Gauss Contest

Grade 7

(The Grade 8 Contest is on the reverse side)

Wednesday, May 16, 2018
(in North America and South America)

Thursday, May 17, 2018
(outside of North America and South America)

UNIVERSITY OF WATERLOO

Time: 1 hour ⓒ2017 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) previously stored information 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.
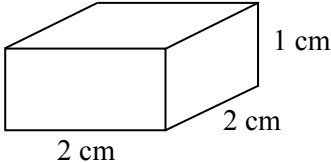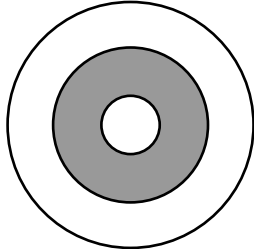
6. Diagrams are *not* drawn to scale. They are intended as aids only.

7. When your supervisor instructs you to start, you will have *sixty* minutes of working time.

Part A: Each correct answer is worth 5.

1. What number should be subtracted from 21 to give 8?

    (A) 12 **(B)** 13 **(C)** 14 **(D)** 15 **(E)** 16

2. In the diagram, the pie chart shows the results of a survey asking students to choose their favourite fruit. 100 students were surveyed. How many students chose banana?

    (A) 40 **(B)** 80 **(C)** 100

    (D) 20 **(E)** 60

3. A class begins at 8:30 a.m. and ends at 9:05 a.m. on the same day. In minutes, what is the length of the class?

    (A) 15 **(B)** 25 **(C)** 35 **(D)** 45 **(E)** 75

4. A square has an area of 144 cm². The side length of the square is

    (A) 288 cm **(B)** 72 cm **(C)** 48 cm **(D)** 12 cm **(E)** 36 cm

5. If there is no tax, which of the following costs more than $18 to purchase?

    (A) Five $1 items and five $2 items
    (B) Nine $1 items and four $2 items
    (C) Nine $1 items and five $2 items
    (D) Two $1 items and six $2 items
    (E) Sixteen $1 items and no $2 items

6. Which of the following numbers lies between 3 and 4 on a number line?

    (A) $\frac{5}{2}$ **(B)** $\frac{11}{4}$ **(C)** $\frac{11}{5}$ **(D)** $\frac{13}{4}$ **(E)** $\frac{13}{5}$

7. An envelope contains 2 sunflower seeds, 3 green bean seeds, and 4 pumpkin seeds. Carrie randomly chooses one of the seeds from the envelope. What is the probability that Carrie chooses a sunflower seed?

    (A) $\frac{2}{9}$ **(B)** $\frac{5}{9}$ **(C)** $\frac{9}{7}$ **(D)** $\frac{7}{9}$ **(E)** $\frac{1}{9}$

8. If $x = 4$ and $y = 3x$, the value of y is

    (A) 12 **(B)** 24 **(C)** 7 **(D)** 81 **(E)** 4

9. The measure of one angle of an isosceles triangle is 50°. The measures of the other angles in this triangle could be

    (A) 50° and 90° **(B)** 40° and 50° **(C)** 50° and 80°
    (D) 30° and 100° **(E)** 60° and 70°

10. The 26 letters of the alphabet are written in order, clockwise around a circle. The *ciphertext* of a message is created by replacing each letter of the message by the letter that is 4 letters clockwise from the original letter. (This is called a *Caesar cipher.*) For example, the message *ZAP* has ciphertext *DET*. What is the ciphertext of the message *WIN*?

   **(A)** *ALN* **(B)** *ZLN* **(C)** *AMR* **(D)** *AMQ* **(E)** *ZMQ*
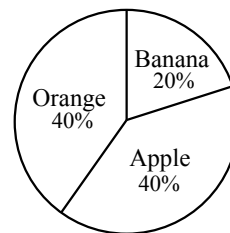
Part B: Each correct answer is worth 6.

11. A cube has exactly six faces and twelve edges. How many vertices does a cube have?

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

12. What is the surface area of a 1 cm by 2 cm by 2 cm rectangular prism?

    (A) 10 cm^2 **(B)** 20 cm^2 **(C)** 12 cm^2

    (D) 24 cm^2 **(E)** 16 cm^2

13. At a factory, 11 410 kg of rice is distributed equally into 3260 bags. A family uses 0.25 kg of rice each day. How many days would it take this family to use up one bag of rice?

    (A) 9   **(B)** 12   **(C)** 13   **(D)** 14   **(E)** 15

14. Dalia's birthday is on a Wednesday and Bruce's birthday is 60 days after Dalia's. On what day of the week is Bruce's birthday?

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

15. Karl has 30 birds. Some of his birds are emus and the rest are chickens. Karl hands out 100 treats to his birds. Each emu gets 2 treats and each chicken gets 4 treats. How many chickens does Karl have?

    (A) 10   **(B)** 15   **(C)** 25   **(D)** 20   **(E)** 6

16. The integers 1 to 32 are spaced evenly and in order around the outside of a circle. Straight lines that pass through the centre of the circle join these numbers in pairs. Which number is paired with 12?

    (A) 28   **(B)** 27   **(C)** 23   **(D)** 21   **(E)** 29

17. In the diagram, the area of the shaded middle ring is 6 times the area of the smallest circle. The area of the unshaded outer ring is 12 times the area of the smallest circle. What fraction of the area of the largest circle is the area of the smallest circle?

    (A) $\frac{1}{3}$ **(B)** $\frac{1}{6}$ **(C)** $\frac{1}{12}$

    (D) $\frac{1}{18}$ **(E)** $\frac{1}{19}$

18. There are several groups of six integers whose product is 1. Which of the following cannot be the sum of such a group of six integers?

    (A) -6 **(B)** -2 **(C)** 0   **(D)** 2   **(E)** 6

19. The heights of 4 athletes on a team are 135 cm, 160 cm, 170 cm, and 175 cm. Laurissa joins the team. On the new team of 5 athletes, the mode height of the players is equal to the median height which is equal to the mean (average) height. How tall is Laurissa?

    (A) 135 cm   **(B)** 160 cm   **(C)** 170 cm   **(D)** 175 cm   **(E)** 148 cm

20. In the diagram, $\triangle PQR$ is isosceles with $PQ = PR$. What is the value of x?

    (**A**) 110   (**B**) 90   (**C**) 95

    (**D**) 100   (**E**) 105
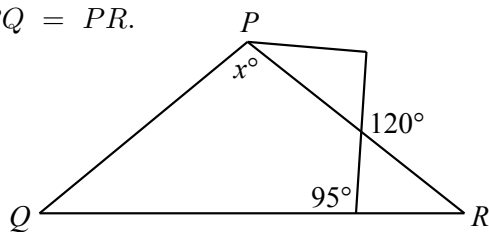
Part C: Each correct answer is worth 8.

21. The figure consists of 8 identical small parallelograms, joined as shown. Including these 8 small parallelograms, how many parallelograms appear in this figure?

    (**A**) 29   (**B**) 30   (**C**) 26

    (**D**) 27   (**E**) 28

22. In a jar, there are 50 coins with a total value of \$5.00. The coins are quarters (worth \$0.25 each), dimes (worth \$0.10 each), and nickels (worth \$0.05 each). The number of nickels in the jar is three times the number of quarters. The number of dimes is one more than the number of nickels. How many quarters are in the jar?

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

23. The digits from 1 to 9 are written in order so that the digit n is written n times. This forms the block of digits $1223334444\cdots999999999$. The block is written 100 times. What is the 1953rd digit written?

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

24. The number 2018 is used to create six-digit positive integers. These six-digit integers must contain the digits 2018 together and in this order. For example, $720\,186$ is allowed, but $209\,318$ and $210\,893$ are not. How many of these six-digit integers are divisible by 9?

    (**A**) 28   (**B**) 27   (**C**) 31   (**D**) 34   (**E**) 22

25. In the triangle, each of the numbers $1, 2, 3, 4, 5, 6, 7, 8$ is placed into a different circle. The sums of the numbers on each of the three sides of the triangle are equal to the same number, S. The sum of all of the different possible values of S is

    (**A**) 85   (**B**) 99   (**C**) 66

    (**D**) 81   (**E**) 67