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

Pascal Contest

(Grade 9)

Tuesday, February 24, 2015
(in North America and South America)

Wednesday, February 25, 2015
(outside of North America and South America)

UNIVERSITY OF WATERLOO

Calculators are allowed, with the following restriction: you may not use a device that has internet access, that can communicate with other devices, or that contains previously stored information. For example, you may not use a smartphone or a tablet.

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, 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.

10. You may not write more than one of the Pascal, Cayley or Fermat Contest in any given year.

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

Part A: Each correct answer is worth 5.

1. The value of $\dfrac{20 + 15}{30 - 25}$ is

    (A) 1   **(B)** 5   **(C)** 2   **(D)** 7   **(E)** 0

2. Which of the following figures is obtained when the shaded figure shown is reflected about the line segment PQ?

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

    (D)   **(E)**

3. If $8 + 6 = n + 8$, then n equals

    (A) 14   **(B)** 22   **(C)** 6   **(D)** -2 **(E)** 9

4. Which of the following numbers is greater than 0.7?

    (A) 0.07   **(B)** -0.41 **(C)** 0.8   **(D)** 0.35   **(E)** -0.9

5. The expression $4 + \frac{3}{10} + \frac{9}{1000}$ is equal to

    (A) 4.12   **(B)** 4.309   **(C)** 4.039   **(D)** 4.012   **(E)** 4.39

6. The average age of Andras, Frances and Gerta is 22 years. What is Gerta's age?

    (A) 19   **(B)** 20   **(C)** 21

    (D) 22   **(E)** 23

Name	Age (Years)
Andras	23
Frances	24
Gerta	?

7. If $n = 7$, which of the following expressions is equal to an even integer?

    (A) $9n$ **(B)** $n + 8$ **(C)** n^2 **(D)** $n(n - 2)$ **(E)** $8n$
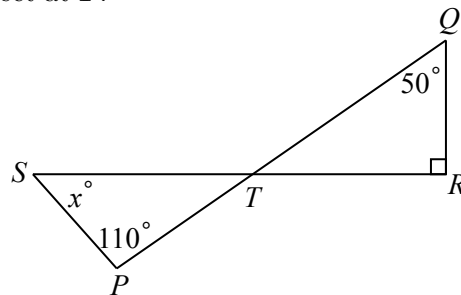
8. Jitka hiked a trail. After hiking 60% of the length of the trail, she had 8 km left to go. What is the length of the trail?

    (A) 28 km   **(B)** 12.8 km   **(C)** 11.2 km   **(D)** $13\frac{1}{3}$ km   **(E)** 20 km

9. In the diagram, line segments PQ and RS intersect at T. The value of x is

    (A) 30   **(B)** 20   **(C)** 40

    (D) 50   **(E)** 35

10. The value of $\sqrt{16} \times \sqrt{16}$ is

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


Part B: Each correct answer is worth 6.

11. Jim wrote the sequence of symbols ♡♠♠♡◇♡♡♡♡◇ a total of 50 times. How many more ♡ symbols than ♠ symbols did he write?

(A) 50   (B) 150   (C) 200   (D) 250   (E) 275

12. What is the smallest positive integer that is a multiple of each of 3, 5, 7, and 9?

(A) 35   (B) 105   (C) 210   (D) 315   (E) 630

13. Sixteen squares are arranged to form a region, as shown. Each square has an area of 400 m². Anna walks along the path ▬▬ formed by the outer edges of the region exactly once. Aaron walks along the path ▪▪▪▪▪ formed by the inner edges of the region exactly once. In total, how far did Anna and Aaron walk?
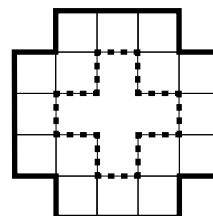
(A) 160 m   (B) 240 m   (C) 320 m

(D) 400 m   (E) 640 m

14. The operation $\otimes$ is defined by $a \otimes b = \dfrac{a}{b} + \dfrac{b}{a}$. What is the value of $4 \otimes 8$?

(A) $\dfrac{1}{2}$ (B) 1   (C) $\dfrac{5}{4}$ (D) 2   (E) $\dfrac{5}{2}$

15. At the end of the year 2000, Steve had \$100 and Wayne had \$10 000. At the end of each following year, Steve had twice as much money as he did at the end of the previous year and Wayne had half as much money as he did at the end of the previous year. At the end of which year did Steve have more money than Wayne for the first time?

(A) 2002   (B) 2003   (C) 2004   (D) 2005   (E) 2006

16. Anca and Bruce left Mathville at the same time. They drove along a straight highway towards Staton. Bruce drove at 50 km/h. Anca drove at 60 km/h, but stopped along the way to rest. They both arrived at Staton at the same time. For how long did Anca stop to rest?
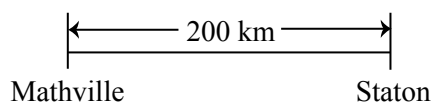
(A) 40 minutes (B) 10 minutes (C) 67 minutes

(D) 33 minutes (E) 27 minutes

17. In the diagram, six identical circles just touch the edges of rectangle $PQRS$ and each circle just touches the adjacent circles. The centres T, V, W, Y of four of these circles form a smaller rectangle $TVWY$, as shown. The centres U and X lie on this rectangle. If the perimeter of $TVWY$ is 60, what is the area of $PQRS$?
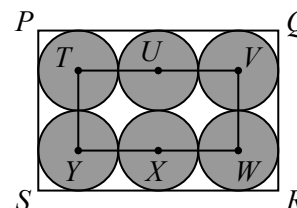
(A) 600   (B) 900   (C) 400

(D) 1200   (E) 1000

18. In a magic square, the numbers in each row, the numbers in each column, and the numbers on each diagonal have the same sum. In the magic square shown, the sum $a + b + c$ equals

a	13	b
19	c	11
12	d	16

(A) 49   (B) 54   (C) 47

(D) 50   (E) 46

19. Krystyna has some raisins. She gives one-third of her raisins to Mike. She then eats 4 raisins, after which she gives one-half of her remaining raisins to Anna. If Krystyna then has 16 raisins left, how many raisins did she have to begin?

(A) 42   (B) 54   (C) 60   (D) 84   (E) 108

20. André has an unlimited supply of $1 coins, $2 coins, and $5 bills. Using only these coins and bills and not necessarily using some of each kind, in how many different ways can he form exactly $10?

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

Part C: Each correct answer is worth 8.

21. Each diagram shows a triangle, labelled with its area.
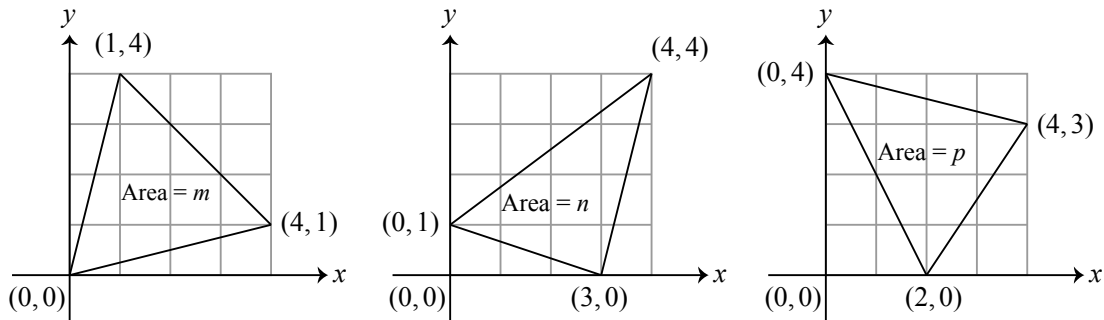
What is the correct ordering of the areas of these triangles?

(A) $m < n < p$ (B) $p < n < m$ (C) $n < m < p$
(D) $n < p < m$ (E) $p < m < n$

22. The chart shown gives the cost of installing carpet in four rectangular rooms of various sizes. The cost per square metre of installing carpet is always the same.

Width (metres)

|		10	y
Length (metres)	15	$397.50	$675.75
	x	$742.00	$z

What is the value of z?

(A) 331.25   (B) 463.75   (C) 1815.25   (D) 476.00   (E) 1261.40

23. How many triples (a, b, c) of positive integers satisfy the conditions $6ab = c^2$ and $a < b < c \leq 35$?

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

24. Paula, Quinn, Rufus, and Sarah are suspects in a crime. The police found links between exactly four pairs of suspects: Paula and Quinn, Quinn and Rufus, Rufus and Paula, and Quinn and Sarah. These links can be shown in a diagram by drawing a point to represent each suspect and a line or curve joining two points whenever the two corresponding suspects are linked. An example of a drawing that represents this information is:
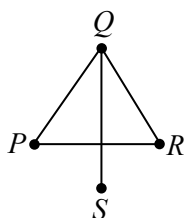
Ali, Bob, Cai, Dee, Eve, and Fay are suspects in a second crime. The police found links between exactly eight pairs of suspects: Ali and Bob, Bob and Cai, Cai and Dee, Dee and Eve, Eve and Fay, Fay and Ali, Ali and Dee, and Bob and Eve. For how many of the following drawings can the six dots be labelled with the names of the six suspects so that each of the eight links given is represented by a line or curve in that drawing?
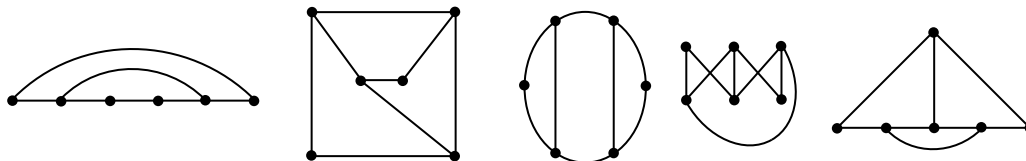
(A) 4   (B) 2   (C) 1   (D) 3   (E) 5

25. The first four rows of a table with columns V, W, X, Y, and Z are shown. For each row, whenever integer n appears in column V, column W contains the integer $2n + 1$, column X contains $3n + 1$, column Y contains $5n+1$, and column Z contains $7n+1$. For every row after the first, the number in column V is the smallest positive integer that does not yet appear in any previous row. The integer 2731 appears in column W. The complete list of columns in which 2731 appears is

V	W	X	Y	Z
1	3	4	6	8
2	5	7	11	15
9	19	28	46	64
10	21	31	51	71

(A) W
(B) W, X, Y, and Z
(C) W, X and Z
(D) W, Y and Z
(E) W and Z

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Thank you for writing the 2015 Pascal Contest! Each year, more than 200 000 students from more than 60 countries register to write the CEMC's Contests.

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

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- Free copies of past contests
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- Information about careers in and applications of mathematics and computer science

For teachers...

Visit our website cemc.uwaterloo.ca to

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