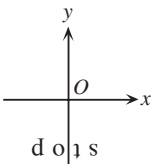
17. If P is a negative integer, which of the following is always positive?
(**A**) P^2 (**B**) $\frac{1}{P}$ (**C**) $2P$ (**D**) $P-1$ (**E**) P^3

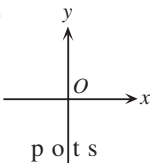
18. When expanded, the number of zeros in 1000^{10} is
(**A**) 13 (**B**) 30 (**C**) 4 (**D**) 10 (**E**) 1000

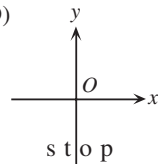
19. The word "stop" starts in the position shown in the diagram to the right. It is then rotated 180° clockwise about the origin, O, and this result is then reflected in the x-axis. Which of the following represents the final image?

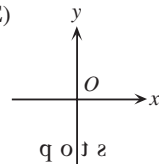


(**A**) 

(**B**) 

(**C**) 

(**D**) 

(**E**) 

20. The units digit (that is, the last digit) of 7^{62} is
(**A**) 7 (**B**) 1 (**C**) 3 (**D**) 9 (**E**) 5

Part C: Each correct answer is worth 8.

21. A rectangle has sides of integer length (when measured in cm) and an area of $36\,\text{cm}^2$. What is the maximum possible perimeter of the rectangle?
(**A**) 72 cm (**B**) 80 cm (**C**) 26 cm (**D**) 74 cm (**E**) 48 cm

22. If each diagonal of a square has length 2, then the area of the square is
(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

23. A map is drawn to a scale of 1:10 000. On the map, the Gauss Forest occupies a rectangular region measuring 10 cm by 100 cm. What is the actual area of the Gauss Forest, in km^2?
(**A**) 100 (**B**) 1 000 000 (**C**) 1000 (**D**) 1 (**E**) 10

24. Veronica has 6 marks on her report card.
The mean of the 6 marks is 74.
The mode of the 6 marks is 76.
The median of the 6 marks is 76.
The lowest mark is 50.
The highest mark is 94.
Only one mark appears twice and no mark appears more than twice.
Assuming all of her marks are integers, the number of possibilities for her second lowest mark is
(**A**) 17 (**B**) 16 (**C**) 25 (**D**) 18 (**E**) 24

25. Emily has created a jumping game using a straight row of floor tiles that she has numbered 1, 2, 3, 4, … . Starting on tile 2, she jumps along the row, landing on every second tile, and stops on the second last tile in the row. Starting from this tile, she turns and jumps back toward the start, this time landing on every third tile. She stops on tile 1. Finally, she turns again and jumps along the row, landing on every fifth tile. This time, she again stops on the second last tile. The number of tiles in the row could be
(**A**) 39 (**B**) 40 (**C**) 47 (**D**) 49 (**E**) 53

Canadian Mathematics Competition

An activity of The Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 16, 2001

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the examination booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be certain that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have decided on your choice, enter the appropriate letter on your answer sheet for that question.
5. Scoring:
   Each correct answer is worth 5 in Part A, 6 in Part B, and 8 in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2, to a maximum of 20.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor tells you to start, you will have *sixty* minutes of working time.

Grade 8

Scoring: There is *no penalty* for an incorrect answer.
Each unanswered question is worth 2, to a maximum of 20.

Part A: Each correct answer is worth 5.

1. In 1998, the population of Canada was 30.3 million. Which number is the same as 30.3 million?
(**A**) 30 300 000 (**B**) 303 000 000 (**C**) 30 300 (**D**) 303 000 (**E**) 30 300 000 000

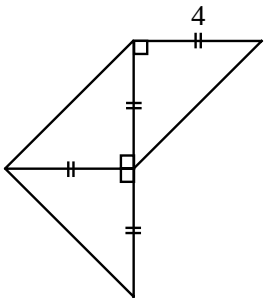
2. What number should be placed in the box to make $\frac{6+\square}{20}=\frac{1}{2}$?
(**A**) 10 (**B**) 4 (**C**) -5 (**D**) 34 (**E**) 14

3. The value of $3\times 4^2-(8\div 2)$ is
(**A**) 44 (**B**) 12 (**C**) 20 (**D**) 8 (**E**) 140

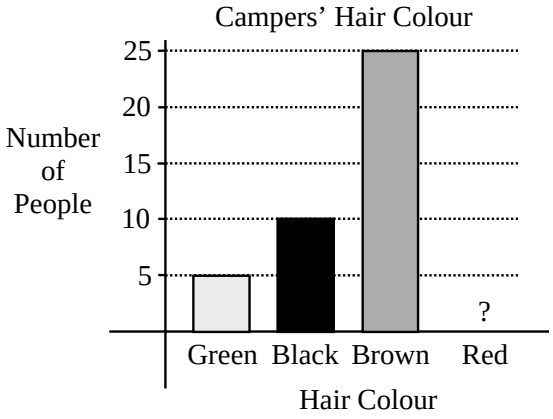
4. When a number is divided by 7, the quotient is 12 and the remainder is 5. The number is
(**A**) 47 (**B**) 79 (**C**) 67 (**D**) 119 (**E**) 89

5. If $2x-5=15$, the value of x is
(**A**) 5 (**B**) -5 (**C**) 10 (**D**) 0 (**E**) -10

6. The area of the entire figure shown is
(**A**) 16 (**B**) 32 (**C**) 20
(**D**) 24 (**E**) 64



7. The bar graph shows the hair colours of the campers at Camp Gauss. The bar corresponding to redheads has been accidentally removed. If 50% of the campers have brown hair, how many of the campers have red hair?
(**A**) 5 (**B**) 10 (**C**) 25
(**D**) 50 (**E**) 60



8. A fair die is constructed by labelling the faces of a wooden cube with the numbers 1, 1, 1, 2, 3, and 3. If this die is rolled once, the probability of rolling an odd number is
(**A**) $\frac{5}{6}$ (**B**) $\frac{4}{6}$ (**C**) $\frac{3}{6}$ (**D**) $\frac{2}{6}$ (**E**) $\frac{1}{6}$

9. In the square shown, the numbers in each row, column, and diagonal multiply to give the same result. The sum of the two missing numbers is
(**A**) 28 (**B**) 15 (**C**) 30
(**D**) 38 (**E**) 72

12	1	18
9	6	4
		3

10. Rowena is able to mow $\frac{2}{5}$ of a lawn in 18 minutes. If she began the job at 10:00 a.m., and mowed at this same constant rate, when did she finish mowing the entire lawn?
(**A**) 10:08 a.m. (**B**) 11:30 a.m. (**C**) 10:40 a.m. (**D**) 10:25 a.m. (**E**) 10:45 a.m.

Part B: Each correct answer is worth 6.

11. In a class of 25 students, each student has at most one pet. Three-fifths of the students have cats, 20% have dogs, three have elephants, and the other students have no pets. How many students have no pets?
(**A**) 5 (**B**) 4 (**C**) 3 (**D**) 2 (**E**) 1

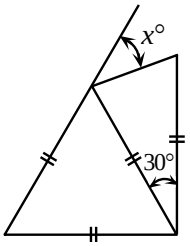
12. A prime number is called a "Superprime" if doubling it, and then subtracting 1, results in another prime number. The number of Superprimes less than 15 is
(**A**) 2 (**B**) 3 (**C**) 4 (**D**) 5 (**E**) 6

13. Laura earns \$10/hour and works 8 hours per day for 10 days. She first spends 25% of her pay on food and clothing, and then pays \$350 in rent. How much of her pay does she have left?
(**A**) \$275 (**B**) \$200 (**C**) \$350 (**D**) \$250 (**E**) \$300

14. A rectangular sign that has dimensions 9 m by 16 m has a square advertisement painted on it. The border around the square is required to be at least 1.5 m wide. The area of the largest square advertisement that can be painted on the sign is
(**A**) $78\ \text{m}^2$ (**B**) $144\ \text{m}^2$ (**C**) $36\ \text{m}^2$ (**D**) $9\ \text{m}^2$ (**E**) $56.25\ \text{m}^2$

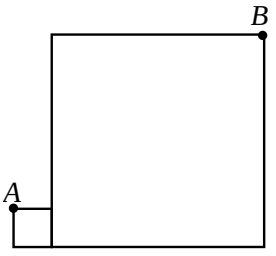
15. The surface area of a cube is $24\ \text{cm}^2$. The volume of this cube is
(**A**) $4\ \text{cm}^3$ (**B**) $24\ \text{cm}^3$ (**C**) $8\ \text{cm}^3$ (**D**) $27\ \text{cm}^3$ (**E**) $64\ \text{cm}^3$

16. In the diagram, the value of x is
(**A**) 30 (**B**) 40 (**C**) 60
(**D**) 50 (**E**) 45



17. Daniel's age is one-ninth of his father's age. One year from now, Daniel's father's age will be seven times Daniel's age. The difference between their ages is
(**A**) 24 (**B**) 25 (**C**) 26 (**D**) 27 (**E**) 28

18. Two squares are positioned, as shown. The smaller square has side length 1 and the larger square has side length 7. The length of AB is
(**A**) 14 (**B**) $\sqrt{113}$ (**C**) 10
(**D**) $\sqrt{85}$ (**E**) $\sqrt{72}$

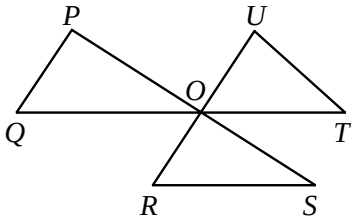


19. Anne, Beth and Chris have 10 candies to divide amongst themselves. Anne gets at least 3 candies, while Beth and Chris each get at least 2. If Chris gets at most 3, the number of candies that Beth could get is
(**A**) 2 (**B**) 2 or 3 (**C**) 3 or 4 (**D**) 2, 3 or 5 (**E**) 2, 3, 4 or 5

20. What number should be placed in the box to make $10^4 \times 100^{\square} = 1000^6$?
(**A**) 7 (**B**) 5 (**C**) 2 (**D**) $\frac{3}{2}$ (**E**) 10

Part C: Each correct answer is worth 8.

21. Lines PS, QT and RU intersect at a common point O, as shown. P is joined to Q, R to S, and T to U, to form triangles. The value of $\angle P + \angle Q + \angle R + \angle S + \angle T + \angle U$ is
(**A**) 450° (**B**) 270° (**C**) 360°
(**D**) 540° (**E**) 720°

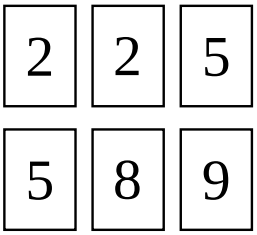


22. Sixty-four white $1 \times 1 \times 1$ cubes are used to form a $4 \times 4 \times 4$ cube, which is then painted red on each of its six faces. This large cube is then broken up into its 64 unit cubes. Each unit cube is given a score as follows:

Exact number of faces painted red	Score
3	3
2	2
1	1
0	-7

The total score for the $4 \times 4 \times 4$ cube is
(**A**) 40 (**B**) 41 (**C**) 42 (**D**) 43 (**E**) 44

23. The integers 2, 2, 5, 5, 8, and 9 are written on six cards, as shown. Any number of the six cards is chosen, and the sum of the integers on these cards is determined. Note that the integers 1 and 30 cannot be obtained as sums in this way. How many of the integers from 1 to 31 cannot be obtained as sums?
(**A**) 4 (**B**) 22 (**C**) 8
(**D**) 10 (**E**) 6



24. A triangle can be formed having side lengths 4, 5 and 8. It is impossible, however, to construct a triangle with side lengths 4, 5 and 9. Ron has eight sticks, each having an integer length. He observes that he cannot form a triangle using any three of these sticks as side lengths. The shortest possible length of the longest of the eight sticks is
(**A**) 20 (**B**) 21 (**C**) 22 (**D**) 23 (**E**) 24

25. Tony and Maria are training for a race by running all the way up and down a 700 m long ski slope. They each run up the slope at different constant speeds. Coming down the slope, each runs at double his or her uphill speed. Maria reaches the top first, and immediately starts running back down, meeting Tony 70 m from the top. When Maria reaches the bottom, how far behind is Tony?
(**A**) 140 m (**B**) 250 m (**C**) 280 m (**D**) 300 m (**E**) 320 m

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Canadian Mathematics Competition

An activity of The Centre for Education
in Mathematics and Computing,
University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 17, 2000

Time: 1 hour

Calculators are permitted.

Instructions

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2. You may use rulers, compasses and paper for rough work.
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   Each unanswered question is worth 2, to a maximum of 20.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor tells you to start, you will have *sixty* minutes of working time.

Grade 8

Scoring:	There is *no penalty* for an incorrect answer. Each unanswered question is worth 2 credits, to a maximum of 20 credits.

Part A (5 credits each)

1. The value of $2^5 + 5$ is
(**A**) 20 (**B**) 37 (**C**) 11 (**D**) 13 (**E**) 21

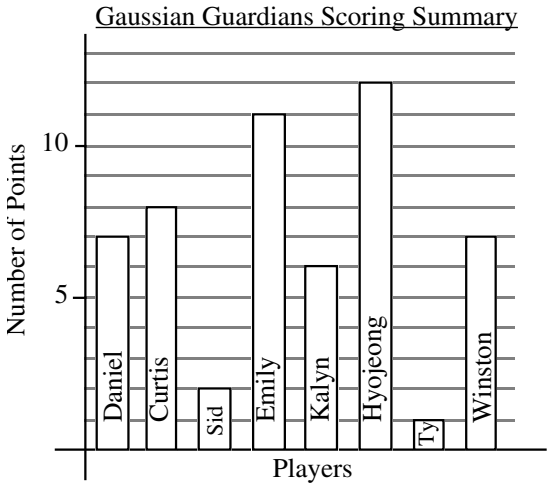
2. A number is placed in the box to make the following statement true: $8 + \frac{7}{\square} + \frac{3}{1000} = 8.073$. What is this number?
(**A**) 1000 (**B**) 100 (**C**) 1 (**D**) 10 (**E**) 70

3. The value of $\frac{5+4-3}{5+4+3}$ is
(**A**) -1 (**B**) $\frac{1}{3}$ (**C**) 2 (**D**) $\frac{1}{2}$ (**E**) $-\frac{1}{2}$

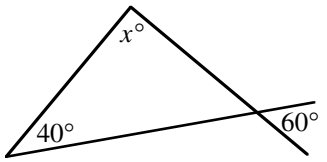
4. In the addition shown, a digit, either the same or different, can be placed in each of the two boxes. What is the sum of the two missing digits?
(**A**) 9 (**B**) 11 (**C**) 13
(**D**) 3 (**E**) 7

$$\begin{array}{r} 8\,6\,3 \\ \square\,9\,1 \\ 7\,\square\,8 \\ \hline 2\,1\,8\,2 \end{array}$$

5. The graph shows the complete scoring summary for the last game played by the eight players on Gaussian Guardians intramural basketball team. The total number of points scored by the Gaussian Guardians was
(**A**) 54 (**B**) 8 (**C**) 12
(**D**) 58 (**E**) 46



6. In the given diagram, what is the value of x?
(**A**) 20 (**B**) 80 (**C**) 100
(**D**) 120 (**E**) 60



7. During the week, the Toronto Stock Exchange made the following gains and losses:

Monday	-150	Thursday	$+182$
Tuesday	$+106$	Friday	-210
Wednesday	-47		

What was the net change for the week?
(**A**) a loss of 119 (**B**) a gain of 119 (**C**) a gain of 91
(**D**) a loss of 91 (**E**) a gain of 695

8. If $x * y = x + y^2$, then $2 * 3$ equals
(**A**) 8 (**B**) 25 (**C**) 11 (**D**) 13 (**E**) 7

9. Of the following five statements, how many are correct?
(i) 20% of $40 = 8$ (ii) $2^3 = 8$ (iii) $7 - 3 \times 2 = 8$ (iv) $3^2 - 1^2 = 8$ (v) $2(6-4)^2 = 8$
(**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5

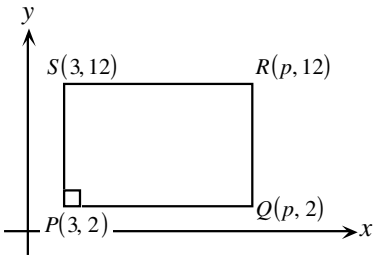
10. Karl had his salary reduced by 10%. He was later promoted and his salary was increased by 10%. If his original salary was \$20 000, what is his present salary?
(**A**) \$16 200 (**B**) \$19 800 (**C**) \$20 000 (**D**) \$20 500 (**E**) \$24 000

Part B (6 credits each)

11. Pat planned to place patio stones in a rectangular garden that has dimensions 15 m by 2 m. If each patio stone measures 0.5 m by 0.5 m, how many stones are needed to cover the garden?
(**A**) 240 (**B**) 180 (**C**) 120 (**D**) 60 (**E**) 30

12. The prime numbers between 10 and 20 are added together to form the number Q. What is the largest prime divisor of Q?
(**A**) 2 (**B**) 3 (**C**) 5 (**D**) 7 (**E**) 11

13. The coordinates of the vertices of rectangle $PQRS$ are given in the diagram. The area of rectangle $PQRS$ is 120. The value of p is
(**A**) 10 (**B**) 12 (**C**) 13
(**D**) 14 (**E**) 15



14. A set of five different positive integers has an average (arithmetic mean) of 11. What is the largest possible number in this set?
(**A**) 45 (**B**) 40 (**C**) 35 (**D**) 44 (**E**) 46

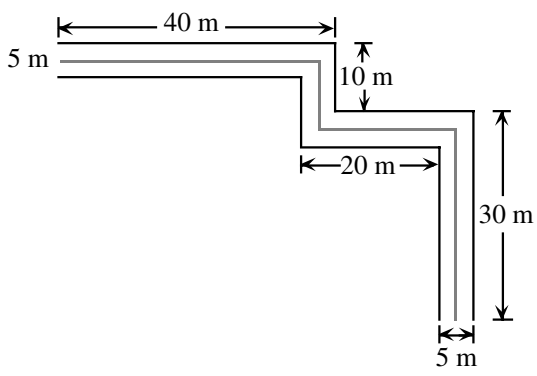
15. $ABCD$ is a square that is made up of two identical rectangles and two squares of area 4 cm^2 and 16 cm^2. What is the area, in cm^2, of the square $ABCD$?
(**A**) 64 (**B**) 49 (**C**) 25 (**D**) 36 (**E**) 20

16. Three tenths of our planet Earth is covered with land and the rest is covered with water. Ninety-seven percent of the water is salt water and the rest is fresh water. What percentage of the Earth is covered in fresh water?
(**A**) 20.1% (**B**) 79.9% (**C**) 32.1% (**D**) 2.1% (**E**) 9.6%

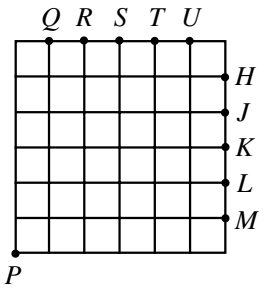
17. In a certain month, three of the Sundays have dates that are even numbers. The tenth day of this month is a
(**A**) Saturday (**B**) Sunday (**C**) Monday (**D**) Tuesday (**E**) Wednesday

18. Jim drives 60 km south, 40 km west, 20 km north, and 10 km east. What is the distance from his starting point to his finishing point?
(**A**) 30 km (**B**) 50 km (**C**) 40 km (**D**) 70 km (**E**) 35 km

19. A paved pedestrian path is 5 metres wide. A yellow line is painted down the middle. If the edges of the path measure 40 m, 10 m, 20 m, and 30 m, as shown, what is the length of the yellow line?
(**A**) 100 m (**B**) 97.5 m (**C**) 95 m
(**D**) 92.5 m (**E**) 90 m



20. In the 6 by 6 grid shown, two lines are drawn through point P, dividing the grid into three regions of equal area. These lines will pass through the points



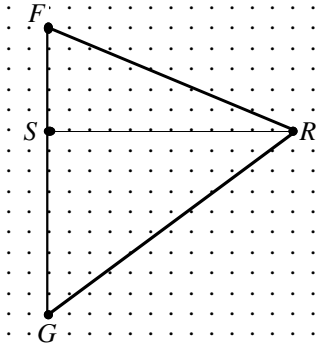
(**A**) M and Q (**B**) L and R (**C**) K and S
(**D**) H and U (**E**) J and T

Part C (8 credits each)

21. Sam is walking in a straight line towards a lamp post which is 8 m high. When he is 12 m away from the lamp post, his shadow is 4 m in length. When he is 8 m from the lamp post, what is the length of his shadow?

(**A**) $1\frac{1}{2}$ m (**B**) 2 m (**C**) $2\frac{1}{2}$ m (**D**) $2\frac{2}{3}$ m (**E**) 3 m

22. The homes of Fred (F), Sandy (S), Robert (R), and Guy (G) are marked on the rectangular grid with straight lines joining them. Fred is considering four routes to visit each of his friends:

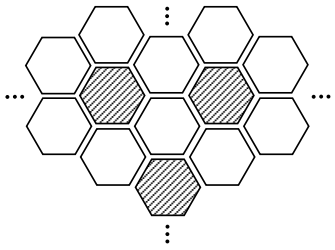


(i) $F \to R \to S \to G$ (ii) $F \to S \to G \to R$
(iii) $F \to R \to G \to S$ (iv) $F \to S \to R \to G$

If $FS = 5$ km, $SG = 9$ km and $SR = 12$ km, the difference between the longest and the shortest trip (in km) is

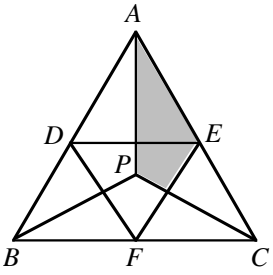
(**A**) 8 (**B**) 13 (**C**) 15
(**D**) 2 (**E**) 0

23. A square floor is tiled, as partially shown, with a large number of regular hexagonal tiles. The tiles are coloured blue or white. Each blue tile is surrounded by 6 white tiles and each white tile is surrounded by 3 white and 3 blue tiles. Ignoring part tiles, the ratio of the number of blue tiles to the number of white tiles is closest to



(**A**) 1:6 (**B**) 2:3 (**C**) 3:10
(**D**) 1:4 (**E**) 1:2

24. In equilateral triangle ABC, line segments are drawn from a point P to the vertices A, B and C to form three identical triangles. The points D, E and F are the midpoints of the three sides and they are joined as shown in the diagram. What fraction of ΔABC is shaded?



(**A**) $\frac{1}{5}$ (**B**) $\frac{5}{24}$ (**C**) $\frac{1}{4}$

(**D**) $\frac{2}{9}$ (**E**) $\frac{2}{7}$

25. The cookies in a jar contain a total of 1000 chocolate chips. All but one of these cookies contains the same number of chips; it contains one more chip than the others. The number of cookies in the jar is between one dozen and three dozen. What is the sum of the number of cookies in the jar and the number of chips in the cookie with the extra chocolate chip?

(**A**) 65 (**B**) 64 (**C**) 63 (**D**) 66 (**E**) 67

Canadian Mathematics Competition

An activity of The Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 12, 1999

Time: 1 hour

Calculators are permitted.

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7. When your supervisor tells you to start, you will have *sixty* minutes of working time.

Grade 8

Scoring:	There is *no penalty* for an incorrect answer. Each unanswered question is worth 2 credits, to a maximum of 20 credits.

Part A (5 credits each)

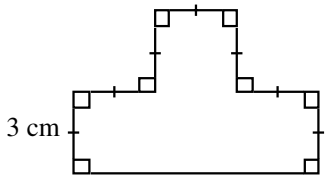
1. $10^3 + 10^2 + 10$ equals
   (**A**) 1110 (**B**) 101 010 (**C**) 111 (**D**) 100 010 010 (**E**) 11 010

2. $\frac{1}{2} + \frac{1}{3}$ is equal to
   (**A**) $\frac{2}{5}$ (**B**) $\frac{1}{6}$ (**C**) $\frac{1}{5}$ (**D**) $\frac{3}{2}$ (**E**) $\frac{5}{6}$

3. Which one of the following gives an odd integer?
   (**A**) 6^2 (**B**) $23 - 17$ (**C**) 9×24 (**D**) 9×41 (**E**) $96 \div 8$

4. What is the remainder when 82 460 is divided by 8?
   (**A**) 0 (**B**) 5 (**C**) 4 (**D**) 7 (**E**) 2

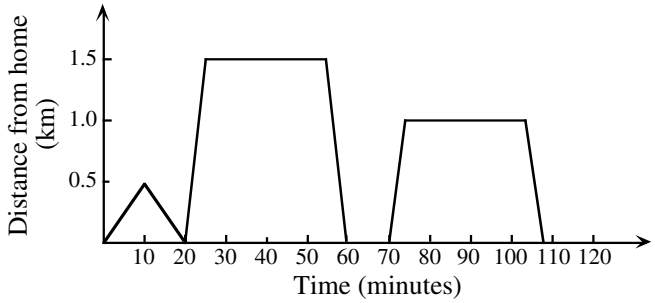
5. In the diagram, line segments meet at 90° as shown. If the short line segments are each 3 cm long, what is the area of the shape?
   (**A**) 30 (**B**) 36 (**C**) 40
   (**D**) 45 (**E**) 54



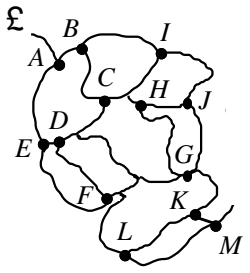
6. The average of $-5, -2, 0, 4$, and 8 is
   (**A**) 1 (**B**) 0 (**C**) $\frac{19}{5}$ (**D**) $\frac{5}{4}$ (**E**) $\frac{9}{4}$

7. If the sales tax rate were to increase from 7% to 7.5%, then the tax on a $1000 item would go up by
   (**A**) $75.00 (**B**) $5.00 (**C**) $0.5 (**D**) $0.05 (**E**) $7.50

8. Tom spent part of his morning visiting and playing with friends. The graph shows his travels. He went to his friends' houses and stopped to play if they were at home. The number of houses at which he stopped to play is
   (**A**) 1 (**B**) 2 (**C**) 3 (**D**) 4 (**E**) 5



9. André is hiking on the paths shown in the map. He is planning to visit sites *A* to *M* in alphabetical order. He can never retrace his steps and he must proceed directly from one site to the next. What is the largest number of labelled points he can visit before going out of alphabetical order?
   (**A**) 6 (**B**) 7 (**C**) 8
   (**D**) 10 (**E**) 13



10. The area of a rectangular shaped garden is $28\ m^2$. It has a length of 7 m. Its perimeter, in metres, is
(**A**) 22 (**B**) 11 (**C**) 24 (**D**) 36 (**E**) 48

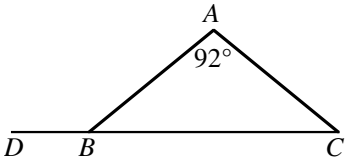
Part B (6 credits each)

11. Which of the following numbers is an odd integer, contains the digit 5, is divisible by 3, and lies between 12^2 and 13^2?
(**A**) 105 (**B**) 147 (**C**) 156 (**D**) 165 (**E**) 175

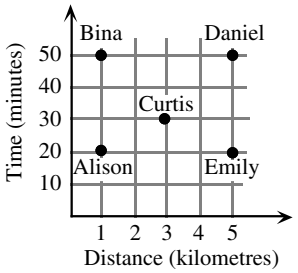
12. If $\frac{n+1999}{2} = -1$, then the value of n is
(**A**) -2001 (**B**) -2000 (**C**) -1999 (**D**) -1997 (**E**) 1999

13. The expression $n!$ means the product of the positive integers from 1 to n. For example, $5! = 1\times2\times3\times4\times5$. The value of $6! - 4!$ is
(**A**) 2 (**B**) 18 (**C**) 30 (**D**) 716 (**E**) 696

14. ABC is an isosceles triangle in which $\angle A = 92°$. CB is extended to a point D. What is the size of $\angle ABD$?
(**A**) 88° (**B**) 44° (**C**) 92°
(**D**) 136° (**E**) 158°



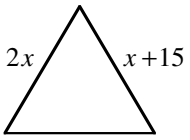
15. The graph shown at the right indicates the time taken by five people to travel various distances. On average, which person travelled the fastest?
(**A**) Alison (**B**) Bina (**C**) Curtis
(**D**) Daniel (**E**) Emily



16. In a set of five numbers, the average of two of the numbers is 12 and the average of the other three numbers is 7. The average of all five numbers is
(**A**) $8\frac{1}{3}$ (**B**) $8\frac{1}{2}$ (**C**) 9 (**D**) $8\frac{3}{4}$ (**E**) $9\frac{1}{2}$

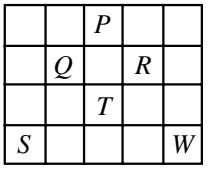
17. In the subtraction question, $\begin{array}{r} 1957 \\ -\ a9 \\ \hline 18b8 \end{array}$, the sum of the digits a and b is
(**A**) 15 (**B**) 14 (**C**) 10 (**D**) 5 (**E**) 4

18. The equilateral triangle has sides of $2x$ and $x+15$ as shown. The perimeter of the triangle is
(**A**) 15 (**B**) 30 (**C**) 90
(**D**) 45 (**E**) 60



19. In a traffic study, a survey of 50 moving cars is done and it is found that 20% of these contain more than one person. Of the cars containing only one person, 60% of these are driven by women. Of the cars containing just one person, how many were driven by men?
(**A**) 10 (**B**) 16 (**C**) 20 (**D**) 30 (**E**) 40

20. A game is played on the board shown. In this game, a player can move three places in any direction (up, down, right or left) and then can move two places in a direction perpendicular to the first move. If a player starts at S, which position on the board (P, Q, R, T, or W) cannot be reached through any sequence of moves?

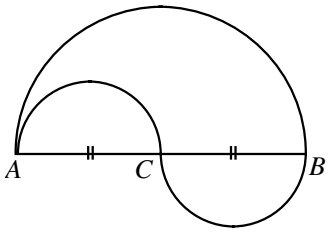


(**A**) P (**B**) Q (**C**) R
(**D**) T (**E**) W

Part C (8 credits each)

21. The sum of seven consecutive positive integers is always
(**A**) odd (**B**) a multiple of 7 (**C**) even
(**D**) a multiple of 4 (**E**) a multiple of 3

22. In the diagram, $AC = CB = 10$ m, where AC and CB are each the diameter of the small equal semi-circles. The diameter of the larger semi-circle is AB. In travelling from A to B, it is possible to take one of two paths. One path goes along the semi-circular arc from A to B. A second path goes along the semi-circular arcs from A to C and then along the semi-circular arc from C to B. The difference in the lengths of these two paths is



(**A**) 12π (**B**) 6π (**C**) 3π
(**D**) 2π (**E**) 0

23. Kalyn writes down all of the integers from 1 to 1000 that have 4 as the sum of their digits. If $\frac{a}{b}$ (in lowest terms) is the fraction of these numbers that are prime, then $a+b$ is
(**A**) 5 (**B**) 4 (**C**) 15 (**D**) 26 (**E**) 19

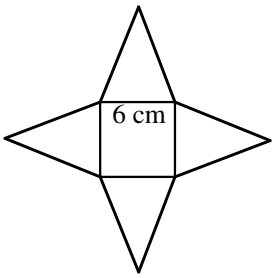
24. Raymonde's financial institution publishes a list of service charges as shown in the table. For her first twenty five transactions, she uses Autodebit three times as often as she writes cheques. She also writes as many cheques as she makes cash withdrawals. After her twenty- fifth transaction, she begins to make single transactions. What is the smallest number of transactions she needs to make so that her monthly service charges will exceed the $15.95 'all-in-one' fee?

	Service Fee per Item
Cheque	$0.50
Autodebit	$0.60
Cash Withdrawal	$0.45

'All-in-one' fee is $15.95

(**A**) 29 (**B**) 30 (**C**) 27
(**D**) 28 (**E**) 31

25. Four identical isosceles triangles border a square of side 6 cm, as shown. When the four triangles are folded up they meet at a point to form a pyramid with a square base. If the height of this pyramid is 4 cm, the total area of the four triangles and the square is



(**A**) 84 cm^2 (**B**) 98 cm^2 (**C**) 96 cm^2
(**D**) 108 cm^2 (**E**) 90 cm^2

35th Anniversary 1963 – 1998

Canadian Mathematics Competition

An activity of The Centre for Education in Mathematics and Computing, University of Waterloo, Waterloo, Ontario

Gauss Contest (Grade 8)

(Grade 7 Contest is on the reverse side)

Wednesday, May 13, 1998

Time: 1 hour

Calculators are permitted.

Instructions

1. Do not open the examination booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be certain that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question is followed by five possible answers marked **A**, **B**, **C**, **D**, and **E**. Only one of these is correct. When you have decided on your choice, enter the appropriate letter on your answer sheet for that question.
5. Scoring:
   Each correct answer is worth 5 credits in Part A, 6 credits in Part B, and 8 credits in Part C.
   There is *no penalty* for an incorrect answer.
   Each unanswered question is worth 2 credits, to a maximum of 20 credits.
6. Diagrams are *not* drawn to scale. They are intended as aids only.
7. When your supervisor instructs you to begin, you will have *sixty* minutes of working time.

Grade 8

Scoring:	There is *no penalty* for an incorrect answer. Each unanswered question is worth 2 credits, to a maximum of 20 credits.

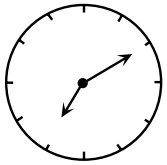
Part A (5 credits each)

1. The number 4567 is tripled. The ones digit (units digit) in the resulting number is
(**A**) 5 (**B**) 6 (**C**) 7 (**D**) 3 (**E**) 1

2. The smallest number in the set $\{0, -17, 4, 3, -2\}$ is
(**A**) -17 (**B**) 4 (**C**) -2 (**D**) 0 (**E**) 3

3. The average of -5, -2, 0, 4, and 8 is
(**A**) $\frac{5}{4}$ (**B**) 0 (**C**) $\frac{19}{5}$ (**D**) 1 (**E**) $\frac{9}{4}$

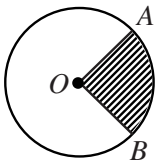
4. Emily sits on a chair in a room. Behind her is a clock. In front of her is a mirror. In the mirror, she sees the image of the clock as shown. The actual time is closest to
(**A**) 4:10 (**B**) 7:10 (**C**) 5:10
(**D**) 6:50 (**E**) 4:50



5. If 1.2×10^6 is doubled, what is the result?
(**A**) 2.4×10^6 (**B**) 2.4×10^{12} (**C**) 2.4×10^3 (**D**) 1.2×10^{12} (**E**) 0.6×10^{12}

6. Tuesday's high temperature was 4°C warmer than that of Monday's. Wednesday's high temperature was 6°C cooler than that of Monday's. If Tuesday's high temperature was 22°C, what was Wednesday's high temperature?
(**A**) 20°C (**B**) 24°C (**C**) 12°C (**D**) 32°C (**E**) 16°C

7. In the circle with centre O, the shaded sector represents 20% of the area of the circle. What is the size of angle AOB?
(**A**) 36° (**B**) 72° (**C**) 90°
(**D**) 80° (**E**) 70°



8. The pattern of figures △●□▲○ is repeated in the sequence
△,●,□,▲,○,△,●,□,▲,○,... .
The 214th figure in the sequence is
(**A**) △ (**B**) ● (**C**) □ (**D**) ▲ (**E**) ○

9. When a pitcher is $\frac{1}{2}$ full it contains exactly enough water to fill three identical glasses. How full would the pitcher be if it had exactly enough water to fill four of the same glasses?
(**A**) $\frac{2}{3}$ (**B**) $\frac{7}{12}$ (**C**) $\frac{4}{7}$ (**D**) $\frac{6}{7}$ (**E**) $\frac{3}{4}$

10. A bank employee is filling an empty cash machine with bundles of \$5.00, \$10.00 and \$20.00 bills. Each bundle has 100 bills in it and the machine holds 10 bundles of each type. What amount of money is required to fill the machine?
(**A**) \$30 000 (**B**) \$25 000 (**C**) \$35 000 (**D**) \$40 000 (**E**) \$45 000

Part B (6 credits each)

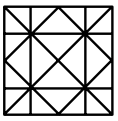
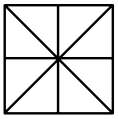
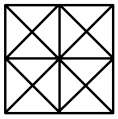
11. The weight limit for an elevator is 1500 kilograms. The average weight of the people in the elevator is 80 kilograms. If the combined weight of the people is 100 kilograms over the limit, how many people are in the elevator?
(**A**) 14 (**B**) 17 (**C**) 16 (**D**) 20 (**E**) 13

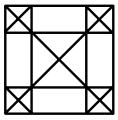
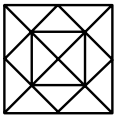
12. In the 4×4 square shown, each row, column and diagonal should contain each of the numbers 1, 2, 3, and 4. Find the value of $K + N$.

1	F	G	H
T	2	J	K
L	M	3	N
P	Q	1	R

(**A**) 4 (**B**) 3 (**C**) 5
(**D**) 6 (**E**) 7

13. Claire takes a square piece of paper and folds it in half four times without unfolding, making an isosceles right triangle each time. After unfolding the paper to form a square again, the creases on the paper would look like

(**A**)  (**B**)  (**C**) 

(**D**)  (**E**) 

14. Stephen had a 10:00 a.m. appointment 60 km from his home. He averaged 80 km/h for the trip and arrived 20 minutes late for the appointment. At what time did he leave his home?
(**A**) 9:35 a.m. (**B**) 9:15 a.m. (**C**) 8:40 a.m. (**D**) 9:00 a.m. (**E**) 9:20 a.m.

15. Michael picks three *different* digits from the set $\{1, 2, 3, 4, 5\}$ and forms a mixed number by placing the digits in the spaces of $\square\frac{\square}{\square}$. The fractional part of the mixed number must be less than 1. (For example, $4\frac{2}{3}$). What is the difference between the largest and smallest possible mixed number that can be formed?

(**A**) $4\frac{3}{5}$ (**B**) $4\frac{9}{20}$ (**C**) $4\frac{3}{10}$ (**D**) $4\frac{4}{15}$ (**E**) $4\frac{7}{20}$

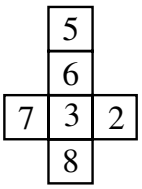
16. Suppose that $x*$ means $\frac{1}{x}$, the reciprocal of x. For example, $5* = \frac{1}{5}$. How many of the following statements are true?

(i) $2* + 4* = 6*$ (ii) $3* \times 5* = 15*$ (iii) $7* - 3* = 4*$ (iv) $12* \div 3* = 4*$

(**A**) 0 (**B**) 1 (**C**) 2 (**D**) 3 (**E**) 4

17. In a ring toss game at a carnival, three rings are tossed over any of three pegs. A ring over peg A is worth *one* point, over peg B *three* points and over peg C *five* points. If all three rings land on pegs, how many different point totals are possible? (It is possible to have more than one ring on a peg.)
(**A**) 12 (**B**) 7 (**C**) 10 (**D**) 13 (**E**) 6

18. The figure shown is folded to form a cube. Three faces meet at each corner. If the numbers on the three faces at a corner are multiplied, what is the largest possible product?



(**A**) 144 (**B**) 168 (**C**) 240
(**D**) 280 (**E**) 336

19. A regular pentagon has all sides and angles equal. If the shaded pentagon is enclosed by squares and triangles, as shown, what is the size of angle x?

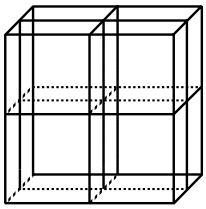
(**A**) 75° (**B**) 108° (**C**) 90°
(**D**) 60° (**E**) 72°

20. Three playing cards are placed in a row. The club is to the right of the heart and the diamond. The 5 is to the left of the heart. The 8 is to the right of the 4. From left to right, the cards are
(**A**) 4 of hearts, 5 of diamonds, 8 of clubs (**B**) 5 of diamonds, 4 of hearts, 8 of clubs
(**C**) 8 of clubs, 4 of hearts, 5 of diamonds (**D**) 4 of diamonds, 5 of clubs, 8 of hearts
(**E**) 5 of hearts, 4 of diamonds, 8 of clubs

Part C (8 credits each)

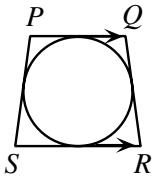
21. The number 315 can be written as the product of two odd integers each greater than 1. In how many ways can this be done?
(**A**) 0 (**B**) 1 (**C**) 3 (**D**) 4 (**E**) 5

22. A cube measures $10\text{ cm} \times 10\text{ cm} \times 10\text{ cm}$. Three cuts are made parallel to the faces of the cube as shown creating eight separate solids which are then separated. What is the increase in the total surface area?
(**A**) 300 cm^2 (**B**) 800 cm^2 (**C**) 1200 cm^2
(**D**) 600 cm^2 (**E**) 0 cm^2



23. If the sides of a triangle have lengths 30, 40 and 50, what is the length of the shortest altitude?
(**A**) 20 (**B**) 24 (**C**) 25 (**D**) 30 (**E**) 40

24. A circle is inscribed in trapezoid $PQRS$.
If $PS = QR = 25\text{ cm}$, $PQ = 18\text{ cm}$ and $SR = 32\text{ cm}$, what is the length of the diameter of the circle?
(**A**) 14 (**B**) 25 (**C**) 24
(**D**) $\sqrt{544}$ (**E**) $\sqrt{674}$



25. A sum of money is to be divided among Allan, Bill and Carol. Allan receives \$1 plus one-third of what is left. Bill then receives \$6 plus one-third of what remains. Carol receives the rest, which amounts to \$40. How much did Bill receive?
(**A**) \$26 (**B**) \$28 (**C**) \$30 (**D**) \$32 (**E**) \$34