

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

UNIVERSITY OF  
**WATERLOO**

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MATHEMATICS

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**Time:** 1 hour

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**Calculators are permitted.**

## Instructions

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**Grade 8**

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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. If  $\frac{8}{12} = \frac{\square}{3}$ , then the value represented by  $\square$  is

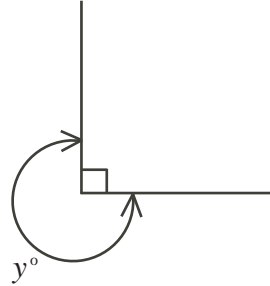
(A) 24            (B) 1            (C) 12            (D) 2            (E) 4

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)  $\frac{14}{100}$

6. If Clara doubles a number and then adds 3, the result is 23. The original number is

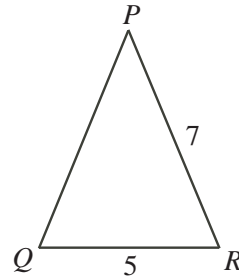
(A) 13            (B) 10            (C) 49            (D) 17            (E) 20

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

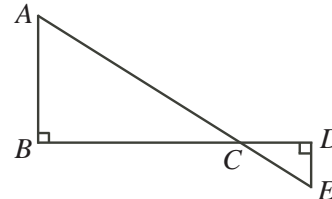
10. Five children had dinner. Chris ate more than Max. Brandon ate less than Kayla. Kayla ate less than Max but more than Tanya. Which child ate the second most?

(A) Brandon    (B) Chris            (C) Kayla            (D) Max            (E) Tanya

## Part B: Each correct answer is worth 6.

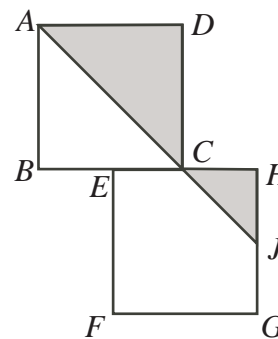
11. Which of the following expressions is equal to 5?  
 (A)  $(2 \times 3)^2$  (B)  $3 + 2^2$  (C)  $2^3 - 1$   
 (D)  $3^2 - 2^2$  (E)  $(3 + 2)^2$
12. Nick charges \$7 for travel costs and then \$10 per hour for babysitting. Which expression always represents the number of dollars that Nick charges 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  $\times$  80 cm. Which of the following measurements would give an area that is exactly double the area of his window?  
 (A) 25 cm  $\times$  160 cm (B) 40 cm  $\times$  100 cm (C) 50 cm  $\times$  160 cm  
 (D) 100 cm  $\times$  160 cm (E) 50 cm  $\times$  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

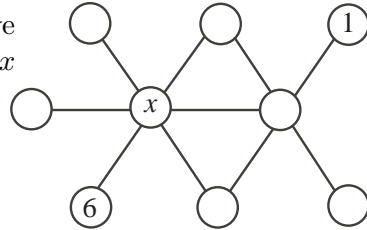
## Part C: Each correct answer is worth 8.

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

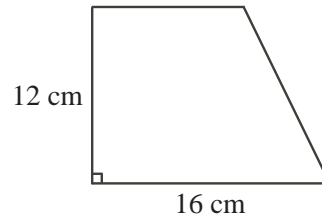
22. In the diagram, each of the integers 1 through 9 is to be placed in one circle so that the integers in every straight row of three joined circles add to 18. The 6 and 1 have been filled in. The value of the number represented by  $x$  is

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



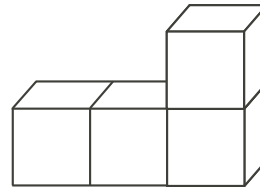
23. The trapezoid shown has a height of length 12 cm, a base of length 16 cm, and an area of  $162 \text{ cm}^2$ . The perimeter of the trapezoid is

(A) 51 cm            (B) 52 cm            (C)  $49.\bar{6}$  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

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

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

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

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

(A)  $-4042109$             (B)  $-4047638$             (C)  $-4038094$   
(D)  $-4044121$             (E)  $-4046132$



# 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



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**Time:** 1 hour

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**Grade 8**

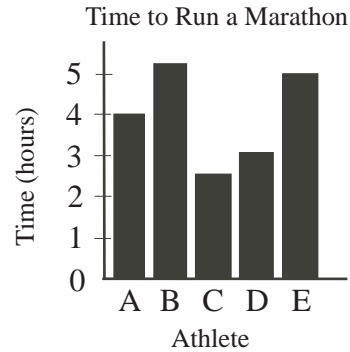
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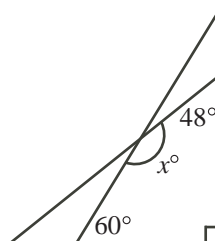
**Part A: Each correct answer is worth 5.**

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  $(\frac{11}{12})^2$  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    |

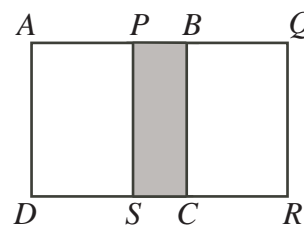
15. If four *different* numbers are chosen from 5, 6, 7, 8, 9 to replace the  $\square$ 's below, what is the smallest possible sum of the two 2-digit numbers?

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

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

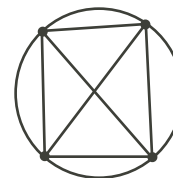
16. Two identical squares,  $ABCD$  and  $PQRS$ , have side length 12. They overlap to form the 12 by 20 rectangle  $AQRD$  shown. What is the area of the shaded rectangle  $PBCS$ ?

(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

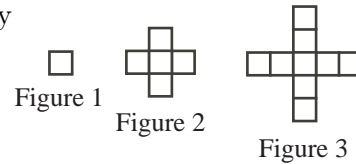


18. A bicycle travels at a constant speed of 15 km/h. A bus starts 195 km behind the bicycle and catches up to the bicycle in 3 hours. What is the average speed of the bus in km/h?

(A) 65            (B) 80            (C) 70            (D) 60            (E) 50

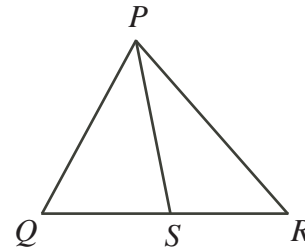
19. In the sequence shown, each figure after the first is formed by adding 4 squares to the previous figure. How many squares form Figure 2010?

(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?

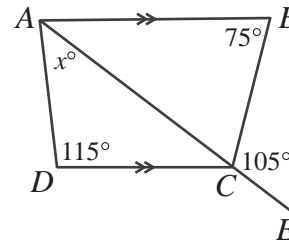
(A)  $PQ = PR$     (B)  $PS = PQ$     (C)  $QR = PS$   
(D)  $QS = SR$     (E)  $PQ = QR$



**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  $r \times s + u \times r + t \times r$ ?

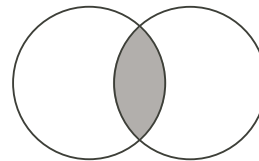
(A) 24            (B) 45            (C) 33            (D) 40            (E) 49

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)  $57.08 \text{ cm}^2$     (B)  $55.24 \text{ cm}^2$     (C)  $51.83 \text{ cm}^2$   
(D)  $54.17 \text{ cm}^2$     (E)  $53.21 \text{ cm}^2$



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



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C.M.C. Sponsors



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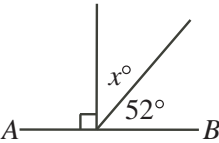
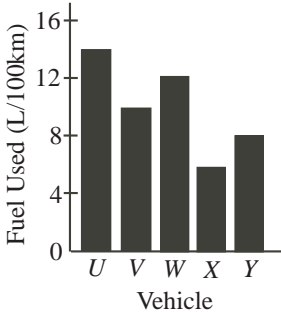
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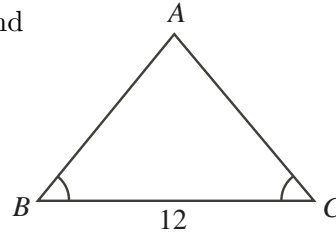
Part A: Each correct answer is worth 5.

- The value of  $1 + 3^2$  is  
(A) 16      (B) 10      (C) 8      (D) 6      (E) 5
- The value of  $-10 + (-12)$  is  
(A) 2      (B) 22      (C)  $-2$       (D)  $-22$       (E) 120
- 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
- In the diagram,  $AB$  is a line segment. The value of  $x$  is  
(A) 128      (B) 38      (C) 48  
(D) 142      (E) 308  

- Rounded to 2 decimal places,  $\frac{7}{9}$  is  
(A) 0.70      (B) 0.77      (C) 0.78      (D) 0.79      (E) 0.80
- 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)  $Y$   

- 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
- 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
- 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)  $\frac{8}{26}$
- 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?

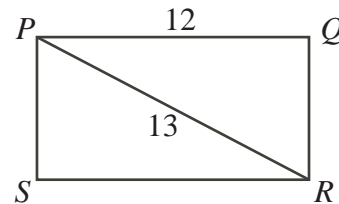
(A) 50            (B) 51            (C) 101            (D) 102            (E) 25

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

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

$$\begin{array}{r} P Q P \\ + R Q Q Q \\ \hline 2 0 0 9 \end{array}$$

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

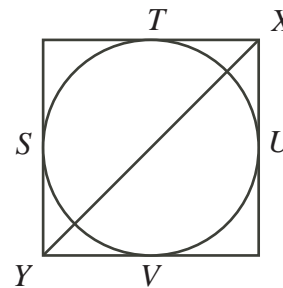
**Part C: Each correct answer is worth 8.**

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  $90^\circ$
  - after starting with a line segment of length 1, each side is 1 longer than the previous side.

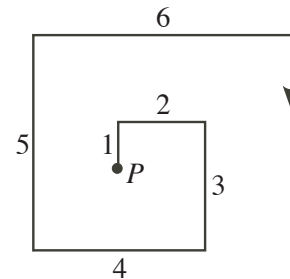
After completing the side with length 21, Breenah's distance from her original starting point  $P$  will be between

- (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

C.M.C. Sponsors



STRONGER COMMUNITIES TOGETHER™

**Deloitte  
& Touche**  
Chartered  
Accountants



C.M.C. Supporter



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**Time:** 1 hour

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**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.

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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.

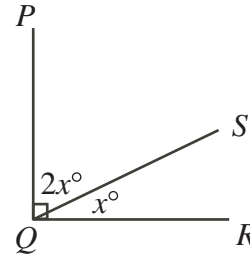
**Grade 8**

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.**

- The value of  $8 \times (6 - 4) + 2$  is  
(A) 46      (B) 20      (C) 18      (D) 12      (E) 56
- 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

- In the diagram,  $\angle PQR = 90^\circ$ . The value of  $x$  is  
(A) 30      (B) 60      (C) 90  
(D) 10      (E) 45

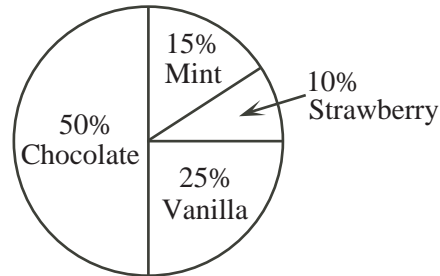


- The value of  $(1 + 2)^2 - (1^2 + 2^2)$  is  
(A) 14      (B) 4      (C) 2      (D) 12      (E) 1
- When the numbers 0.28, -0.2, 2.8, -8.2 are listed in increasing order, the correct order is  
(A) -8.2, -0.2, 0.28, 2.8  
(B) 2.8, 0.28, -0.2, -8.2  
(C) -8.2, -0.2, 2.8, 0.28  
(D) 2.8, 0.28, -8.2, -0.2  
(E) -0.2, -8.2, 0.28, 2.8

- 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   | <input style="width: 40px; height: 20px;" type="text"/> |

- 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)  $\frac{5}{8}$



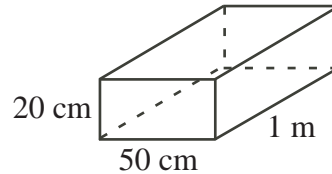
- A number is multiplied by 5 and then 9 is subtracted from the result, giving 51. What is the original number?  
(A) 210      (B) 8.4      (C) 65      (D) 12      (E) 15

**Grade 8**

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)  $\frac{5}{11}$

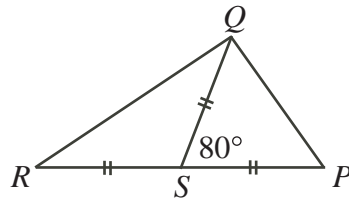
**Part B: Each correct answer is worth 6.**

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

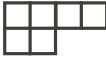



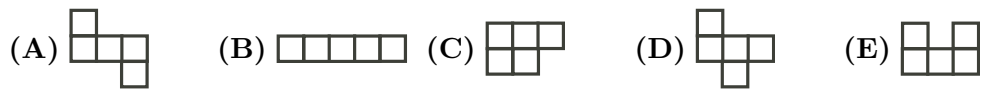
12. As a fund raiser, Gaussville Elementary School bought 8-slice pizzas for \$6.85 each. The school bought 55 pizzas and sold every slice. If each slice sold for \$1, the school's profit was  
 (A) \$55.00      (B) \$57.75      (C) \$60.50      (D) \$63.25      (E) \$66.00

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



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



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

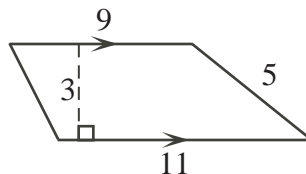
**Grade 8**

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

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

The value of  $y - x$  is

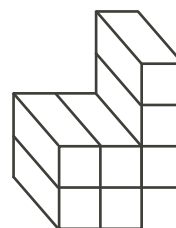
- (A) 3            (B)  $-5$             (C) 7            (D)  $-7$             (E) 2
20. What is the area of the figure shown?
- (A) 45            (B) 55            (C) 27  
(D) 30            (E) 33



**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  $3 \times 3$  grid is filled with the digits 1, 2 and 3 so that each number appears once in each row and column. Two different examples are

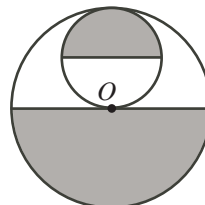
|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 3 | 1 | 2 |
| 2 | 3 | 1 |

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  $64\pi$ . The total area of the shaded regions is
- (A)  $34\pi$             (B)  $36\pi$             (C)  $44\pi$   
(D)  $40\pi$             (E)  $33\pi$



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

C.M.C. Sponsors



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**Time:** 1 hour

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**Calculators are permitted.**

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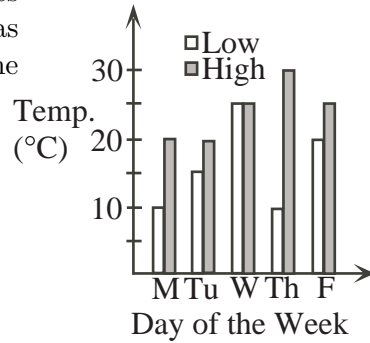
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Grade 8

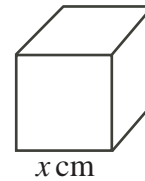
Scoring: There is *no penalty* for an incorrect answer.  
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

**Part A: Each correct answer is worth 5.**

- The value of  $(4 \times 12) - (4 + 12)$  is  
(A) 8            (B) 16            (C) 20            (D) 24            (E) 32
- 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
- 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



- 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)  $\frac{2}{5}$
- In the diagram, the cube has a volume of  $8 \text{ cm}^3$ . What is the value of  $x$ ?  
(A) 2            (B) 8            (C) 4  
(D) 6            (E) 3
- 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
- What is the equivalent of 200 metres in kilometres?  
(A) 0.2            (B) 0.02            (C) 2            (D) 20            (E) 200 000
- 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
- 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



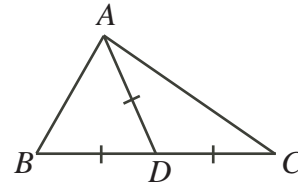
10. The number 519 is formed using the digits 5, 1 and 9. The three digits of this number are rearranged to form the largest possible and then the smallest possible three digit numbers. What is the difference between these largest and smallest numbers?
- (A) 332      (B) 432      (C) 792      (D) 756      (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  $\angle BCA = 40^\circ$ .  
The size of  $\angle BAC$  is

- (A)  $80^\circ$       (B)  $120^\circ$       (C)  $60^\circ$   
(D)  $90^\circ$       (E)  $100^\circ$



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?

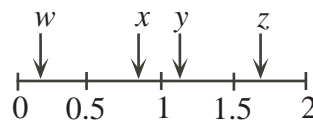
- (A) 1 273 500      (B) 1 263 000      (C) 1 306 000      (D) 1 336 000      (E) 1 346 500

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)  $\frac{z}{w}$

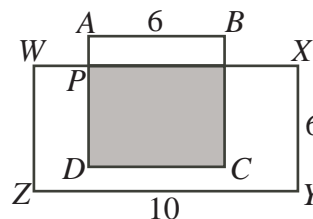


20. Lorri took a 240 km trip to Waterloo. On her way there, her average speed was 120 km/h. She was stopped for speeding, so on her way home her average speed was 80 km/h. What was her average speed, in km/h, for the entire round-trip?  
 (A) 90      (B) 96      (C) 108      (D) 102      (E) 110

**Part C: Each correct answer is worth 8.**

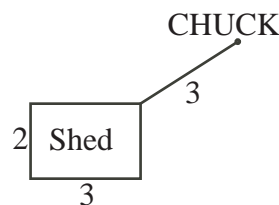
21. In the diagram,  $ABCD$  is a square with side length 6, and  $WXYZ$  is a rectangle with  $ZY = 10$  and  $XY = 6$ . Also,  $AD$  and  $WX$  are perpendicular. If the shaded area is equal to half of the area of  $WXYZ$ , the length of  $AP$  is

(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)  $7\pi \text{ m}^2$       (B)  $9\pi \text{ m}^2$       (C)  $\frac{27}{4}\pi \text{ m}^2$   
 (D)  $4\pi \text{ m}^2$       (E)  $5\pi \text{ m}^2$

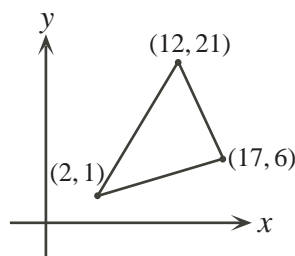


23. There are various ways to make \$207 using only \$2 coins and \$5 bills. One such way is using one \$2 coin and forty-one \$5 bills. Including this way, in how many different ways can \$207 be made using only \$2 coins and \$5 bills?

(A) 9      (B) 10      (C) 19      (D) 41      (E) 21

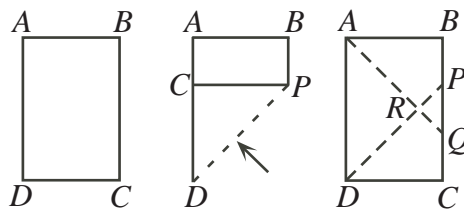
24. A lattice point is a point  $(x, y)$ , with  $x$  and  $y$  both integers. For example,  $(2, 3)$  is a lattice point but  $(4, \frac{1}{3})$  is not. In the diagram, how many lattice points lie on the perimeter of the triangle?

(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  $\text{cm}^2$ , 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

C.M.C. Sponsors:



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**Time:** 1 hour

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**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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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.
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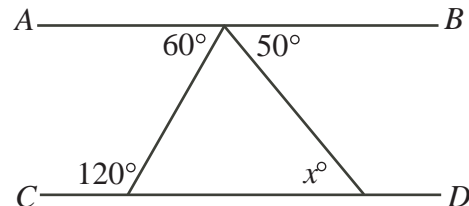
**Grade 8**

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. 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  $120 \text{ cm}^3$ . If the area of its base is  $24 \text{ cm}^2$ , 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

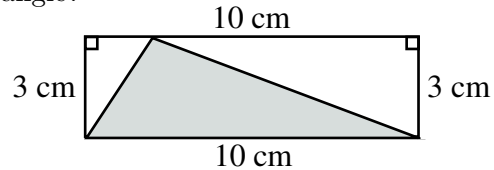
## Part B: Each correct answer is worth 6.

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)  $6.5 \text{ cm}^2$       (B)  $7.5 \text{ cm}^2$       (C)  $15 \text{ cm}^2$   
 (D)  $13 \text{ cm}^2$       (E)  $22.5 \text{ cm}^2$



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?

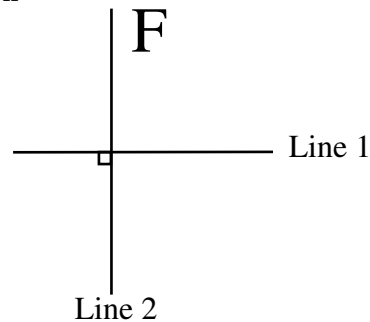
(A) 11      (B) 21      (C) 4      (D) 18      (E) 16

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

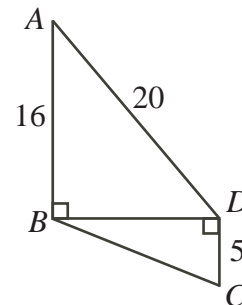
15. The letter F is reflected in Line 1. The image is then reflected in Line 2. The shape that results is

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



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

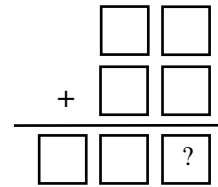
**Grade 8**

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?

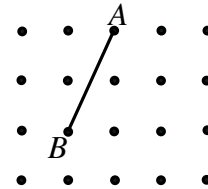
(A) 130                      (B) 117                      (C) 98                      (D) 91                      (E) 140

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

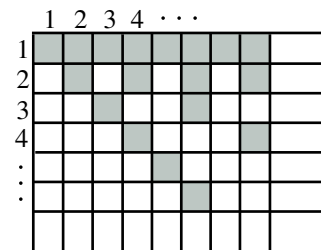
23. In the diagram, the points are evenly spaced vertically and horizontally. A segment  $AB$  is drawn using two of the points, as shown. Point  $C$  is chosen to be one of the remaining 18 points. For how many of these 18 possible points is triangle  $ABC$  isosceles?

(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  $n$ th 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?

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

|    |    |   |    |    |
|----|----|---|----|----|
|    |    |   | 20 | 21 |
|    | 6  | 5 | 4  |    |
| 23 | 7  | 1 | 3  | ?  |
|    | 9  | 8 | 2  |    |
| 25 | 24 |   |    | 22 |



# 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

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**Time:** 1 hour

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**Calculators are permitted.**

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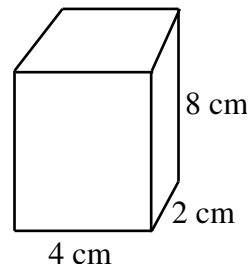
## Grade 8

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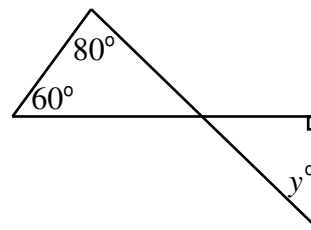
Each unanswered question is worth 2, to a maximum of 10 unanswered questions.

### Part A: Each correct answer is worth 5.

- 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)  $\frac{7}{8}$
- The value of  $(-3)(-4)(-1)$  is  
(A)  $-12$       (B)  $-8$       (C)  $8$       (D)  $11$       (E)  $12$
- In the diagram, the volume of the rectangular prism is  
(A)  $72 \text{ cm}^3$       (B)  $48 \text{ cm}^3$       (C)  $64 \text{ cm}^3$   
(D)  $24 \text{ cm}^3$       (E)  $14 \text{ cm}^3$



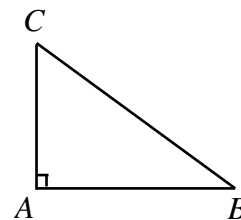
- The average (mean) of the numbers 6, 8, 9, 11, and 16 is  
(A) 8      (B) 9      (C) 10      (D) 11      (E) 7
- 10% of 10 multiplied by 20% of 20 equals  
(A) 40 000      (B) 0.4      (C) 400      (D) 40      (E) 4
- If  $8210 = 8.21 \times 10^{\square}$ , then the value that should go in the  $\square$  is  
(A) 1      (B) 2      (C) 3      (D) 4      (E) 5
- In the diagram, the value of  $y$  is  
(A) 40      (B) 60      (C) 45  
(D) 50      (E) 80



- How many integers between 1 and 60 contain the digit 3 at least once?  
(A) 6      (B) 10      (C) 14      (D) 15      (E) 20
- 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
- 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  $\angle A = 90^\circ$ . What is the area of triangle  $ABC$ ?
- (A)  $500 \text{ cm}^2$     (B)  $300 \text{ cm}^2$     (C)  $60 \text{ cm}^2$   
 (D)  $150 \text{ cm}^2$     (E)  $250 \text{ cm}^2$

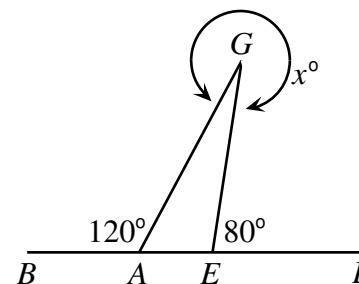


12. What is the largest possible value for the sum of five consecutive even numbers, if 10 and 12 are included amongst the five numbers?

(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  $\angle BAG = 120^\circ$  and  $\angle GEL = 80^\circ$ . If the reflex angle at  $G$  is  $x^\circ$ , then  $x$  equals

(A) 340    (B) 200    (C) 300  
 (D) 240    (E) 310



14. Which of these values is the largest?

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

15. Which equation represents the relationship between the values of  $x$  and  $y$  in the table?

(A)  $y = x + 0.5$   
 (B)  $y = 1.5x$   
 (C)  $y = 0.5x + 1$   
 (D)  $y = 2x - 0.5$   
 (E)  $y = x^2 + 0.5$

| $x$ | $y$ |
|-----|-----|
| 1   | 1.5 |
| 2   | 3   |
| 3   | 4.5 |
| 4   | 6   |

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?

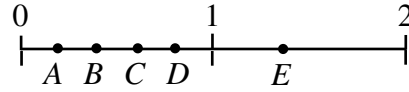
(A)  $ab$     (B)  $a + 2b$     (C)  $2a - 2b$     (D)  $a + b + 1$     (E)  $a - b$

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?

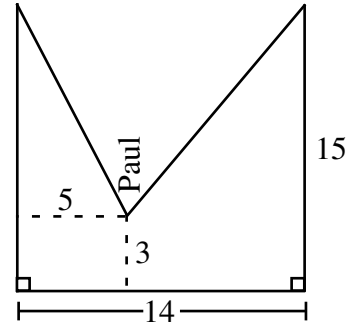
(A) 5    (B) 20    (C) 75    (D) 36    (E) 120

**Grade 8**

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  $B \times C$ ?



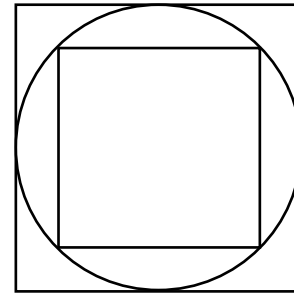
- (A)  $A$             (B)  $B$             (C)  $C$   
 (D)  $D$             (E)  $E$
20. A “slackrope walker” is much like a tightrope walker except that the rope on which he performs is not pulled tight. Paul, a slackrope walker, has a rope tied to two 15 m high poles which are 14 m apart. When he 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)  $4\pi$             (B) 2            (C)  $2\pi$             (D)  $\pi$             (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



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## *Gauss Contest (Grade 8)*

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**Time:** 1 hour

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**Calculators are permitted.**

### Instructions

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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.
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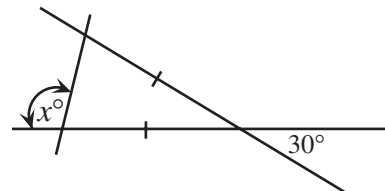
## Grade 8

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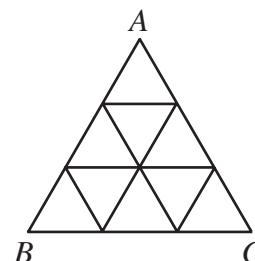
### Part A: Each correct answer is worth 5.

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  $800\,670 = 8 \times 10^x + 6 \times 10^y + 7 \times 10^z$ , 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



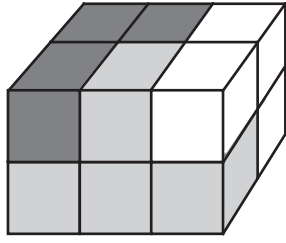
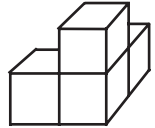
6.  $\triangle ABC$  is constructed from nine small, equilateral triangles, as shown. If the perimeter of each of the nine small triangles is 6 cm, then the perimeter of  $\triangle ABC$ , in cm, is  
(A) 18      (B) 24      (C) 27  
(D) 36      (E) 54

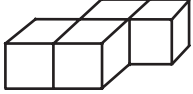


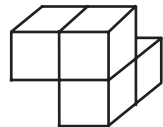
7. If  $x = -4$  and  $y = 4$ , which of the following expressions gives the largest answer?  
(A)  $\frac{x}{y}$       (B)  $y - 1$       (C)  $x - 1$       (D)  $-xy$       (E)  $x + y$
8. Two fair coins are tossed at the same time. What is the probability they will both land as “HEADS”?  
(A) 0      (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

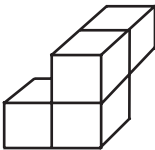
## Grade 8

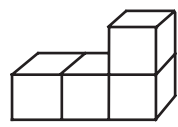
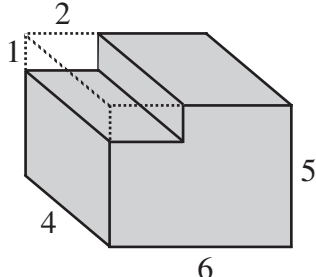
### Part B: Each correct answer is worth 6.

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

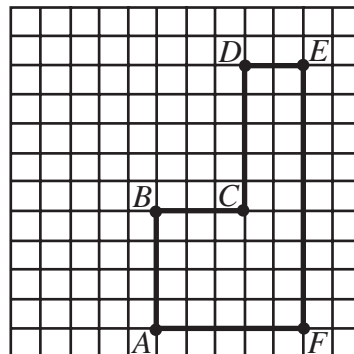
## Grade 8

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?

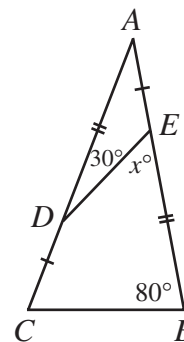
(A) 1:50 000                      (B) 1:200 000                      (C) 1:500 000                      (D) 1:2 000 000                      (E) 1:5 000 000

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

X X X X X

### PUBLICATIONS

Please see our website <http://www.cemc.uwaterloo.ca> for information on publications which are excellent resources for enrichment, problem solving and contest preparation.



# 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

C.M.C. Sponsors:



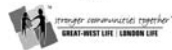
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**Time:** 1 hour

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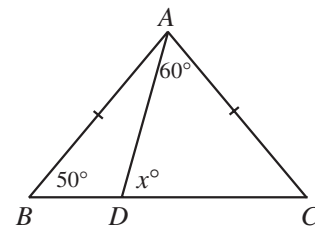
## Grade 8

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**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 ( $^\circ\text{C}$ ) | Low Temperature ( $^\circ\text{C}$ ) |
|-----------|---------------------------------------|--------------------------------------|
| Monday    | 5                                     | -3                                   |
| Tuesday   | 0                                     | -10                                  |
| Wednesday | -2                                    | -11                                  |
| Thursday  | -8                                    | -13                                  |
| Friday    | -7                                    | -9                                   |
8. When the numbers  $\sqrt{5}$ , 2.1,  $\frac{7}{3}$ ,  $2.0\bar{5}$ ,  $2\frac{1}{5}$  are arranged in order from smallest to largest, the middle number is  
(A)  $\sqrt{5}$       (B) 2.1      (C)  $\frac{7}{3}$       (D)  $2.0\bar{5}$       (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

## Grade 8

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10. A different digit is inserted into each of the two boxes to make the equation

$$15.2 + 1.52 + 0.15\Box + \Box.128 = 20$$

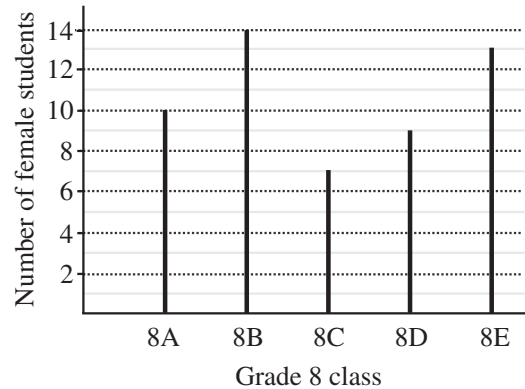
true. The sum of the digits in the two boxes is

- (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  $\text{m}^3$ , is needed to completely fill the pit?

- (A) 6                      (B) 5                      (C) 20                      (D) 7.5                      (E) 10

16. The value of  $\frac{1}{1 + \frac{1}{1 + \frac{1}{2}}}$  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

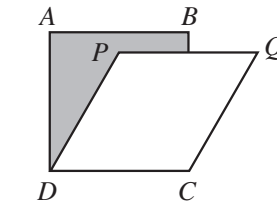
## Grade 8

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  $\text{cm}^2$ , 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  $\text{cm}^2$ , 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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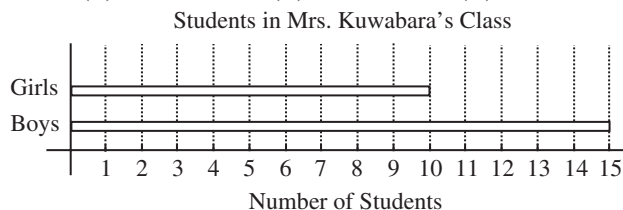
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## Grade 8

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### Part A: Each correct answer is worth 5.

- 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)  $\frac{3}{4}$
- The expression  $6 \times 1000 + 5 \times 100 + 6 \times 1$  is equivalent to  
(A) 656            (B) 6506            (C) 6056            (D) 60 506            (E) 6560
- The value of  $3^2 - (4 \times 2)$  is  
(A) 4            (B) 17            (C) 1            (D) -2            (E) 0
- 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
- 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)  $\frac{3+5}{2}$
- 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
- The volume of a rectangular box is  $144 \text{ cm}^3$ . 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
- 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
- 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%



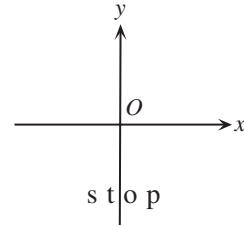
- Which of the following statements is **not** true?  
(A) A quadrilateral has four sides.  
(B) The sum of the angles in a triangle is  $180^\circ$ .  
(C) A rectangle has four  $90^\circ$  angles.  
(D) A triangle can have two  $90^\circ$  angles.  
(E) A rectangle is a quadrilateral.





## Grade 8

19. The word “stop” starts in the position shown in the diagram to the right. It is then rotated  $180^\circ$  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  $\text{km}^2$ ?  
 (A) 100 (B) 1 000 000 (C) 1000 (D) 1 (E) 70
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



**PUBLICATIONS**

Please see our website <http://www.cemc.uwaterloo.ca> for information on publications which are excellent resources for enrichment, problem solving and contest preparation.



# 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**

C.M.C. Sponsors:



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of Canada

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**Time:** 1 hour

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**Calculators are permitted.**

### **Instructions**

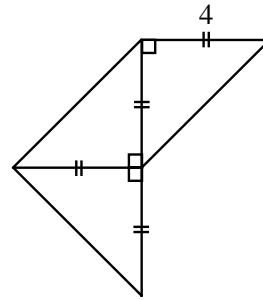
1. Do not open the examination booklet until you are told to do so.
2. You may use rulers, compasses and paper for rough work.
3. Be certain that you understand the coding system for your answer sheet. If you are not sure, ask your teacher to explain it.
4. This is a multiple-choice test. Each question 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

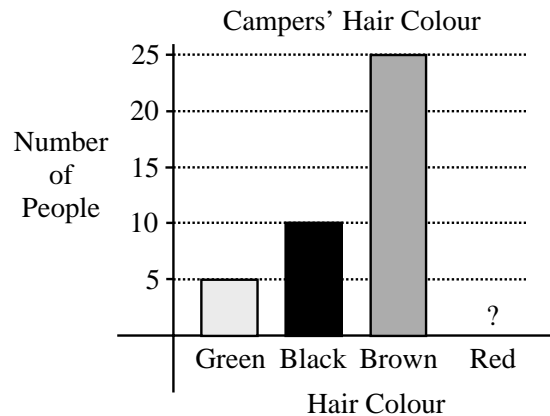
Scoring: There is *no penalty* for an incorrect answer.  
Each unanswered question is worth 2, to a maximum of 20.

**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)  $\frac{1}{6}$

## Grade 8

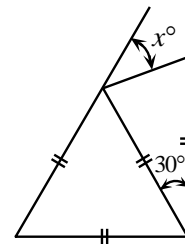
9. In the square shown, the numbers in each row, column, and diagonal multiply to give the same result. The sum of the two missing numbers is  
 (A) 28                      (B) 15                      (C) 30  
 (D) 38                      (E) 72

|    |   |    |
|----|---|----|
| 12 | 1 | 18 |
| 9  | 6 | 4  |
|    |   | 3  |

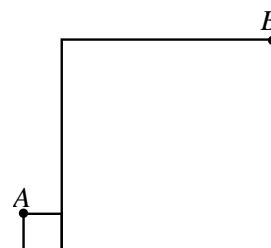
10. Rowena is able to mow  $\frac{2}{5}$  of a lawn in 18 minutes. If she began the job at 10:00 a.m., and mowed at this same constant rate, when did she finish mowing the entire lawn?  
 (A) 10:08 a.m.      (B) 11:30 a.m.      (C) 10:40 a.m.      (D) 10:25 a.m.      (E) 10:45 a.m.

**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 m<sup>2</sup>                      (B) 144 m<sup>2</sup>                      (C) 36 m<sup>2</sup>                      (D) 9 m<sup>2</sup>                      (E) 56.25 m<sup>2</sup>
15. The surface area of a cube is 24 cm<sup>2</sup>. The volume of this cube is  
 (A) 4 cm<sup>3</sup>                      (B) 24 cm<sup>3</sup>                      (C) 8 cm<sup>3</sup>                      (D) 27 cm<sup>3</sup>                      (E) 64 cm<sup>3</sup>
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)  $\sqrt{72}$

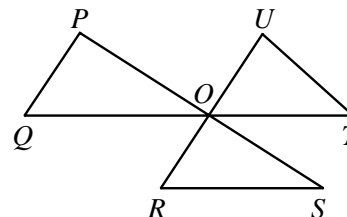


## Grade 8

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.**

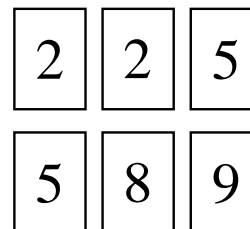
21. Lines  $PS$ ,  $QT$  and  $RU$  intersect at a common point  $O$ , as shown.  $P$  is joined to  $Q$ ,  $R$  to  $S$ , and  $T$  to  $U$ , to form triangles. The value of  $\angle P + \angle Q + \angle R + \angle S + \angle T + \angle U$  is  
 (A)  $450^\circ$                       (B)  $270^\circ$                       (C)  $360^\circ$   
 (D)  $540^\circ$                       (E)  $720^\circ$



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:

| <u>Exact number of faces painted red</u> | <u>Score</u> |
|--|--------------|
| 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



# 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**

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Financial

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of Canada

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**Time:** 1 hour

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**Calculators are permitted.**

### Instructions

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2. You may use rulers, compasses and paper for rough work.
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## Grade 8

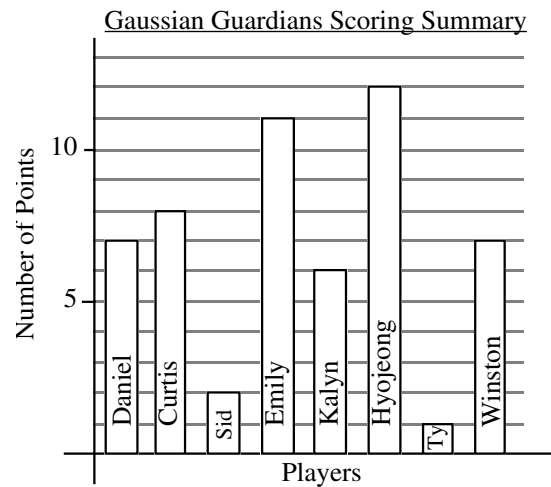
Scoring: There is *no penalty* for an incorrect answer.  
Each unanswered question is worth 2 credits, to a maximum of 20 credits.

**Part A** (5 credits each)

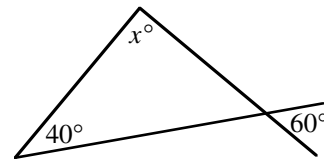
- The value of  $2^5 + 5$  is  
(A) 20                      (B) 37                      (C) 11                      (D) 13                      (E) 21
- A number is placed in the box to make the following statement true:  $8 + \frac{7}{\square} + \frac{3}{1000} = 8.073$ . What is this number?  
(A) 1000                      (B) 100                      (C) 1                      (D) 10                      (E) 70
- The value of  $\frac{5+4-3}{5+4+3}$  is  
(A) -1                      (B)  $\frac{1}{3}$                       (C) 2                      (D)  $\frac{1}{2}$                       (E)  $-\frac{1}{2}$
- 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

$$\begin{array}{r} 863 \\ \square 91 \\ 7\square 8 \\ \hline 2182 \end{array}$$

- 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



- In the given diagram, what is the value of  $x$ ?  
(A) 20                      (B) 80                      (C) 100  
(D) 120                      (E) 60



- 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
- If  $x * y = x + y^2$ , then  $2 * 3$  equals  
(A) 8                      (B) 25                      (C) 11                      (D) 13                      (E) 7

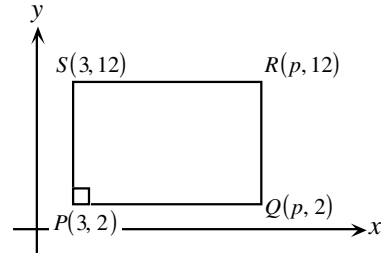
## Grade 8

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)

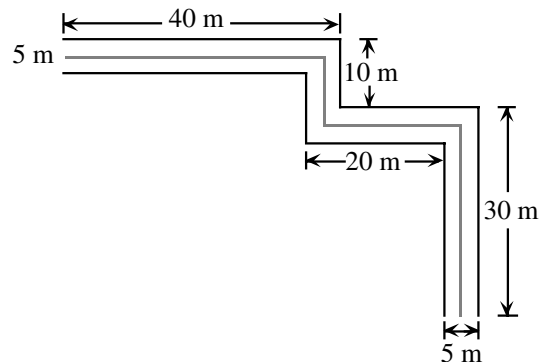
11. Pat planned to place patio stones in a rectangular garden that has dimensions 15 m by 2 m. If each patio stone measures 0.5 m by 0.5 m, how many stones are needed to cover the garden?  
 (A) 240    (B) 180    (C) 120    (D) 60    (E) 30
12. The prime numbers between 10 and 20 are added together to 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



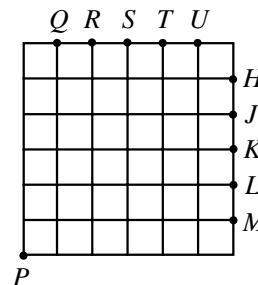
14. A set of five different positive integers has an average (arithmetic mean) of 11. What is the largest possible number in this set?  
 (A) 45    (B) 40    (C) 35    (D) 44    (E) 46
15.  $ABCD$  is a square that is made up of two identical rectangles and two squares of area  $4 \text{ cm}^2$  and  $16 \text{ cm}^2$ . What is the area, in  $\text{cm}^2$ , 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



## Grade 8

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?

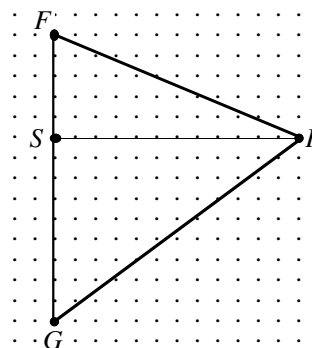
- (A)  $1\frac{1}{2}$  m      (B) 2 m      (C)  $2\frac{1}{2}$  m      (D)  $2\frac{2}{3}$  m      (E) 3 m

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)  $F \rightarrow R \rightarrow S \rightarrow G$       (ii)  $F \rightarrow S \rightarrow G \rightarrow R$   
 (iii)  $F \rightarrow R \rightarrow G \rightarrow S$       (iv)  $F \rightarrow S \rightarrow R \rightarrow G$

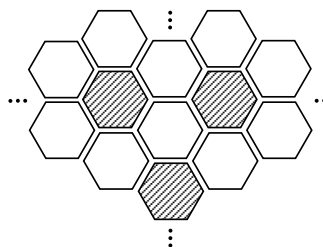
If  $FS = 5$  km,  $SG = 9$  km and  $SR = 12$  km, the difference between the longest and the shortest trip (in km) is

- (A) 8      (B) 13      (C) 15  
 (D) 2      (E) 0



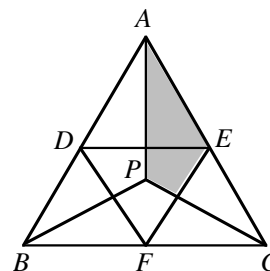
23. A square floor is tiled, as partially shown, with a large number of regular hexagonal tiles. The tiles are coloured blue or white. Each blue tile is surrounded by 6 white tiles and each white tile is surrounded by 3 white and 3 blue tiles. Ignoring part tiles, the ratio of the number of blue tiles 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  $\triangle ABC$  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

C.M.C. Sponsors:



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**Time:** 1 hour

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## Grade 8

10. The area of a rectangular shaped garden is  $28 \text{ m}^2$ . It has a length of 7 m. Its perimeter, in metres, is  
 (A) 22                      (B) 11                      (C) 24                      (D) 36                      (E) 48

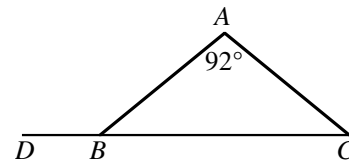
**Part B** (6 credits each)

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

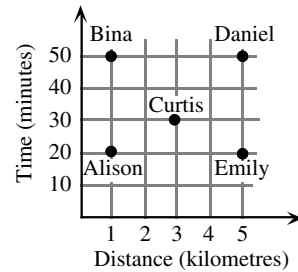
12. If  $\frac{n+1999}{2} = -1$ , then the value of  $n$  is  
 (A) -2001                      (B) -2000                      (C) -1999                      (D) -1997                      (E) 1999

13. The expression  $n!$  means the product of the positive integers from 1 to  $n$ . For example,  $5! = 1 \times 2 \times 3 \times 4 \times 5$ . The value of  $6! - 4!$  is  
 (A) 2                      (B) 18                      (C) 30                      (D) 716                      (E) 696

14.  $ABC$  is an isosceles triangle in which  $\angle A = 92^\circ$ .  $CB$  is extended to a point  $D$ . What is the size of  $\angle ABD$ ?  
 (A)  $88^\circ$                       (B)  $44^\circ$                       (C)  $92^\circ$   
 (D)  $136^\circ$                       (E)  $158^\circ$



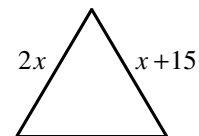
15. The graph shown at the right indicates the time taken by five people to travel various distances. On average, which person travelled the fastest?  
 (A) Alison                      (B) Bina                      (C) Curtis  
 (D) Daniel                      (E) Emily



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,  $\frac{1957}{18b8} - a9$ , the sum of the digits  $a$  and  $b$  is  
 (A) 15                      (B) 14                      (C) 10                      (D) 5                      (E) 4

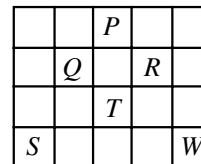
18. The equilateral triangle has sides of  $2x$  and  $x + 15$  as shown. The perimeter of the triangle is  
 (A) 15                      (B) 30                      (C) 90  
 (D) 45                      (E) 60



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

## Grade 8

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?



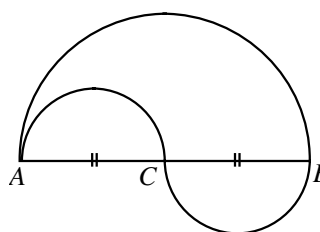
- (A)  $P$                       (B)  $Q$                       (C)  $R$   
 (D)  $T$                       (E)  $W$

**Part C** (8 credits each)

21. The sum of seven consecutive positive integers is always  
 (A) odd                                      (B) a multiple of 7  
 (D) a multiple of 4                      (E) a multiple of 3

(C) even

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)  $12\pi$                       (B)  $6\pi$                       (C)  $3\pi$   
 (D)  $2\pi$                       (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?

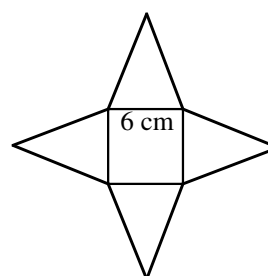
Service Fee per Item

|                 |        |
|-----------------|--------|
| 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)  $84 \text{ cm}^2$                       (B)  $98 \text{ cm}^2$                       (C)  $96 \text{ cm}^2$   
 (D)  $108 \text{ cm}^2$                       (E)  $90 \text{ cm}^2$



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**

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**Time:** 1 hour

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**Calculators are permitted.**

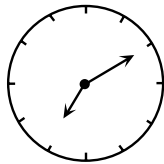
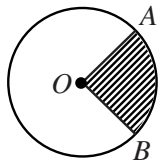
### Instructions

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.
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  - There is *no penalty* for an incorrect answer.
  - Each unanswered question is worth 2 credits, to a maximum of 20 credits.
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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  $1.2 \times 10^6$  is doubled, what is the result?  
(A)  $2.4 \times 10^6$                       (B)  $2.4 \times 10^{12}$                       (C)  $2.4 \times 10^3$                       (D)  $1.2 \times 10^{12}$                       (E)  $0.6 \times 10^{12}$
  
  6. Tuesday's high temperature was  $4^\circ\text{C}$  warmer than that of Monday's. Wednesday's high temperature was  $6^\circ\text{C}$  cooler than that of Monday's. If Tuesday's high temperature was  $22^\circ\text{C}$ , what was Wednesday's high temperature?  
(A)  $20^\circ\text{C}$                       (B)  $24^\circ\text{C}$                       (C)  $12^\circ\text{C}$                       (D)  $32^\circ\text{C}$                       (E)  $16^\circ\text{C}$
  
  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)  $36^\circ$                       (B)  $72^\circ$                       (C)  $90^\circ$   
(D)  $80^\circ$                       (E)  $70^\circ$
- 
8. The pattern of figures  $\triangle \bullet \square \blacktriangle \circ$  is repeated in the sequence  
 $\triangle, \bullet, \square, \blacktriangle, \circ, \triangle, \bullet, \square, \blacktriangle, \circ, \dots$   
The 214th figure in the sequence is  
(A)  $\triangle$                       (B)  $\bullet$                       (C)  $\square$                       (D)  $\blacktriangle$                       (E)  $\circ$
  
  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)

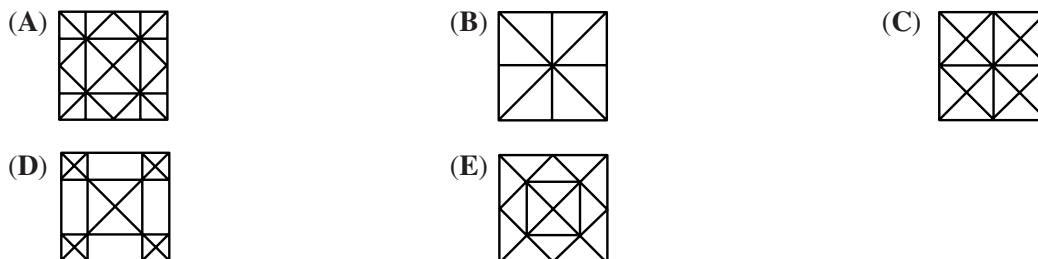
11. The weight limit for an elevator is 1500 kilograms. The average weight of the people in the elevator is 80 kilograms. If the combined weight of the people is 100 kilograms over the limit, how many people are in the elevator?  
(A) 14                      (B) 17                      (C) 16                      (D) 20                      (E) 13

## Grade 8

12. In the  $4 \times 4$  square shown, each row, column and diagonal should contain each of the numbers 1, 2, 3, and 4. Find the value of  $K + N$ .
- (A) 4                      (B) 3                      (C) 5  
(D) 6                      (E) 7

|   |   |   |   |
|---|---|---|---|
| 1 | F | G | H |
| T | 2 | J | K |
| L | M | 3 | N |
| P | Q | 1 | R |

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



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?

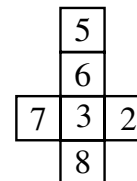
- (i)  $2^* + 4^* = 6^*$             (ii)  $3^* \times 5^* = 15^*$             (iii)  $7^* - 3^* = 4^*$             (iv)  $12^* \div 3^* = 4^*$

- (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

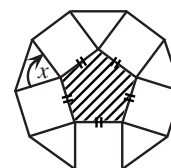
18. The figure shown is folded to form a cube. Three faces meet at each corner. If the numbers on the three faces at a corner are multiplied, what is the largest possible product?

- (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)  $75^\circ$                       (B)  $108^\circ$                       (C)  $90^\circ$   
(D)  $60^\circ$                       (E)  $72^\circ$



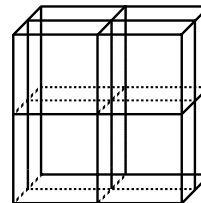
## Grade 8

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)

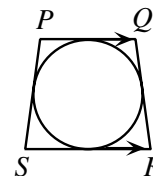
21. The number 315 can be written as the product of two odd integers each greater than 1. In how many ways can this be done?
- (A) 0      (B) 1      (C) 3      (D) 4      (E) 5

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)  $300\text{ cm}^2$       (B)  $800\text{ cm}^2$       (C)  $1200\text{ cm}^2$   
(D)  $600\text{ cm}^2$       (E)  $0\text{ cm}^2$
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