

# THE UNIVERSITY OF THE WEST INDIES, MONA

Presents

## The 2014 Jamaican Mathematical Olympiad

### Test for Grades 9, 10, and 11

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

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

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

PRINCIPAL: \_\_\_\_\_

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

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

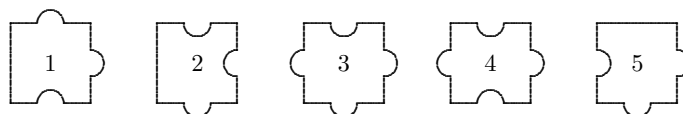
CONTACT TEACHER: \_\_\_\_\_

#### EXAMINATION QUESTIONS

1) What is the value of  $(2000 + 14) - (2000 - 14)$ ?

- (a) 0                      (b) 28                      (c) 3988                      (d) 4000                      (e) 4028

2) Two of the puzzle pieces below have the same area. Which ones are they?



- (a) 2 and 4                      (b) 1 and 3                      (c) 1 and 5                      (d) 4 and 5                      (e) 3 and 5

3) Which of the following expressions is equal to  $\frac{2^{2012} \times 3^{2014}}{6^{2013}}$ ?

- (a)  $\frac{1}{6}$                       (b)  $\frac{1}{3}$                       (c)  $\frac{1}{2}$                       (d)  $\frac{2}{3}$                       (e)  $\frac{3}{2}$

4) What is the ones digit of  $1 + 9^{99}$ ?

- (a) 0                      (b) 2                      (c) 4                      (d) 6                      (e) 8

- 5) In Figure 5(a) below, the perimeter of the shaded region is 16 cm. What is the perimeter, in cm, of the shaded region in Figure 5(b)?



Fig. 5(a)

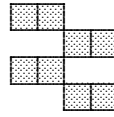
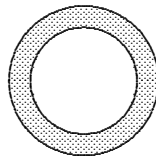


Fig. 5(b)

- (a) 8                      (b) 16                      (c) 18                      (d) 24                      (e) 32
- 6) In a certain classroom, the number of boys is equal to 80% of the number of girls. What is the number of girls equal to, expressed as a percentage of the number of boys?
- (a) 80%                      (b) 100%                      (c) 120%                      (d) 125%                      (e) 160%
- 7) Little Red Riding Hood was on her way to Grandma's house with a basket of fruit containing 7 apples, 6 pears, and 3 oranges. Along the way, Little Red Riding Hood ate two pieces of fruit from the basket. Which of the following situations is possible?
- (a) Grandma did not receive any oranges.  
 (b) Grandma received fewer pears than oranges.  
 (c) Grandma received the same number of each fruit.  
 (d) Grandma received the same number of two types of fruit.  
 (e) Grandma received more apples than the rest of the fruit together.
- 8) The figure below shows two concentric circles. The larger one has radius 7 cm and the smaller one has radius 5 cm. What is the area of the shaded region?



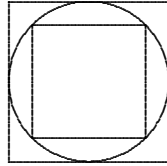
- (a)  $2\pi$                       (b)  $5\pi$                       (c)  $7\pi$                       (d)  $12\pi$                       (e)  $24\pi$
- 9) How many four-digit numbers can be made from the digits 5, 6, 7, and 8 if no digit can be used twice in the same number?
- (a) 24                      (b) 256                      (c) 120                      (d) 16                      (e) 10
- 10) If  $\frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} \times \frac{6}{5} \times \cdots \times \frac{a}{b} = 9$ , what is  $a + b$ ?
- (a) 17                      (b) 18                      (c) 35                      (d) 37                      (e) 41



16) A triangle in the first quadrant of the coordinate system is bounded by the graph of  $ax + by = 6$  and the coordinate axes. If the area of the triangle is 6, what is the product  $ab$ ?

- (a) 3                      (b) 6                      (c) 12                      (d) 108                      (e) 432

17) In the figure below, a circle has square with side length  $a$  is inscribed in it and a square with side length  $b$  circumscribed about it. Which of the expressions below is equal to  $a/b$ ?

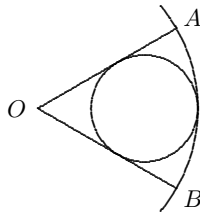


- (a)  $\frac{1}{2}$                       (b)  $\frac{1}{4}$                       (c)  $\frac{\sqrt{2}}{2}$                       (d)  $\frac{\sqrt{2}}{4}$                       (e)  $\frac{\sqrt{3}}{2}$

18) Which of the numbers below is divisible by 7 no matter what digits the letters  $A$  and  $B$  stand for?

- (a)  $AABBAB$                       (b)  $BABABA$                       (c)  $ABAABB$                       (d)  $BAABBA$                       (e)  $AAABBB$

19) In the figure below, a circle is inscribed in the circular sector  $AOB$  with  $AO = OB = r$  and  $\angle AOB = 60^\circ$ . What is the radius of the inscribed circle?



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

20) The sum of a two-digit number  $N$  and the number obtained by reversing the digits of  $N$  is a perfect square. How many such numbers  $N$  are there?

- (a) 8                      (b) 6                      (c) 4                      (d) 2                      (e) None

21) How many sequences of two or more consecutive integers are there whose sum is 100?

- (a) 1                      (b) 2                      (c) 3                      (d) 4                      (e) 5

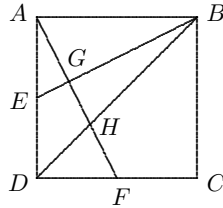
22) Sarah pours four ounces of coffee into a large black cup and four ounces of cream into a large white cup. She then transfers half the coffee to the white cup and, after stirring thoroughly, transfers half the liquid back to the black cup. What fraction of the liquid in the black cup is now cream?

- (a)  $\frac{1}{4}$                       (b)  $\frac{1}{3}$                       (c)  $\frac{3}{8}$                       (d)  $\frac{2}{5}$                       (e)  $\frac{1}{2}$

23) Let  $P(n)$  and  $S(n)$  denote the product and sum, respectively, of the digits of a number  $n$ . For example  $P(23) = 6$  and  $S(23) = 5$ . How many two-digit numbers  $N$  have the property that  $P(N) + S(N) = N$ ?

- (a) None      (b) 1      (c) 5      (d) 9      (e) 49

24) In the figure below,  $ABCD$  is a  $2 \times 2$  square,  $E$  is the midpoint of  $AD$ , and  $F$  is the midpoint of  $DC$ . The segment  $AF$  intersects  $EB$  at  $G$  and  $DB$  at  $H$ . What is the area of the quadrilateral  $EGHD$ ?



- (a)  $\frac{1}{3}$       (b)  $\frac{2}{5}$       (c)  $\frac{7}{15}$       (d)  $\frac{8}{15}$       (e)  $\frac{3}{5}$

25) A positive integer  $n$  has the property that  $2n$  has 28 divisors and  $3n$  has 30 divisors. How many divisors does  $6n$  have? (The divisors of an integer  $m$  include 1 and  $m$  itself.)

- (a) 32      (b) 35      (c) 34      (d) 38      (e) 36

### 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 2, 2013 in order to be considered.

For more information, a copy of this question paper, or the latest updates, please visit

<http://myspot.mona.uwi.edu/mathematics/>

(see the link to the Olympiad Resource Centre).