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 15, 2024
(in North America and South America)

Thursday, May 16, 2024
(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 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.

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. When the four digits of 2024 are added, the result is

   (A) 10 **(B)** 8 **(C)** 224 **(D)** 44 **(E)** 16

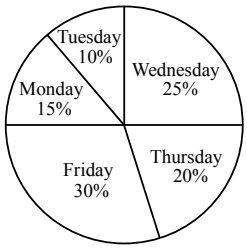
2. If $n = 5$, the value of $n + 2$ is

   (A) 5 **(B)** 6 **(C)** 7 **(D)** 8 **(E)** 9

3. Which of the following shapes has a vertical line of symmetry?

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

4. Students at Gauss Middle School were asked to choose their favourite school day. The results are shown in the circle graph. Which day was chosen by exactly one-quarter of the students?

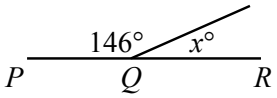
   

   (A) Monday **(B)** Tuesday **(C)** Wednesday
   (D) Thursday **(E)** Friday

5. A square with side length 5 has an area of

   (A) 5 **(B)** 10 **(C)** 15 **(D)** 16 **(E)** 25

6. In the diagram, $\angle PQR$ is a straight angle. The value of x is

   (A) 54 **(B)** 14 **(C)** 24
   (D) 64 **(E)** 34

7. Katie completed two laps of a track without stopping. The first lap took 3 minutes and 45 seconds, and the second lap took 4 minutes and 35 seconds. What was her total time?

   (A) 8 minutes 30 seconds
   (B) 7 minutes 50 seconds
   (C) 8 minutes 50 seconds
   (D) 8 minutes 20 seconds
   (E) 7 minutes 40 seconds

8. The sequence of the five symbols ◯ ◄ ⊠ △ ★ repeats to form the pattern:

   ◯ ◄ ⊠ △ ★ ◯ ◄ ⊠ △ ★ ⋯

   If the pattern is continued, the 23rd symbol in the pattern is

   (A) ◯ **(B)** ◄ **(C)** ⊠ **(D)** △ **(E)** ★

9. Olivia cuts a 42 cm length of string into 2 cm pieces. Jeff cuts a 42 cm length of string into 3 cm pieces. How many more pieces of string does Olivia have than Jeff?

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

10. A number is randomly chosen from the list 1, 2, 3, 4, 5, 6, 7, 8, 9. The probability that the chosen number is divisible by 2, or by 3, or by both 2 and 3, is

(A) $\frac{4}{9}$ **(B)** $\frac{5}{9}$ **(C)** $\frac{6}{9}$ **(D)** $\frac{7}{9}$ **(E)** $\frac{8}{9}$

Part B: Each correct answer is worth 6.

11. In the subtraction of the two-digit numbers shown, the letters P and Q each represent a single digit.

$$\begin{array}{r} 8\,P \\ -\,Q\,6 \\ \hline 4\;9 \end{array}$$

The value of $P + Q$ is

(A) 7 **(B)** 9 **(C)** 11 **(D)** 8 **(E)** 10

12. The length of a rectangle is twice its width. The perimeter of the rectangle is 120 cm. The width of the rectangle is

(A) 20 cm **(B)** 60 cm **(C)** 30 cm **(D)** 50 cm **(E)** 10 cm

13. Eloise purchased a number of water hand pumps to give to a charity. The mean (average) price was \$85 per water pump. If Eloise spent a total of \$765, how many water pumps did she purchase?

(A) 7 **(B)** 8 **(C)** 9 **(D)** 10 **(E)** 6

14. The number 385 has three prime factors. The sum of these prime factors is

(A) 21 **(B)** 26 **(C)** 25 **(D)** 23 **(E)** 22

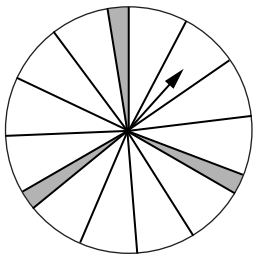
15. A circle has radius 2. If the radius of the circle is tripled, the area of the original circle divided by the area of the new circle is

(A) $\frac{1}{3}$ **(B)** $\frac{1}{6}$ **(C)** $\frac{1}{9}$ **(D)** $\frac{1}{2}$ **(E)** $\frac{1}{8}$

16. Brett and Juanita each have a glass containing 300 mL of water. Brett pours half of his water out and then Juanita pours 20% of her water into Brett's glass. What volume of water is now in Brett's glass?

(A) 210 mL **(B)** 360 mL **(C)** 180 mL **(D)** 330 mL **(E)** 240 mL

17. A circular spinner is divided into 12 identical unshaded sections and 3 identical shaded sections, as shown. Each unshaded section is 3 times the size of each shaded section. An arrow is attached to the centre of the spinner. The arrow is spun once. What is the probability that the arrow stops in a shaded section?



(A) $\frac{1}{15}$ **(B)** $\frac{1}{5}$ **(C)** $\frac{1}{12}$
(D) $\frac{1}{13}$ **(E)** $\frac{1}{4}$

18. The Gaussbot factory assembles robots. Each robot comes in one of three colours: red, blue, or green. Each robot also has a number stamped on its head: 1, 2, 3, or 4. The nth robot assembled is the first robot to have the same colour and the same number as a previously assembled robot. What is the greatest possible value of n?

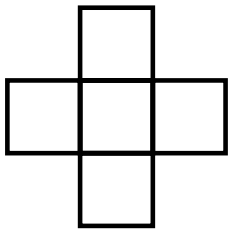
(A) 11 **(B)** 12 **(C)** 13 **(D)** 7 **(E)** 8

19. Five *different* integers in a list have a median of 10 and a range of 7. What is the smallest possible integer in the list?
(A) 4 **(B)** 5 **(C)** 6 **(D)** 7 **(E)** 8

20. A standing desk has 31 height settings, numbered from the lowest height, 1, to the highest height, 31. Since the desk is not working properly, when the up button is pressed, the desk goes up 6 settings at a time if possible, otherwise it does not move. When the down button is pressed, the desk goes down 4 settings at a time if possible, otherwise it does not move. If the desk starts at setting number 1, how many of the 31 settings will the desk be able to stop at?
(A) 14 **(B)** 16 **(C)** 9 **(D)** 15 **(E)** 10

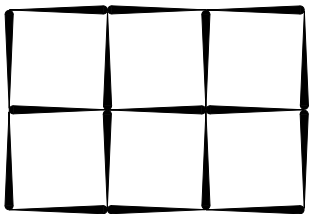
Part C: Each correct answer is worth 8.

21. Five *different* integers are selected from 1 to 6 and one integer is placed into each of the five squares shown. The integers are placed so that the sum of the three integers in the vertical column is 7, and the sum of the three integers in the horizontal row is 11. Which integer does not appear in any square?



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

22. In the diagram, 17 toothpicks are used to make a 2 by 3 grid of squares. Of the toothpicks used, 10 are outer toothpicks and 7 are inner toothpicks. Suppose that toothpicks are used to make a 20 by 24 grid of squares. To the nearest percent, what percentage of toothpicks used are inner toothpicks?



(A) 88% **(B)** 95% **(C)** 93%
(D) 70% **(E)** 91%

23. A rectangular prism has integer edge lengths and has a volume of V. The six faces of the prism are painted and then the prism is cut into 1 by 1 by 1 cubes. Of these cubes, 50 cubes have no paint on them. What is the mean (average) of all possible values of V?
(A) 224 **(B)** 310 **(C)** 396 **(D)** 288 **(E)** 348

24. A three-digit integer is an integer from 100 to 999, inclusive. A three-digit integer is called *Tiny* if no rearrangement of its digits gives a three-digit integer that is smaller. For example, 138, 207 and 566 are Tiny, but 452, 360 and 727 are not. How many three-digit integers are Tiny?
(A) 255 **(B)** 201 **(C)** 212 **(D)** 234 **(E)** 219

25. Suppose that

$$w, x, y, z, (x+y), (x+z), (234+z), \text{ and } (234-z)$$

are 8 *different* prime numbers. If $w+x+y=234$, and each of y and z is less than 50, the value of $w-y$ is
(A) 226 **(B)** 150 **(C)** 210 **(D)** 174 **(E)** 222