



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

# *Pascal Contest*

*(Grade 9)*

*Thursday, February 21, 2013*  
*(in North America and South America)*

*Friday, February 22, 2013*  
*(outside of North America and South America)*

UNIVERSITY OF  
**WATERLOO**

**WATERLOO**  
**MATHEMATICS**

**Deloitte.**

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**Time:** 60 minutes

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**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.

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

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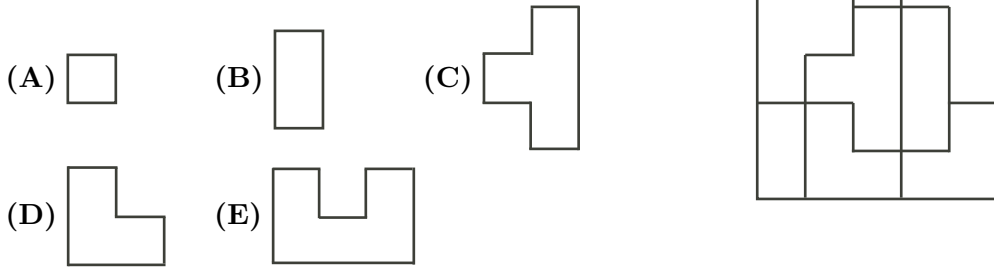
*The name, grade, school and location, and score range of some top-scoring students will be published on our website, <http://www.cemc.uwaterloo.ca>. In addition, the name, grade, school and location, and score of some top-scoring students may be shared with other mathematical organizations for other recognition opportunities.*

Scoring: There is *no penalty* for an incorrect answer.  
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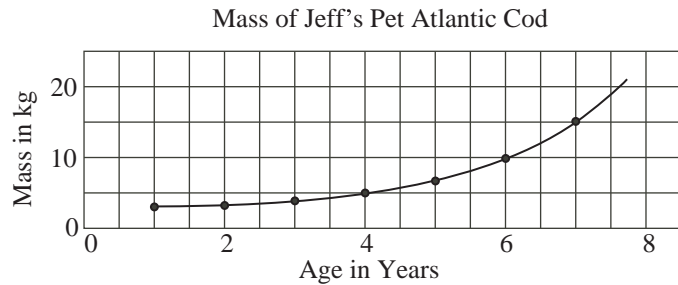
**Part A: Each correct answer is worth 5.**

1. The value of  $(4 + 44 + 444) \div 4$  is  
(A) 111      (B) 123      (C) 459      (D) 489      (E) 456
2. Jing purchased eight identical items. If the total cost was \$26, then the cost per item, in dollars, was  
(A)  $26 \div 8$       (B)  $8 \div 26$       (C)  $26 - 8$       (D)  $8 \times 26$       (E)  $8 + 26$

3. The diagram shows a square divided into eight pieces.  
Which shape is *not* one of those pieces?



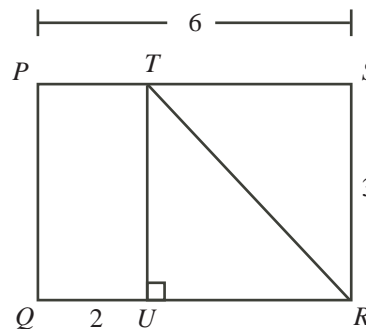
4. The graph shows the mass, in kilograms, of Jeff's pet Atlantic cod, given its age in years. What is the age of the cod when its mass is 15 kg?



- (A) 3      (B) 7      (C) 4      (D) 6      (E) 5
5. What is the value of  $1^3 + 2^3 + 3^3 + 4^3$ ?  
(A)  $10^1$       (B)  $10^3$       (C)  $10^2$       (D)  $10^5$       (E)  $10^4$
6. Erin walks  $\frac{3}{5}$  of the way home in 30 minutes. If she continues to walk at the same rate, how many minutes will it take her to walk the rest of the way home?  
(A) 24      (B) 20      (C) 6      (D) 18      (E) 12
7. The expression  $(\sqrt{100} + \sqrt{9}) \times (\sqrt{100} - \sqrt{9})$  is equal to  
(A) 91      (B) 19      (C) 9991      (D) 9919      (E) 10991

8. In the diagram, rectangle  $PQRS$  has  $PS = 6$  and  $SR = 3$ . Point  $U$  is on  $QR$  with  $QU = 2$ . Point  $T$  is on  $PS$  with  $\angle TUR = 90^\circ$ . What is the length of  $TR$ ?

- (A) 3            (B) 4            (C) 5  
(D) 6            (E) 7



9. Owen spends \$1.20 per litre on gasoline. He uses an average of 1 L of gasoline to drive 12.5 km. How much will Owen spend on gasoline to drive 50 km?

- (A) \$4.80        (B) \$1.50        (C) \$4.50        (D) \$6.00        (E) \$7.50

10. The time on a cell phone is 3:52. How many minutes will pass before the phone next shows a time using each of the digits 2, 3 and 5 exactly once?

- (A) 27            (B) 59            (C) 77            (D) 91            (E) 171

**Part B: Each correct answer is worth 6.**

11. The same sequence of four symbols repeats to form the following pattern:



How many times does the symbol  $\heartsuit$  occur within the first 53 symbols of the pattern?

- (A) 25            (B) 26            (C) 27            (D) 28            (E) 29

12. If  $x = 11$ ,  $y = -8$ , and  $2x - 3z = 5y$ , what is the value of  $z$ ?

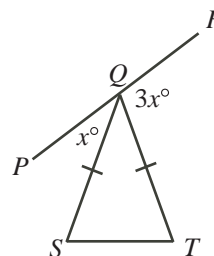
- (A) -6            (B) 13            (C) 54            (D)  $\frac{62}{3}$             (E)  $-\frac{71}{3}$

13. Which number from the set  $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11\}$  must be removed so that the mean (average) of the numbers remaining in the set is 6.1?

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

14. In the diagram,  $PQR$  is a straight line segment and  $QS = QT$ . Also,  $\angle PQS = x^\circ$  and  $\angle TQR = 3x^\circ$ . If  $\angle QTS = 76^\circ$ , the value of  $x$  is

- (A) 28            (B) 38            (C) 26  
(D) 152          (E) 45



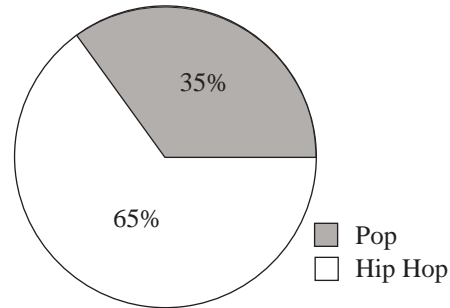
15. If  $4^n = 64^2$ , then  $n$  equals

- (A) 3            (B) 5            (C) 6            (D) 8            (E) 12

16. An integer  $x$  is chosen so that  $3x + 1$  is an even integer. Which of the following must be an odd integer?

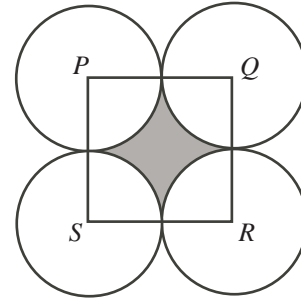
(A)  $x + 3$       (B)  $x - 3$       (C)  $2x$       (D)  $7x + 4$       (E)  $5x + 3$

17. The graph shows styles of music on a playlist. Country music songs are added to the playlist so that now 40% of the songs are Country. If the ratio of Hip Hop songs to Pop songs remains the same, what percentage of the total number of songs are now Hip Hop?



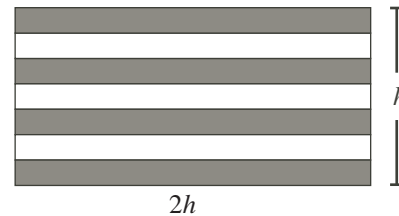
(A) 7      (B) 15      (C) 21  
(D) 35      (E) 39

18. In the diagram,  $PQRS$  is a square with side length 2. Each of  $P$ ,  $Q$ ,  $R$ , and  $S$  is the centre of a circle with radius 1. What is the area of the shaded region?



(A)  $16 - \pi^2$       (B)  $16 - 4\pi$       (C)  $4 - 4\pi$   
(D)  $4 - 4\pi^2$       (E)  $4 - \pi$

19. The rectangular flag shown is divided into seven stripes of equal height. The height of the flag is  $h$  and the length of the flag is twice its height. The total area of the four shaded regions is  $1400 \text{ cm}^2$ . What is the height of the flag?



(A) 70 cm      (B) 200 cm      (C) 35 cm  
(D) 1225 cm      (E) 14 cm

20. Sam rolls a fair four-sided die containing the numbers 1, 2, 3, and 4. Tyler rolls a fair six-sided die containing the numbers 1, 2, 3, 4, 5, and 6. What is the probability that Sam rolls a larger number than Tyler?

(A)  $\frac{1}{8}$       (B)  $\frac{5}{12}$       (C)  $\frac{3}{5}$       (D)  $\frac{3}{4}$       (E)  $\frac{1}{4}$

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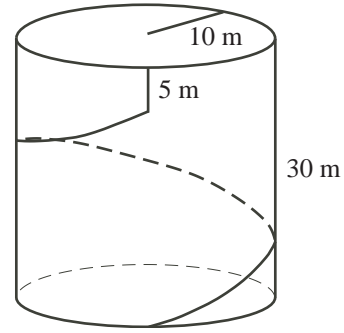
**Part C: Each correct answer is worth 8.**

21. The integer 636 405 may be written as the product of three 2-digit positive integers. The sum of these three integers is

(A) 259      (B) 132      (C) 74      (D) 140      (E) 192

22. A water tower in the shape of a cylinder has radius 10 m and height 30 m. A spiral staircase, with constant slope, circles once around the outside of the water tower. A vertical ladder of height 5 m then extends to the top of the tower. Which of the following is closest to the total distance along the staircase and up the ladder to the top of the tower?

(A) 72.6 m      (B) 320.2 m      (C) 74.6 m  
(D) 67.6 m      (E) 45.1 m



23. Joshua chooses five distinct numbers. In how many different ways can he assign these numbers to the variables  $p$ ,  $q$ ,  $r$ ,  $s$ , and  $t$  so that  $p < s$ ,  $q < s$ ,  $r < t$ , and  $s < t$ ?

(A) 4      (B) 5      (C) 6      (D) 8      (E) 15

24. Pascal High School organized three different trips. Fifty percent of the students went on the first trip, 80% went on the second trip, and 90% went on the third trip. A total of 160 students went on all three trips, and all of the other students went on exactly two trips. How many students are at Pascal High School?

(A) 1400      (B) 600      (C) 1200      (D) 800      (E) 1600

25. The *GEB sequence*  $1, 3, 7, 12, \dots$  is defined by the following properties:

- (i) the GEB sequence is increasing (that is, each term is larger than the previous term),
- (ii) the sequence formed using the differences between each pair of consecutive terms in the GEB sequence (namely, the sequence  $2, 4, 5, \dots$ ) is increasing, and
- (iii) each positive integer that does not occur in the GEB sequence occurs exactly once in the sequence of differences in (ii).

What is the 100th term of the GEB sequence?

(A) 5751      (B) 5724      (C) 5711      (D) 5777      (E) 5764



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**For students...**

Thank you for writing the 2013 Pascal Contest!

In 2012, more than 75 000 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.

Visit our website to find

- More information about the Fryer Contest
- Free copies of past contests
- Workshops to help you prepare for future contests
- Information about our publications for mathematics enrichment and contest preparation

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Visit our website to

- Register your students for the Fryer, Galois and Hypatia Contests which will be written in April
- Learn about our face-to-face workshops and our resources
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