The CENTRE for EDUCATION
in MATHEMATICS and COMPUTING
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Gauss Contest
Grade 7
(The Grade 8 Contest is on the reverse side)

Wednesday, May 18, 2022
(in North America and South America)

Thursday, May 19, 2022
(outside of North America and South America)

UNIVERSITY OF WATERLOO

Time: 1 hour   ©2022 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.

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.

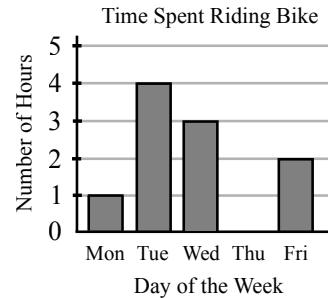## Part A: Each correct answer is worth 5.

1. Which of the following numbers is closest to 10?

    (A) 1   **(B)** 5   **(C)** 8   **(D)** 13   **(E)** 19

2. The graph shows the number of hours that Gabe spent riding his bike from Monday to Friday. The day on which Gabe spent the greatest number of hours riding his bike is

    (A) Monday
    (B) Tuesday
    (C) Wednesday
    (D) Thursday
    (E) Friday

    Time Spent Riding Bike

3. If x is less than 5, a possible value of x could be

   **(A)** 7   **(B)** 0   **(C)** 108   **(D)** 12   **(E)** 23

4. In a sequence of numbers, the first term is 3. Each new term is obtained by adding 5 to the previous term. The first four terms are $3, 8, 13, 18$. What are the next three terms in the sequence?

    (A) $25, 30, 35$ **(B)** $5, 10, 15$ **(C)** $23, 28, 33$ **(D)** $23, 33, 43$ **(E)** $19, 20, 21$
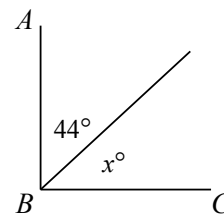
5. The faces of a cube are labelled with 1, 2, 3, 4, 5, and 6 dots. Three of the faces are shown. What is the total number of dots on the other three faces?

    (A) 6   **(B)** 8   **(C)** 10

    (D) 12   **(E)** 15
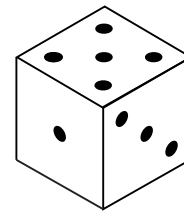
6. In the diagram, $\angle ABC = 90°$. The value of x is

    (A) 46   **(B)** 22   **(C)** 36

    (D) 42   **(E)** 54

7. The singers in Saura's choir have heights

    $$148 \text{ cm}, 141 \text{ cm}, 172.5 \text{ cm}, 168 \text{ cm}, 151.5 \text{ cm}, 183.5 \text{ cm}, \text{ and } 178.5 \text{ cm}$$

    What is the range of their heights?

    (A) 42.5 cm   **(B)** 27 cm   **(C)** 52.5 cm   **(D)** 37.5 cm   **(E)** 31.5 cm

8. In the diagram, the point $(3, -4)$ is labelled

    (A) P **(B)** Q **(C)** R

    (D) S **(E)** T
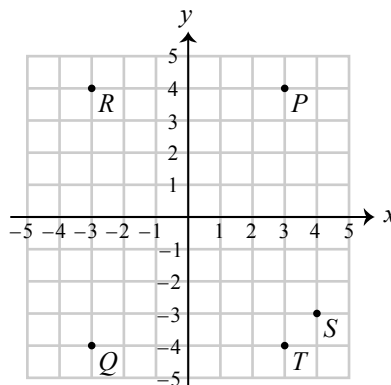
9. While using a skipping rope, Emily jumps 52 times in 60 seconds. Jumping at this same rate, how many times does Emily jump in 75 seconds?

    (A) 66   **(B)** 52   **(C)** 65   **(D)** 67   **(E)** 73

10. A dime is worth \$0.10 and a quarter is worth \$0.25. Terry has a jar that contains \$1.00 worth of dimes and \$1.00 worth of quarters. If he randomly removes one coin from the jar, what is the probability that it is a dime?

    (A) $\frac{1}{10}$ **(B)** $\frac{2}{7}$ **(C)** $\frac{10}{11}$ **(D)** $\frac{2}{5}$ **(E)** $\frac{5}{7}$
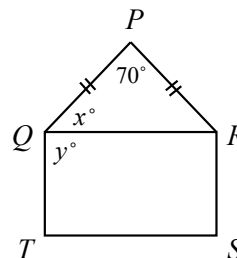

Part B: Each correct answer is worth 6.

11. The sum of the prime factors of 42 is

    (A) 23   **(B)** 43   **(C)** 12   **(D)** 17   **(E)** 13

12. In the diagram, $\triangle PQR$ is isosceles with $PQ = PR$, and $QRST$ is a rectangle. If $\angle QPR = 70°$, $\angle PQR = x°$, and $\angle RQT = y°$, the value of $x + y$ is

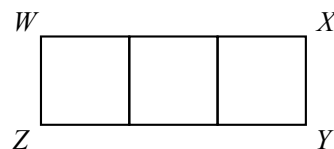   **(A)** 70   **(B)** 90   **(C)** 160

    (D) 145   **(E)** 60

13. How many two-digit numbers have at least one digit that is a 4?

    (A) 17   **(B)** 11   **(C)** 18   **(D)** 10   **(E)** 19

14. Three identical squares form rectangle $WXYZ$, as shown. The perimeter of $WXYZ$ is 56 m. The area of $WXYZ$ is

    (A) 66 m^2 **(B)** 147 m^2 **(C)** 168 m^2

    (D) 196 m^2 **(E)** 348 m^2

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

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

16. A standard fair coin is tossed three times. What is the probability that the three outcomes are all the same?

    (A) $\frac{1}{2}$ **(B)** $\frac{3}{16}$ **(C)** $\frac{1}{4}$ **(D)** $\frac{5}{16}$ **(E)** $\frac{1}{8}$

17. In the sum shown, each letter represents a digit from 1 to 9, inclusive. The value of $P + Q + R$ is

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

    (D) 16   **(E)** 17

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

18. Box A contains one 100 g block, one 20 g block and three 5 g blocks. Box B contains one 50 g block and three 10 g blocks. Jasmine moves some of the blocks from Box A to Box B and some of the blocks from Box B to Box A. After these moves, Box A contains 65 g less than it originally did and Box B contains 65 g more. What is the fewest number of blocks that Jasmine could have moved from Box A to Box B?

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

19. In a candy dish, the ratio of red to blue candies is $3 : 5$. When 3 blue candies are removed, the ratio of red to blue candies becomes $2 : 3$. How many more blue candies than red candies were in the dish before any candies were removed?

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

20. Four friends, standing in a row for a picture, are in the following order:

    <div align="center">Anyu   Brad   Chi   Diego</div>

    The friends then move so that Anyu is not in the 1$^{\text{st}}$ position, Brad is not in the 2$^{\text{nd}}$ position, Chi is not in the 3$^{\text{rd}}$ position, and Diego is not in the 4$^{\text{th}}$ position. In how many ways can the friends do this? That is, in how many ways can they rearrange themselves so that each person is not in their original position?

    (A) 6   **(B)** 9   **(C)** 12   **(D)** 18   **(E)** 24

Part C: Each correct answer is worth 8.

21. Square $ABCD$ is divided into four identical smaller squares, which are further divided into triangles, as shown. What fraction of $ABCD$ is shaded?
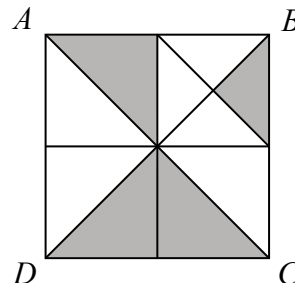
    (A) $\frac{1}{4}$ (B) $\frac{15}{32}$ (C) $\frac{7}{16}$

    (D) $\frac{3}{8}$ (E) $\frac{7}{8}$

22. In the list p, q, r, s, t, u, v, w, each letter represents a positive integer. The sum of the values of each group of four consecutive letters in the list is 35. If $q + v = 14$, the largest possible value of p is

    (A) 15   (B) 19   (C) 20   (D) 23   (E) 26

23. Ishari places the letters A, B, C, D, E, F clockwise around a circle, starting with A at the top. Jaxon writes a list beginning with A, and then, moving clockwise around the circle, writes down every third letter *that he has not yet written*. Doing this, Jaxon's list is A, D, B, F, C, E. Katharina *mixes up* the letters L, M, N, O, P, Q, R, S and places them in the mixed-up order around a circle, starting with L at the top. Jaxon writes a list beginning with L and then again moving clockwise around the circle, writes down every third letter that he has not yet written. Jaxon's list is L, M, N, O, P, Q, R, S. Starting with L, what was Katharina's clockwise order?

    (A) L, O, R, N, S, Q, M, P (B) L, Q, O, M, S, R, N, P (C) L, R, O, M, S, Q, N, P

    (D) L, M, N, O, P, Q, R, S (E) L, O, R, M, Q, P, N, S

24. A palindrome is a positive integer whose digits are the same when read forwards or backwards. For example, $32\,523$ is a palindrome. How many palindromes greater than $10\,000$ and less than $100\,000$ are multiples of 18?

    (A) 41   (B) 42   (C) 43   (D) 44   (E) 45

25. Arjun has a bag that contains 5 balls and Becca has a bag that contains 3 balls. Arjun's bag contains 2 red balls, 1 green, 1 yellow, and 1 violet ball. Becca's bag contains 2 black balls and 1 orange ball. Arjun randomly chooses 1 ball from his bag and puts it into Becca's bag. Becca then randomly chooses 1 ball from her bag and puts it into Arjun's bag. Again, Arjun randomly chooses 1 ball from his bag and puts it into Becca's bag. After these exchanges, there are 4 balls in each bag. What is the probability that each bag contains exactly 3 different colours of balls?

    (A) $\frac{3}{10}$ (B) $\frac{6}{25}$ (C) $\frac{9}{50}$ (D) $\frac{3}{25}$ (E) $\frac{9}{25}$