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

Gauss Contest

Grade 8

(The Grade 7 Contest is on the reverse side)

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

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

Time: 1 hour

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

Instructions

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

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

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

Part A: Each correct answer is worth 5.

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

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

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

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

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

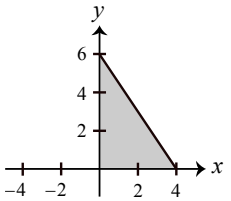
   (A) $\frac{8}{6}$ **(B)** $\frac{9}{5}$ **(C)** $\frac{10}{4}$ **(D)** $\frac{11}{3}$ **(E)** $\frac{12}{2}$

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

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

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

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



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

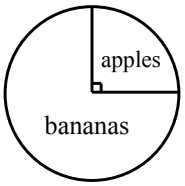
   (A) 0 **(B)** 1 **(C)** 2 **(D)** 3 **(E)** 4

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

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

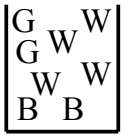
8. In the pie chart shown, 168 students chose bananas as their favourite fruit. How many students chose apples as their favourite fruit?

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



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

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



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

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

Part B: Each correct answer is worth 6.

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

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

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

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

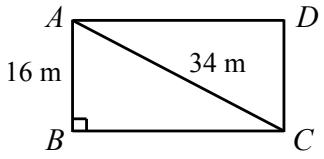
The value of $P + Q + R$ is

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

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

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

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

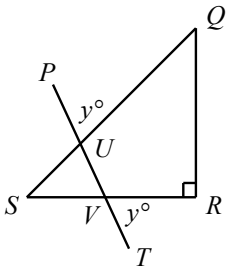


(A) 46 m **(B)** 126 m **(C)** 100 m **(D)** 92 m **(E)** 240 m

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

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

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

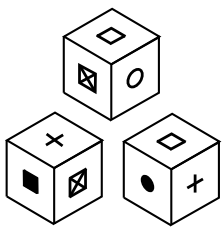


(A) 72.5 **(B)** 60 **(C)** 67.5 **(D)** 62.5 **(E)** 70

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

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

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



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

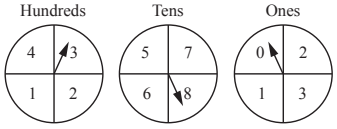
19. X is 20% of 50. 40 is 20% of Y. 40 is Z% of 50. What does $X + Y + Z$ equal?
(A) 218 **(B)** 335 **(C)** 98 **(D)** 290 **(E)** 380

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

Part C: Each correct answer is worth 8.

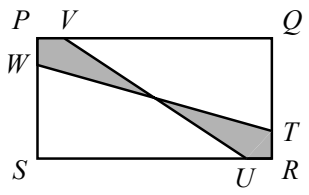
21. The ratio of green balls to yellow balls in a bag is 3 : 7. When 9 balls of each colour are removed, the ratio of green balls to yellow balls becomes 1 : 3. How many balls were originally in the bag?
(A) 60 **(B)** 90 **(C)** 100 **(D)** 70 **(E)** 80

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



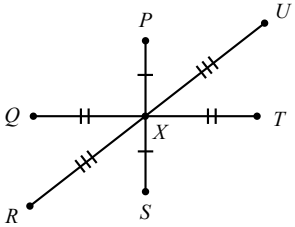
(A) 11 **(B)** 16 **(C)** 22
(D) 12 **(E)** 9

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



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

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



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

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