



**KENYA MATHEMATICS OLYMPIAD 2016** Question Paper  
**DATE:** 16 February, 2016 **DURATION :** 1hr 45 min

## INSTRUCTIONS

1. **DO NOT** open the booklet until you are told to do so.
2. This paper has a total of **20 MULTIPLE CHOICE QUESTIONS**..
3. Each multiple choice question is followed by choices labeled A, B, C, D, and E. Only **ONE** of these is correct.
4. To score full marks you **MUST** attempt all questions. You **MUST** use a pencil for the multiple choice questions.
5. All questions must be done on the answer sheets provided.
6. Each correct answer is **WORTH 5 marks**.
7. For each **INCORRECT** answer for the multiple choice question , 1 mark will be DEDUCTED. There is **NO PENALTY** for unanswered questions.
8. Diagrams are not drawn to scale.
9. Calculators and Geometry instruments mobile phones and Formula tables are **NOT** permitted.
10. Rulers, rough paper and erasers are **ALLOWED**.

1. What is the units digit of  $7^7$ ?

- (A). 1    (B). 3    (C). 5    (D). 7    (E).9

2. What are the last 2 digits of

$$1 + 2 + 3 + \dots + 2005 + 2006$$

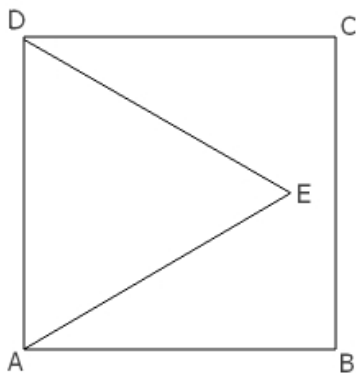
- (A). 00    (B). 21    (C). 26    (D). 42    (E).82

3. If a polygon has its sum of interior angles smaller than  $2016^\circ$ , what is the maximum number of sides of the polygon?

- (A). 11    (B). 12    (C). 13    (D). 14    (E).15

4. The diagram shows an equilateral triangle  $ADE$  inside a square  $ABCD$ . If the area of triangle  $ADE = p$  and the area of triangle  $DEC = q$ , what is the value of  $\frac{q}{p}$ ?

- (A).  $\frac{\sqrt{3}}{4}$     (B).  $\frac{1}{4}$     (C).  $\frac{\sqrt{3}}{2}$     (D).  $\frac{1}{\sqrt{3}}$     (E).2



5. Suppose  $\sqrt{x^2 + y^2}$  is a positive integer. Which of the following can be possible values of  $x$  and  $y$ .

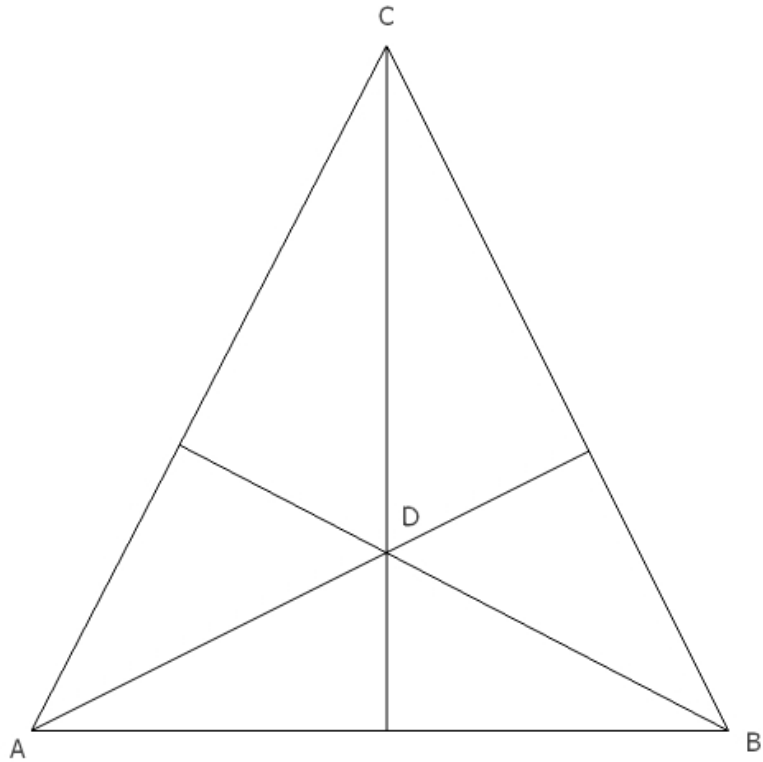
- (A).  $x = 25530$      $y = 29464$     (B).  $x = 37,615$      $y = 26,855$   
(C).  $x = 15122$      $y = 32477$     (D).  $x = 28326$      $y = 27642$   
(E).  $x = 22536$      $y = 27642$

6. Which of the following numbers is odd for any integer value of  $k$ ?

- (A).  $2007+k^3$     (B).  $2007+7k$     (C).  $2007+2k^2$     (D).  $2007+2007k$     (E).  $2007k$

7 How many triangles are in the following figure?

- (A). 7    (B). 10    (C).12    (D). 16    (E).20



8. Suppose  $x^2 - 13x + 1 = 0$ . what is the last digit of  $x^4 + \frac{1}{x^4}$ ?

- (A). 1    (B). 7    (C). 3    (D). 4    (E).9

9. The number of integers between 208 and 2008 ending with 1 is

- (A).101    (B).163    (C).179    (D).180    (E).200

10. A rectangle whose length is twice its width has a diagonal equal to one side of a given square. The ratio of the area of the rectangle to the area of the square is

- (A). 3 : 5    (B).4 : 5    (C).3 : 25    (D).9 : 25    (E).16 : 25

11. An eleven digit number  $a123456789a$  is divisible by 8. A possible value for  $a$  is  
 (A). 2 (B). 4 (C). 6 (D). 8 (E).0
12. If  $a$  and  $b$  are positive numbers such that  $a^b = b^a$  and  $b = 2a$ , Then the value of  $b$  is  
 (A).1 (B).  $\sqrt{2}$  (C). 2 (D).  $2\sqrt{2}$  (E).4
13. Which of the following numbers is the largest?  
 (A).  $29-2\sqrt{210}$  (B).  $\sqrt{290}-17$  (C).  $5\sqrt{13}-18$  (D).  $13-2\sqrt{42}$  (E).  $\frac{1}{29}$
14. The last 2 digits of  
 $3005 + (3005)^2 + (3005)^3 + \dots + (3005)^{2016}$   
 (A). 15 (B). 25 (C). 80 (D). 30 (E).50
15. What is the value of  
 $(0.00000006)^4 + 4 \times (0.00000006)^3 \times (-1.00000006) + 6 \times (0.00000006)^2 \times (-1.00000006)^2$   
 $+ 4 \times (0.00000006) \times (-1.00000006)^3 + (-1.00000006)^4$   
 (A). 1 (B). -2 (C). -1 (D). 7 (E).1.6
16. The side of a square is increased by 30%. The area of the square is increased by  
 (A). 30% (B). 60% (C). 69% (D). 90% (E).None of the above
17. The sum of 2 positive numbers is equal to the sum of their reciprocals. What is the product of the 2 numbers?  
 (A). 1 (B). 2 (C). 3 (D). 4 (E).  $\frac{1}{2}$
18. The minimum value of the function  $f(x) = 3^{x^2-2x}$  is  
 (A). 1 (B).  $\frac{1}{3}$  (C). 3 (D). 27 (E).9
19. If  $a^x = c^q = b$  and  $c^y = a^z = d$ , then  
 (A).  $xy = qz$  (B).  $\frac{x}{y} = \frac{q}{z}$  (C).  $x^y = q^z$  (D).  $x-y = q-z$  (E).  $x+y = q+z$
20. John walked from town A to town B at a uniform speed of 4km/hr. When he reached town B, he was turned back immediately and he walked back to town A along the same road at a uniform speed of 6km/hr. What is his average speed for the whole trip?  
 (A). 4.4km/hr (B). 4.8km/hr (C). 5km/hr (D). 5.2km/hr (E).5.5km/hr