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

Pascal Contest
(Grade 9)

Thursday, February 20, 2014
(in North America and South America)

Friday, February 21, 2014
(outside of North America and South America)

UNIVERSITY OF WATERLOO

WATERLOO MATHEMATICS

Deloitte.

Time: 60 minutes   ©2013 University of Waterloo
Calculators are permitted
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 response form. If you are not sure, ask your teacher to clarify it. All coding must be done with a pencil, preferably HB. Fill in circles completely.

4. On your response form, print your school name and city/town in the box in the upper right corner.

5. **Be certain that you code your name, age, sex, grade, and the Contest you are writing in the response form. Only those who do so can be counted as eligible students.**

6. 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. After making your choice, fill in the appropriate circle on the response form.

7. 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.

8. Diagrams are *not* drawn to scale. They are intended as aids only.

9. When your supervisor tells you to begin, you will have *sixty* minutes of working time.

Do not discuss the problems or solutions from this contest online for the next 48 hours.

The name, grade, school and location, and score range of some top-scoring students will be published on our website, http://www.cemc.uwaterloo.ca. In addition, the name, grade, school and location, and score of some top-scoring students may be shared with other mathematical organizations for other recognition opportunities.
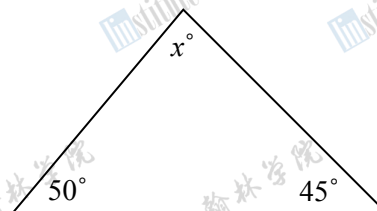
Part A: Each correct answer is worth 5.

1.   The value of $(8 \times 6) - (4 \div 2)$ is

(A) 6   (B) 8   (C) 46   (D) 32   (E) 22

2.   In the diagram, what is the value of x?
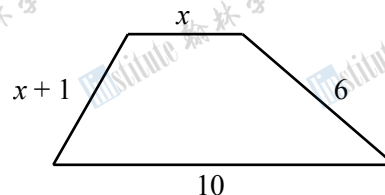
(A) 65   (B) 75   (C) 85

(D) 95   (E) 105

3.   30% of 200 equals

(A) 0.06   (B) 0.6   (C) 6   (D) 60   (E) 600

4.   If $x = 3$, what is the perimeter of the figure shown?

(A) 23   (B) 20   (C) 21

(D) 22   (E) 19

5.   A sports team earns 2 points for each win, 0 points for each loss, and 1 point for each tie. How many points does the team earn for 9 wins, 3 losses and 4 ties?

(A) 26   (B) 16   (C) 19   (D) 21   (E) 22

6.   At 2 p.m., Sanjay measures the temperature to be 3°C. He measures the temperature every hour after this until 10 p.m. He plots the temperatures that he measures on the graph shown. At what time after 2 p.m. does he again measure a temperature of 3°C?

(A) 9 p.m.   (B) 5 p.m.   (C) 8 p.m.

(D) 10 p.m.   (E) 7 p.m.

Temperature in Waterloo
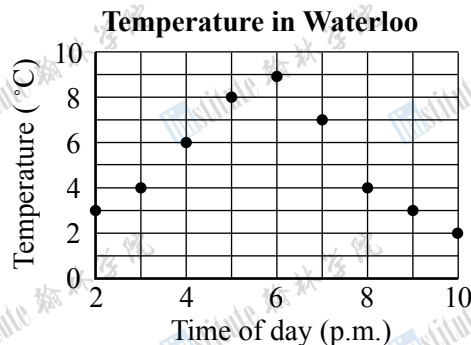
7.   If $2 \times 2 \times 3 \times 3 \times 5 \times 6 = 5 \times 6 \times n \times n$, then n could equal

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

8. In the diagram, a figure is formed dividing a square into eight identical pieces using its two diagonals and the two lines joining the midpoints of opposite sides, and then drawing a circle in the square as shown. This figure is reflected in line L. Which of the following shows the final position of the figure?

(A)   (B)   (C)   (D)   (E)
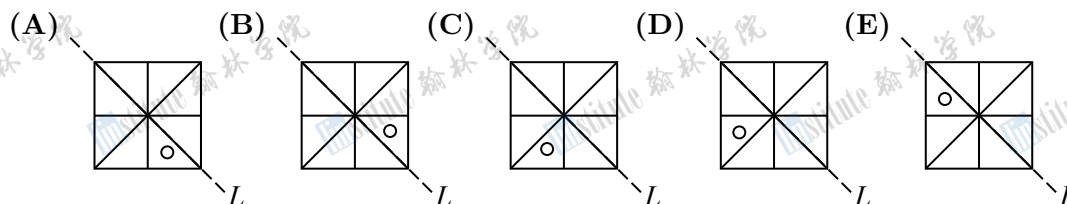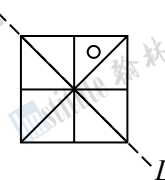
9. The value of $2^4 - 2^3$ is

    (A) 0^1 (B) 2^1 (C) 2^2 (D) 2^3 (E) 1^1

10. What number should go in the $\square$ to make the equation $\dfrac{3}{4} + \dfrac{4}{\square} = 1$ true?
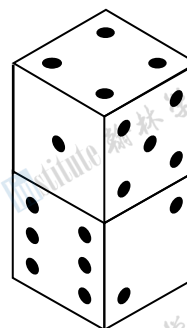
    (A) 1   (B) 3   (C) 5   (D) 13   (E) 16

Part B: Each correct answer is worth 6.

11. Two cubes are stacked as shown. The faces of each cube are labelled with 1, 2, 3, 4, 5, and 6 dots. A total of five faces are shown. What is the total number of dots on the other seven faces of these two cubes?

    (A) 13   (B) 14   (C) 18

    (D) 21   (E) 24

12. Strips are made up of identical copies of ▭. Each ▭ has length $\frac{2}{3}$. Which strip has length 4?

    (A) ▭   (B) ▭   (C) ▭

    (D) ▭   (E) ▭

13. In the subtraction shown, X and Y are digits. What is the value of $X + Y$?

    (A) 15   (B) 12   (C) 10
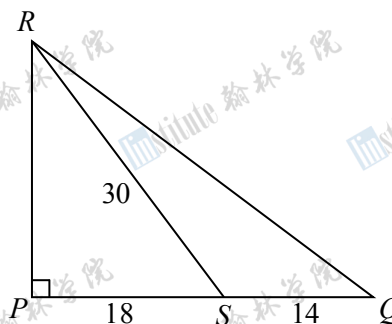
    (D) 13   (E) 9

$$\begin{array}{r} 1\ X\ 2 \\ -\ \ \ 8\ Y \\ \hline 4\ 5 \end{array}$$

14. If $x = 2y$ and $y \neq 0$, then $(x + 2y) - (2x + y)$ equals

    (A) $-2y$ (B) $-y$ (C) 0   (D) y (E) $2y$

15. In $\triangle PQR$, $\angle RPQ = 90°$ and S is on PQ. If $SQ = 14$, $SP = 18$, and $SR = 30$, then the area of $\triangle QRS$ is

    (A) 84   (B) 168   (C) 210

    (D) 336   (E) 384

16. In the 4×4 grid shown, each of the four symbols has a different value. The sum of the values of the symbols in each row is given to the right of that row. What is the value of ♦?

    (A) 5   (B) 6   (C) 7

    (D) 8   (E) 9

♡	△	△	♡	26
△	△	△	△	24
□	♦	♡	♦	27
□	♡	□	△	33

17. A cube has an edge length of 30. A rectangular solid has edge lengths 20, 30 and L. If the cube and the rectangular solid have equal surface areas, what is the value of L?

    (A) 15   (B) 21   (C) 42

    (D) 40   (E) 96
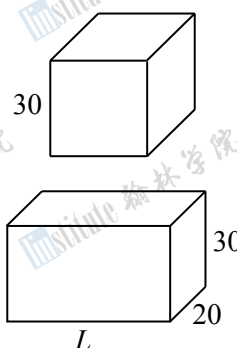
18. How many pairs of positive integers (x, y) have the property that the ratio $x : 4$ equals the ratio $9 : y$?

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

19. On each spin of the spinner shown, the arrow is equally likely to stop on any one of the four numbers. Deanna spins the arrow on the spinner twice. She multiplies together the two numbers on which the arrow stops. Which product is most likely to occur?

    (A) 2   (B) 4   (C) 6

    (D) 8   (E) 12
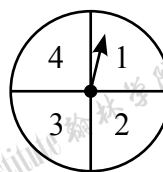
20. In the diagram, line segment PS has length 4. Points Q and R are on line segment PS. Four semi-circles are drawn on the same side of PS. The diameters of these semi-circles are PS, PQ, QR, and RS. The region inside the largest semi-circle and outside the three smaller semi-circles is shaded. What is the area of a square whose perimeter equals the perimeter of the shaded region?

    (A) 4   (B) π (C) π^2

   (D) $2\pi^2$ (E) $\dfrac{\pi^2}{4}$
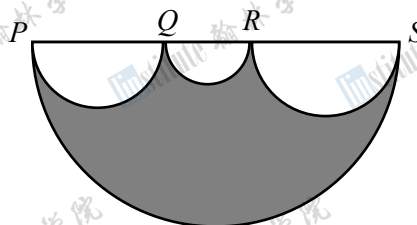
Part C: Each correct answer is worth 8.

21. Twenty-four identical 1×1 squares form a 4×6 rectangle, as shown. A *lattice point* is a point where a horizontal grid line intersects a vertical grid line. A diagonal of this rectangle passes through the three lattice points P, Q and R. When a 30×45 rectangle is constructed using identical 1×1 squares, how many lattice points will a diagonal of this rectangle pass through?
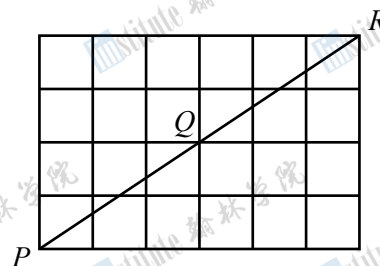
    (A) 19 **(B)** 16 **(C)** 15

    (D) 18 **(E)** 12

22. A rectangular flag is divided into four triangles, labelled Left, Right, Top, and Bottom, as shown. Each triangle is to be coloured one of red, white, blue, green, and purple so that no two triangles that share an edge are the same colour. How many different flags can be made?
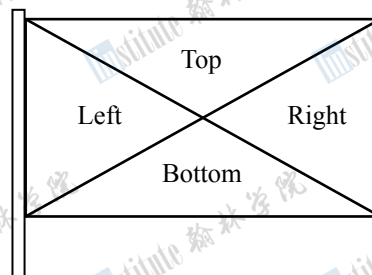
    (A) 180 **(B)** 200 **(C)** 220

    (D) 240 **(E)** 260

23. In the diagram, the shape consists of 48 identical cubes with edge length $\sqrt{n}$. Entire faces of the cubes are attached to one another, as shown. What is the smallest positive integer n so that the distance from P to Q is an integer?
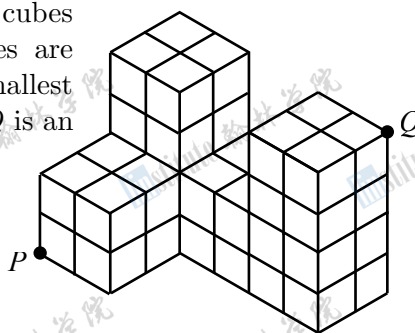
    (A) 17 **(B)** 68 **(C)** 7

    (D) 28 **(E)** 3

24. Nadia walks along a straight path that goes directly from her house (N) to her Grandmother's house (G). Some of this path is on flat ground, and some is downhill or uphill. Nadia walks on flat ground at 5 km/h, walks uphill at 4 km/h, and walks downhill at 6 km/h. It takes Nadia 1 hour and 36 minutes to walk from N to G and 1 hour and 39 minutes to walk from G to N. If 2.5 km of the path between N and G is on flat ground, the total distance from N to G is closest to

    (A) 8.0 km **(B)** 8.2 km **(C)** 8.1 km **(D)** 8.3 km **(E)** 7.9 km

25. Suppose that $\dfrac{2009}{2014} + \dfrac{2019}{n} = \dfrac{a}{b}$, where a, b and n are positive integers with $\dfrac{a}{b}$ in lowest terms. What is the sum of the digits of the smallest positive integer n for which a is a multiple of 1004?

    (A) 16 **(B)** 17 **(C)** 14 **(D)** 20 **(E)** 21

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For students...

Thank you for writing the 2014 Pascal Contest!
In 2013, more than 65 000 students around the world registered to write the Pascal, Cayley and Fermat Contests.

Encourage your teacher to register you for the Fryer Contest which will be written in April.

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