



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

Gauss Contest

Grade 7

(The Grade 8 Contest is on the reverse side)

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

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



Time: 1 hour

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

Instructions

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

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

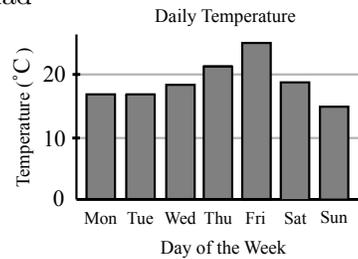
Grade 7

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. Kiyana gives half of her 24 grapes to a friend. How many grapes does she give away?
(A) 2 (B) 4 (C) 6 (D) 12 (E) 48

2. Based on the graph shown, which day of the week had the highest temperature?
(A) Tuesday (B) Thursday (C) Friday
(D) Saturday (E) Sunday

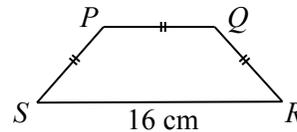


3. At a local farm, strawberries are sold at \$16.50 for each basket. What is the cost to buy 4 baskets of strawberries?
(A) \$64.00 (B) \$66.00 (C) \$64.50 (D) \$65.50 (E) \$65.00

4. The temperature last night was -5°C . It is now 3°C . How many degrees warmer is it now?
(A) 8°C (B) 3°C (C) 2°C (D) 13°C (E) 5°C

5. Sarah multiplied an integer by itself. Which of the following could be the result?
(A) 32 (B) 33 (C) 34 (D) 35 (E) 36

6. In the figure shown, $PQRS$ has three sides of equal length and $SR = 16$ cm. If the perimeter of $PQRS$ is 40 cm, then the length of PQ is
(A) 6 cm (B) 7 cm (C) 8 cm
(D) 9 cm (E) 10 cm



7. Which of the following is equal to a whole number?
(A) $\frac{52}{5}$ (B) $\frac{52}{7}$ (C) $\frac{52}{4}$ (D) $\frac{52}{3}$ (E) $\frac{52}{6}$
8. A circle has a radius of 4 cm. A line segment joins two points on the circle. What is the greatest possible length of the line segment?
(A) 10 cm (B) 8 cm (C) 4 cm (D) 12 cm (E) 6 cm
9. An integer is randomly chosen from the list 10, 11, 12, 13, 14, 15, 16, 17, 18, 19. What is the probability that the chosen integer is even?
(A) $\frac{3}{10}$ (B) $\frac{4}{10}$ (C) $\frac{5}{10}$ (D) $\frac{6}{10}$ (E) $\frac{7}{10}$

10. The grocery receipt shows the cost of three items before tax is added. When a 5% tax is added to the cost of the items, what is the total cost for the three items?

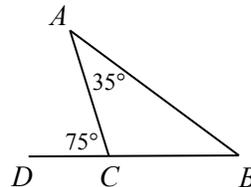
Sponge	\$4.20
Shampoo	\$7.60
Soap	\$3.20

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

Part B: Each correct answer is worth 6.

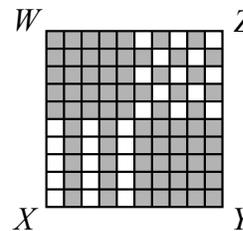
11. In the diagram, BCD is a straight line segment. The measure of $\angle ABC$ is

- (A) 35° (B) 40° (C) 60°
(D) 75° (E) 45°



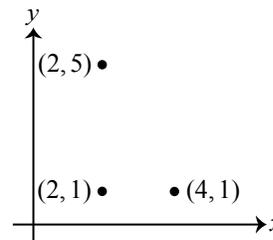
12. Square $WXYZ$ is divided into 100 small identical squares. Some small squares are shaded and some are unshaded, as shown. How many more of the small squares need to be shaded so that 75% of the area of $WXYZ$ is shaded?

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



13. In the diagram, the points $(2, 1)$, $(4, 1)$ and $(2, 5)$ are three vertices of a rectangle. What are the coordinates of the fourth vertex of the rectangle?

- (A) $(5, 2)$ (B) $(4, 4)$ (C) $(1, 5)$
(D) $(4, 5)$ (E) $(2, 4)$



14. The sum of two different prime numbers is 10. The product of these two numbers is
(A) 24 (B) 16 (C) 4 (D) 21 (E) 9

15. Suppose n is a number such that the mean (average) of the list of numbers 2, 9, 4, n , $2n$ is equal to 6. What is the value of n ?

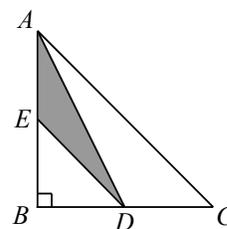
- (A) 9 (B) 12 (C) 10 (D) 5 (E) 6

16. Each number from 1 to 6 replaces one of the letters P, Q, R, S, T , and U . The sum of P and Q is 5 and the difference between R and S is 5. If T is greater than U , what number replaces the letter T ?

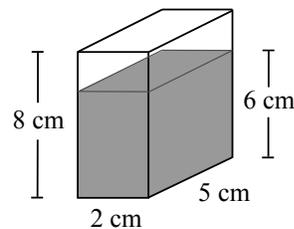
- (A) 4 (B) 6 (C) 2 (D) 3 (E) 5

17. In the diagram, $\triangle ABC$ is a right-angled isosceles triangle. D is the midpoint of BC and E is the midpoint of AB . If $AB = BC = 24$ cm, what is the area of $\triangle AED$?

- (A) 48 cm^2 (B) 36 cm^2 (C) 72 cm^2
(D) 9 cm^2 (E) 54 cm^2



18. A closed rectangular prism with height 8 cm is standing on a face with dimensions 2 cm by 5 cm. The prism contains water with a depth of 6 cm, as shown. When the prism is tipped so that it stands on a face with the greatest area, the depth of the water is



- (A) 0.75 cm (B) 1 cm (C) 1.25 cm
(D) 1.5 cm (E) 1.75 cm

19. Two standard dice are rolled. The product of the two numbers rolled is calculated. What is the probability that the ones digit of this product is 0?

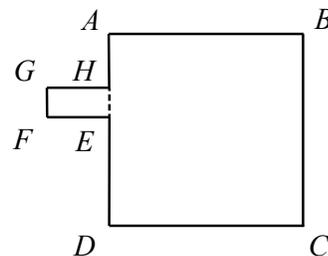
- (A) $\frac{11}{36}$ (B) $\frac{2}{9}$ (C) $\frac{1}{36}$ (D) $\frac{1}{6}$ (E) $\frac{5}{36}$

20. How many pairs of positive integers a and b satisfy the equation $\frac{a}{7} + \frac{2}{b} = 1$?

- (A) 4 (B) 1 (C) 0 (D) 5 (E) 2

Part C: Each correct answer is worth 8.

21. Eight-sided polygon $ABCDEFGH$ has integer side lengths. It can be divided into a rectangle and a square, as shown. The area of the square is greater than the area of the rectangle. The product of the two areas is equal to 98. Which of the following could be the perimeter of $ABCDEFGH$?



- (A) 51 (B) 32 (C) 44
(D) 34 (E) 33

22. A *Gareth sequence* is a sequence of numbers in which each number after the second is the *non-negative* difference between the two previous numbers. For example, if a Gareth sequence begins 15, 12, then

- the third number in the sequence is $15 - 12 = 3$,
- the fourth number is $12 - 3 = 9$,
- the fifth number is $9 - 3 = 6$,

and so the resulting sequence is 15, 12, 3, 9, 6, \dots . If a Gareth sequence begins 10, 8, what is the sum of the first 30 numbers in the sequence?

- (A) 40 (B) 72 (C) 34 (D) 56 (E) 64

23. The digits from 1 to 9 are each used exactly once to write three one-digit integers and three two-digit integers. The one-digit integers are equal to the length, width and height of a rectangular prism. The two-digit integers are equal to the areas of the faces of the same prism. What is the surface area of the rectangular prism?

- (A) 176 (B) 184 (C) 186 (D) 198 (E) 212

24. A circle is divided into six equal sections. Each section is to be coloured with a single colour so that three sections are red, one is blue, one is green, and one is yellow. Two circles have the same colouring if one can be rotated to match the other. In the diagram, Figure 1 and Figure 2 have the same colouring, while Figure 1 and Figure 3 have different colourings. How many different colourings are there for the circle?

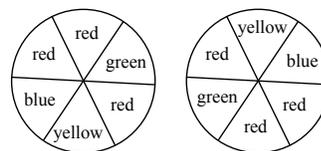


Figure 1

Figure 2

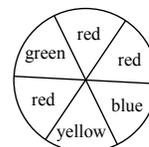


Figure 3

- (A) 14 (B) 12 (C) 24
(D) 10 (E) 20

25. A school trip offered its participants three activities: hiking, canoeing and swimming. Attendance records show that of all participants
- 10 students participated in all three activities,
 - 50% participated in at least hiking and canoeing,
 - 60% participated in at least hiking and swimming,
 - $k\%$ participated in at least canoeing and swimming, and
 - no students participated in fewer than two activities.

If k is a positive integer, what is the sum of all possible values of k ?

- (A) 191 (B) 185 (C) 261 (D) 95 (E) 175