

**The University of the West Indies, Mona Campus**  
**The 2015 Jamaican Mathematical Olympiad**

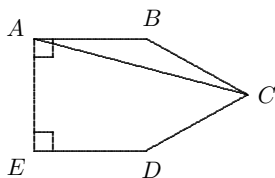
FIRST ROUND EXAMINATION, GRADES 7 AND 8

JANUARY 17, 2015, AT 9:30 AM

**Part A**

This part consists of four multiple-choice questions. For each one, mark the letter for the correct answer ((a), (b), (c), (d), or (e)) on Page 3 of the answer book provided. Each question in this part is worth 5 marks.

- 1) What is the value of  $2003 \times 3002$ ?  
a) 736                      b) 61306                      c) 6013006                      d) 600130006                      e) 60001300006
  
- 2) Suppose 29 is subtracted from the largest two-digit number and the difference is divided by 10. What will the result be?  
a) 6                      b) 7                      c) 9                      d) 10                      e) 11
  
- 3) There were five people in a certain room. Each of them was either a liar who always lies or a knight who always tells the truth. Each of them was asked, "How many liars are among you?" Their answers were "one", "two", "three", "four", and "five", respectively. How many liars were in that room?  
a) 1                      b) 2                      c) 3                      d) 4                      e) 5
  
- 4) In the figure below,  $\angle BAE$  and  $\angle AED$  measure  $90^\circ$  and all sides of the pentagon  $ABCDE$  have length 1. What is the measure of  $\angle BCA$ ?

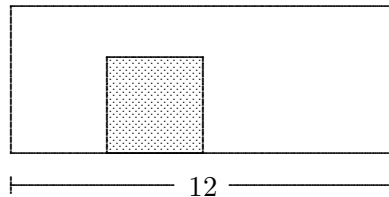


- a)  $15^\circ$                       b)  $12^\circ$                       c)  $30^\circ$                       d)  $20^\circ$                       e)  $18^\circ$

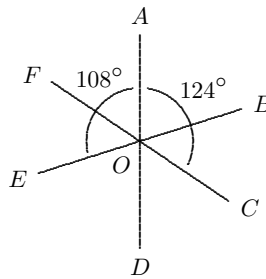
## Part B

This part consists of six written-answer questions. For each one, give your solution in the answer book provided. Each question in this part is worth 10 marks. To score full marks, you must provide an answer which is both correct and completely justified.

- 5) There are 800 students at our school. According to a survey, 50% of them have bicycles. Of the students who have bicycles, 30% have a skateboard. What percent of the students at our school have a bicycle and a skateboard?
- 6) Tom has \$147 and Stan has \$57. How much money should Tom give Stan so that Tom will have twice as much money as Stan?
- 7) A shaded square is placed on the base of a rectangle with a width of 12 cm (see the figure below). The square is 3 cm from one side of the rectangle and twice as far from the other side. The area of the unshaded portion of the rectangle is  $39 \text{ cm}^2$ . What is the height of the rectangle?



- 8) Suppose  $\frac{x - 3y}{y} = 12$ . What is the value of  $\frac{x}{y}$ ?
- 9) In the figure below, lines  $AD$ ,  $BE$ , and  $CF$  intersect at  $O$ ,  $\angle EOA = 108^\circ$ , and  $\angle AOC = 124^\circ$ . What is the measure of  $\angle EOF$ ?



- 10) A circus trainer needs 40 minutes to wash an elephant. His son needs 2 hours to do the same job. How much time will the trainer and his son need to wash three elephants if they work together?

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FIRST ROUND SOLUTIONS, GRADES 7 AND 8

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1. We have  $2003 \times 3002 = 6013006$ .

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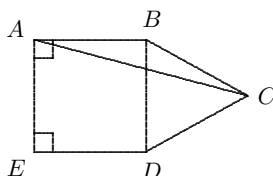
2. The largest two-digit number is 99. If 29 is subtracted from this number the difference will be 70. If 70 is divided by 10 the result will be 7.

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3. It is not possible that two or more persons told the truth. This is because no two people gave the same answer. So, either nobody told the truth or only one person told the truth. Thus there were either 4 or 5 liars in the room. If all five persons were lying then the one who said “five” would have told the truth. Since this is impossible, not all five people were lying. The only possibility is that four persons were lying. (One person, the one who said “four”, told the truth.)

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4. Join  $B$  and  $D$ , as shown in the figure below. The quadrilateral  $ABDE$  is a parallelogram because sides  $AB$  and  $ED$  are parallel and equal in length. Since it contains two right angles in the interior,



$ABDE$  is a square. Thus  $BD = AE = 1$ . It follows that  $BCD$  is an equilateral triangle. Then  $\angle ABD = 90^\circ$ ,  $\angle DBC = 60^\circ$ , and so  $\angle ABC = 90^\circ + 60^\circ = 150^\circ$ . The triangle  $ABC$  is isosceles with  $AB = BC = 1$ . It follows that  $\angle BCA = \angle BAC = 15^\circ$ .

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5. According to the survey, 50% of the 800 students at our school have a bicycle. This is 400 students. Furthermore, 30% of these students have a skateboard. The number of students who have a bicycle and a skateboard is

$$\frac{30}{100} \times 400 = \frac{3}{10} \times 400 = \frac{1200}{10} = 120.$$

The ratio of students who have a bicycle and a skateboard to all students in our school is

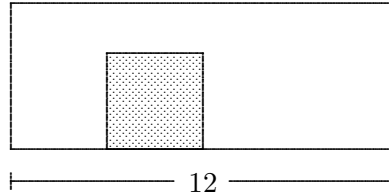
$$\frac{120}{800} = \frac{12}{80} = \frac{3}{20} = \frac{15}{100}.$$

Then 15% of the students in our school have a bicycle and a skateboard.

6. Tom has \$147 and Stan has \$57. Between them, they have  $\$147 + \$57 = \$204$ . When Tom has twice as much money as Stan, Tom will have  $\frac{2}{3}$  of the total and Stan will have  $\frac{1}{3}$  of the total. Then Tom will have \$136 and Stan will have \$68. Tom should give Stan \$11.

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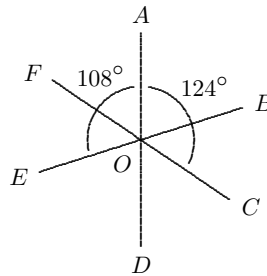
7. The shaded square is 3 cm from one side and 6 cm from the other side of the rectangle. So, the width of the square is 3 cm. Its area is square  $9\text{ cm}^2$ . The area of the unshaded region is  $39\text{ cm}^2$ . The total area of the rectangle is  $9\text{ cm}^2 + 39\text{ cm}^2 = 48\text{ cm}^2$ . Since the width of the rectangle is 12 cm, its height is 4 cm.



8. Given that  $\frac{x - 3y}{y} = 12$ , we may multiply both sides by  $y$  to see that  $x - 3y = 12y$ . Adding  $3y$  to both sides gives  $x = 15y$ . Dividing both sides by  $y$  gives  $x/y = 15$ .

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9. Note that  $\angle FOA$  is the supplement of  $\angle AOC$ . Thus  $\angle FOA = 180^\circ - 124^\circ = 56^\circ$ . Also,  $\angle EOF + \angle FOA = \angle EOA$ . Then  $\angle EOF + 56^\circ = 108^\circ$ . Subtracting  $56^\circ$  from both sides gives  $\angle EOF = 52^\circ$ .



10. If a circus trainer can wash 1 elephant in 40 minutes, he can wash 2 elephants in 80 minutes and 3 elephants in 120 minutes. His son can wash 1 elephant in two hours. This means he can wash 1 elephant in 120 minutes. Together, they can wash 4 elephants in 120 minutes. At this rate, working together they can wash 1 elephant in 30 minutes. They can wash 3 elephants in 90 minutes, or  $1\frac{1}{2}$  hours.