

**THE UNIVERSITY OF THE WEST INDIES, MONA**  
**The 2016 Jamaican Mathematical Olympiad**

**Test for Grades 7 and 8**

NAME: \_\_\_\_\_

GRADE: \_\_\_\_\_

SCHOOL: \_\_\_\_\_

YEAR OF BIRTH: \_\_\_\_\_

STUDENT PHONE: \_\_\_\_\_

EXAMINATION QUESTIONS

1) Which of the following fractions has the smallest value?

a)  $\frac{1}{2}$

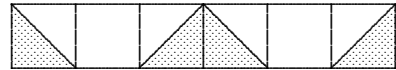
b)  $\frac{2}{6}$

c)  $\frac{3}{12}$

d)  $\frac{4}{20}$

e)  $\frac{5}{30}$

2) The figure on the right shows six equal squares placed side-by-side to form a rectangle. What fraction of the area of the rectangle is shaded?



a)  $\frac{1}{2}$

b)  $\frac{1}{3}$

c)  $\frac{1}{4}$

d)  $\frac{2}{5}$

e)  $\frac{2}{3}$

3) In a class with 16 boys and 10 girls, 75% of the boys and 50% of the girls registered for a trip to the art museum. How many students registered for the trip?

a) 12

b) 15

c) 16

d) 17

e) 18

4) A pharmacist has to pour 3.2 litres of medicine into bottles that hold 80 millilitres each. How many bottles will he fill?

a) 40

b) 80

c) 25

d) 400

e) 250

5) What is the value of the expression  $(1 - 2) - (3 - 4) - (5 - 6) - (7 - 8) - (9 - 10) - (11 - 12)$ ?

a) -6

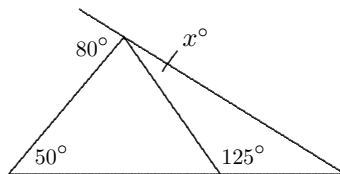
b) 0

c) 4

d) 6

e) 13

6) In the figure below, some of the angles have the values shown. What is the value of  $x$ ?



a)  $55^\circ$

b)  $32.5^\circ$

c)  $5^\circ$

d)  $20^\circ$

e)  $25^\circ$

7) Mr. Williams asked his five students how many of them were ready for their mathematics test. Al said none of them, Beth said one of them, Chris said two of them, Don said three of them, and Earl said four of them. Mr. Williams knows that students always lie if they are not ready for a test and always tell the truth if they are. How many students were ready for the test?

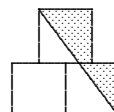
- a) 0                      b) 1                      c) 2                      d) 3                      e) 4

8) A *palindrome* is a positive integer which gives the same number when its digits are reversed. For example, 6556 is a palindrome. What is the smallest number that can be added to 2002 to give another palindrome?

- a) 11                      b) 110                      c) 108                      d) 18                      e) 1001

9) The figure on the right shows three squares of side length 1. The square on top is centred over the two squares below it. What is the area of the shaded region?

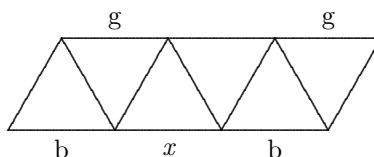
- a) 1                      b)  $\frac{3}{4}$                       c)  $\frac{7}{8}$                       d)  $1\frac{1}{4}$                       e)  $1\frac{1}{2}$



10) In a set of five numbers, the average of two of them is 12 and the average of the other three is 7. What is the average of all five numbers?

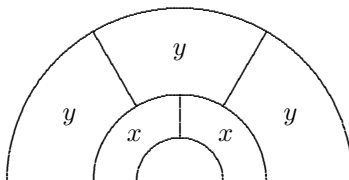
- a)  $8\frac{1}{3}$                       b)  $8\frac{1}{2}$                       c)  $8\frac{3}{4}$                       d)  $9\frac{1}{2}$                       e) 9

11) The figure below shows a parallelogram that has been divided into 6 equilateral triangles. The sides of the triangles have been coloured in such a way that each triangle has one red, one green, and one blue side. The sides marked “b” below are blue, and those marked “g” are green. What colour is the side marked “x”?



- a) red                      b) blue                      c) green  
 d) blue or green, but not red                      e) red, blue, or green

12) The figure below shows three semicircles with the same centre. Their radii are 1, 2, and 4, respectively. The two regions marked  $x$  have equal area, and the three regions marked  $y$  have equal area. What is the ratio  $x : y$ ?



- a) 1 : 3                      b) 1 : 2                      c) 2 : 3                      d) 3 : 8                      e) 4 : 9

13) In a ring-toss game at a carnival, a ring on peg  $A$  scores 1 point, one on peg  $B$  scores 3 points, and one on peg  $C$  scores 5 points. If all three rings land on pegs, how many different point totals are possible? (Two or more rings can land on the same peg.)

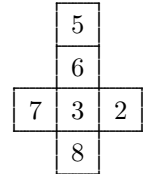
- a) 12                      b) 7                      c) 10                      d) 13                      e) 6

- 14) There are positive integers  $w$ ,  $x$ , and  $y$  such that

$$w + \frac{1}{x + \frac{1}{y}} = \frac{97}{19}.$$

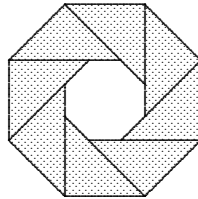
What is the value of  $w + x + y$ ?

- a) 16                      b) 17                      c) 18                      d) 19                      e) 26
- 15) When the net shown on the right is folded into a cube, three numbered faces will meet at each corner. If Janice multiplies all three numbers on the faces that meet at one of these corners, what is the largest product she could get?

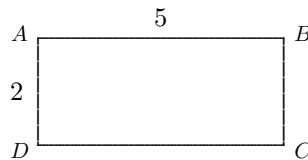


- a) 144                      b) 168                      c) 240                      d) 280                      e) 336

- 16) In the figure below, eight isosceles right triangles have been arranged to form two regular octagons. One octagon is the outer boundary of the shaded region and the other is its inner boundary. If the outer octagon has side length 1, what is the side length of the inner octagon?



- a)  $\frac{1}{2}\sqrt{2}$                       b)  $\frac{1}{2}$                       c)  $2 - \sqrt{2}$                       d)  $\sqrt{2} - 1$                       e)  $\sqrt{3}$
- 17) Which expression below is equal in value to  $4^{2015} + 4^{2015} + 4^{2015} + 4^{2015}$ ?
- a)  $4^{2016}$                       b)  $16^{2015}$                       c)  $4^{8064}$                       d)  $16^{8064}$                       e)  $(4^{2016})^4$
- 18) Neither of the positive integers  $a$  and  $b$  are divisible by 10. If  $a \times b = 10,000$ , what is the value of  $a + b$ ?
- a) 1024                      b) 641                      c) 1258                      d) 2401                      e) 1000
- 19) In rectangle  $ABCD$  below,  $AB = 5$  and  $AD = 2$ . A ball is rolled from point  $A$  to side  $DC$  on a path making an angle of  $45^\circ$  with side  $AB$ . At side  $DC$ , and every time it reaches another side, it bounces off the side at a  $45^\circ$  angle. It continues until it reaches  $D$ . How many times will the ball bounce as it moves from  $A$  to  $D$ ?



- a) 9                      b) 8                      c) 7                      d) 5                      e) 4
- 20) If  $m$  is an even integer and  $n$  is odd, which of the following represents an odd integer?
- a)  $3m + 4n$                       b)  $5mn$                       c)  $5m + 6n$                       d)  $m^3n^3$                       e)  $(m + 3n)^2$

21) If Al gave Ben 6 of his marbles, they would have the same number of marbles. If Al gave Ben half of his marbles, Ben would have 8 marbles more than Al. How many marbles do the two boys have together?

- a) 20                      b) 12                      c) 28                      d) 24                      e) 36

22) Sherika wants to place a positive integer in each of the nine boxes below so that the product of the integers in each row, column, and diagonal are equal. She has already placed numbers in three of the boxes. How many values of  $N$  can she choose that will allow her to complete the square?

$N$		24
	12	
6		

- a) 7                      b) 15                      c) 9                      d) 6                      e) 12

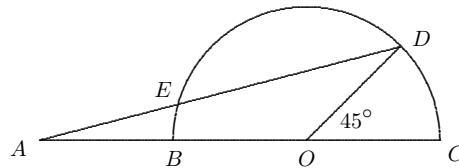
23) Let

$$S = \frac{\sqrt{2} - \sqrt{1}}{\sqrt{2}} + \frac{\sqrt{3} - \sqrt{2}}{\sqrt{6}} + \frac{\sqrt{4} - \sqrt{3}}{\sqrt{12}} + \dots + \frac{\sqrt{9} - \sqrt{8}}{\sqrt{72}}.$$

Which of the expressions below is equal in value to  $S$ ?

- a)  $\frac{1}{\sqrt{2}}$                       b)  $\frac{1}{2}$                       c)  $\frac{3}{4}$                       d)  $\frac{1}{3}$                       e)  $\frac{2}{3}$

24) In the figure below, points  $A$ ,  $B$ ,  $O$ , and  $C$  are collinear,  $BC$  is the diameter of a semicircle with centre  $O$ , and line  $AD$  intersects the semicircle at  $D$  and  $E$ . If  $AE = OC$  and  $\angle DOC = 45^\circ$ , what is the measure of  $\angle DAO$ ?



- a)  $10^\circ$                       b)  $15^\circ$                       c)  $20^\circ$                       d)  $22.5^\circ$                       e)  $25^\circ$

25) The number 2004 is divisible by 12, and the sum of its digits is 6. All together, how many four-digit numbers are divisible by 12 and have 6 as the sum of their digits?

- a) 10                      b) 12                      c) 13                      d) 15                      e) 18

END OF QUESTIONS

You may mail your completed question paper to:

Mathematical Olympiad  
P.O. Box 94  
Mona Post Office  
Kingston 7

You may also deliver your entry by hand or by courier directly to the Department of Mathematics at the UWI, Mona Campus. In all cases, an entry must be received by December 7, 2015, in order to be considered.