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 15, 2019
(in North America and South America)

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

UNIVERSITY OF
WATERLOO

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.

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

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

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

    (A) 30   **(B)** 60   **(C)** 45

    (D) 90   **(E)** 55
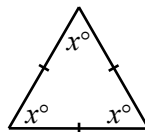
3. Which of the following integers is closest to 0?

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

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

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

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

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

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

    (A) 45   **(B)** 15   **(C)** 35

    (D) 70   **(E)** 50
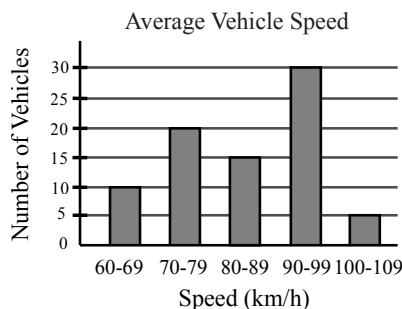
7. How many positive integers less than 100 are divisible by both 3 and 7?

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

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

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

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

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

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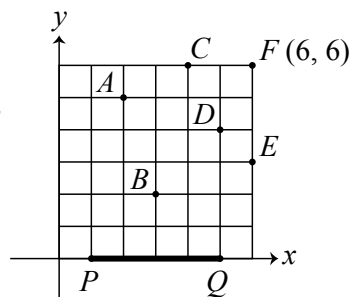
10. Canadian currency has coins with values $2.00, $1.00, $0.25, $0.10, and $0.05. Barry has 12 coins including at least one of each of these coins. What is the smallest total amount of money that Barry could have?

    (A) $3.75   **(B)** $3.90   **(C)** $3.70   **(D)** $3.40   **(E)** $3.95
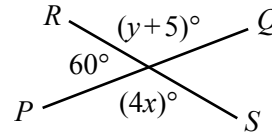
Part B: Each correct answer is worth 6.

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

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

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

    (**A**) 145   (**B**) 70   (**C**) 130

    (**D**) 85   (**E**) 240
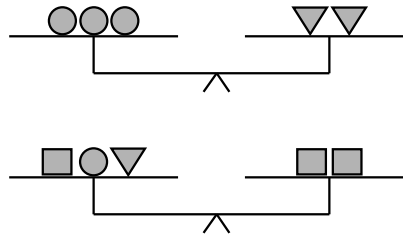

13. The mean (average), the median and the mode of the five numbers $12, 9, 11, 16, x$ are all equal. What is the value of x?
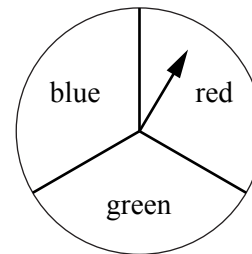
    (**A**) 9   (**B**) 11   (**C**) 12   (**D**) 13   (**E**) 16

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

    (**A**) ▢▢▢
    (**B**) ▽▽▢▢
    (**C**) ◯◯◯◯
    (**D**) ◯◯◯▢
    (**E**) ◯◯◯

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

    (**A**) $\dfrac{1}{9}$ (**B**) $\dfrac{2}{3}$ (**C**) $\dfrac{1}{2}$

    (**D**) $\dfrac{1}{3}$ (**E**) $\dfrac{2}{9}$

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

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

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

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

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

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

19. A line segment joins the points $P(-4, 1)$ and $Q(1, -11)$. What is the length of PQ?

    (**A**) 13   (**B**) 12   (**C**) 12.5   (**D**) 13.6   (**E**) 12.6

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

    (**A**) 21   (**B**) 15   (**C**) 23

    (**D**) 19   (**E**) 17
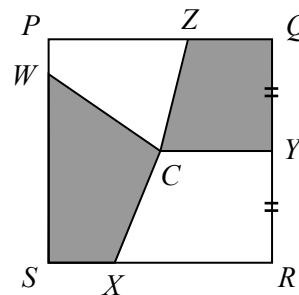
Part C: Each correct answer is worth 8.

21. In Jen's baseball league, each team plays exactly 6 games against each of the other teams in the league. If a total of 396 games are played, how many teams are in the league?

    (**A**) 12   (**B**) 16   (**C**) 15   (**D**) 13   (**E**) 9

22. Rich chooses a 4-digit positive integer. He erases one of the digits of this integer. The remaining digits, in their original order, form a 3-digit positive integer. When Rich adds this 3-digit integer to the original 4-digit integer, the result is 6031. What is the sum of the digits of the original 4-digit integer?

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

23. If n is a positive integer, the notation $n!$ (read "n factorial") is used to represent the product of the integers from 1 to n inclusive. For example, $5! = 1 \times 2 \times 3 \times 4 \times 5 = 120$. Which of the following is equal to a perfect square?

    (**A**) $\dfrac{(20!)(19!)}{1}$ (**B**) $\dfrac{(20!)(19!)}{2}$ (**C**) $\dfrac{(20!)(19!)}{3}$ (**D**) $\dfrac{(20!)(19!)}{4}$ (**E**) $\dfrac{(20!)(19!)}{5}$

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

    (**A**) 26   (**B**) 29   (**C**) 24   (**D**) 27   (**E**) 32

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

    (**A**) 7   (**B**) 5   (**C**) 9

    (**D**) 6   (**E**) 8