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MATHEMATICS ASSOCIATION OF KENYA

Kenya Mathematical Olympiad

KMO 9-1

Kenya Mathematical Olympiad 9-Round I

SENIOR KENYA MATHEMATICS OLYMPIAD

SCHOOL OF MATHEMATICS, UNIVERSITY OF NAIROBI

INSTRUCTIONS

TIME ALLOWED: 2 HOURS

SEPTEMBER 21, 2018

1. This question paper consists of **4 printed pages**, including this cover. There are **20 questions**.
2. This is a multiple choice paper with each labeled A, B, C, D, and E. Only **ONE** of these is correct.
3. Each correct answer is **WORTH** 5 marks.
4. For each **INCORRECT** answer, 1 mark will be **DEDUCTED**. There is **NO PENALTY** for unanswered questions.
5. Attempt **ALL** Questions. You **MUST** use a pencil.
6. Rulers, pair of compasses, rough paper and erasers are **ALLOWED**.
7. Calculators, Formula Tables and other Geometrical Instruments are **NOT** permitted.
8. Diagrams are **NOT** necessarily drawn to scale.

The Committee on the Kenyan Mathematical Olympiads (CKMO) reserves the right to disqualify all scores from a school if it determines that the required security procedures were not followed.

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TURN OVER

1. The square of the number 234567891 is an m digit number. What is the value of m ?
 A. 13 B. 14 C. 15 D. 16 E. 17

2. Solve for x

$$\sqrt{\sqrt{(x+1)}\sqrt{(x+1)}\sqrt{(x+1)}}.$$

- A. 14 B. 15 C. 16 D. 17 E. 18

3. If x and y satisfy

$$16^x - 16^y = 64512$$

$$4^x - 4^y = 224$$

then $x + y =$

- A. 5.5 B. 6 C. 6.5 D. 8.5 E. 16.5

4. If $2018^{2018} - 2018^{2017} = 2018^x \times 2017$. What is the value of x ?
 A. 0 B. 1 C. 2016 D. 2017 E. 2018

5. If x and $\frac{221}{x}$ are both integers greater than 1, the total number of possible values of x is
 A. 2 B. 4 C. 6 D. 8 E. 3

6. If $a = \sqrt{6} - \sqrt{4}$ and $b = \sqrt{8} - \sqrt{6}$, then
 A. $a = b$ B. $a > b$ C. $a < b$ D. $b = \sqrt{2a}$ E. $a = \sqrt{2b}$

7. Given that $\frac{3}{2} < x < \frac{5}{2}$, the value of

$$\sqrt{4x^2 - 12x + 9} - \sqrt{4x^2 - 20x + 25}$$
 is

- A. -2 B. 2 C. 8 D. $4x + 8$ E. $4x - 8$

8. In how many ways can a straight line divide a parallelogram into two identical parts?
 A. 2 B. 4 C. 6 D. 8 E. Infinitely many ways

9. Arrange the following numbers in increasing order

$$a = 4^{396}, \quad b = 6^{297}, \quad c = 15^{198}$$

- A. $b < c < a$ B. $a < c < b$ C. $b < a < c$ D. $c < b < a$ E. $a < b < c$

10. For how many values of integers n is the following expression a perfect square?

$$n^4 + 2n^3 + 2n^2 + 2n + 1$$

- A. 0 B. 1 C. 2 D. 3 E. 4

11. Find the value of $\sqrt{\frac{x-2}{6}}$ when $x = 2019^3 - 2017^3$.
 A . 2016 B. 2017 C. 2018 D. 2019 E. 1

12. What is the minimum value of

$$y = (x - 16)(x - 14)(x + 14)(x + 16).$$

- A. -896 B. -897 C. -898 D. 900 E. -900

13. Which of the following numbers is the largest

- A . 30^{20} B. 10^{30} C. $30^{10} + 20^{20}$ D. $(30 + 10)^{20}$ E. $(30 \times 20)^{10}$

14. Let

$$m = \left(1 + \frac{1}{2}\right) \left(1 + \frac{1}{3}\right) \left(1 + \frac{1}{4}\right) \cdots \left(1 + \frac{1}{2017}\right) \left(1 + \frac{1}{2018}\right) + \frac{1}{2}.$$

Find the sum of the digits of m .

- A. 5 B. 2 C. 4 D. 6 E. 8

15. When 2007 bars of soap are packed into N boxes, where N is a positive integer and $N > 1$, there is a remainder of 5. How many possible values of N are there if each box has the same number of bars?

- A. 13 B. 14 C. 15 D. 16 E. 17

16. Given that $x + y = 12$ and $xy = 50$ find the exact value of y .

- A. 44 B. 100 C. 144 D. 50 E. 48

17. Find the remainder when $2^{55} + 1$ is divided by 33.

- A . 0 B. 2 C. 5 D. 1 E. 3

18. In the quadrilateral in the figure below we have

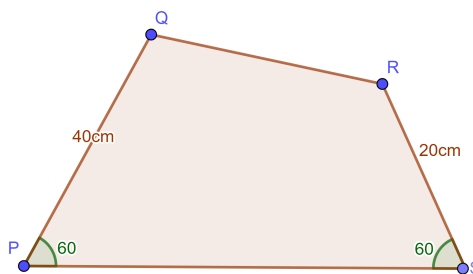


Figure 1: Problem 18 Figure.

$PQ = 40$ cm, $RS = 20$ cm, $PS = 60$ cm and $\angle QPS = \angle RSP = 60^\circ$. Find $\angle QRS$.

- A. 150° B. 120° C. 100° D. 130° E. 110°

19. The area of triangle ABC is 40 cm^2 . Points D , E and F are on sides AB , BC and CA respectively. If $AD = 3$ cm, and $DB = 5$ cm, and the area of triangle ABE is equal to the area of the quadrilateral $DBEF$.

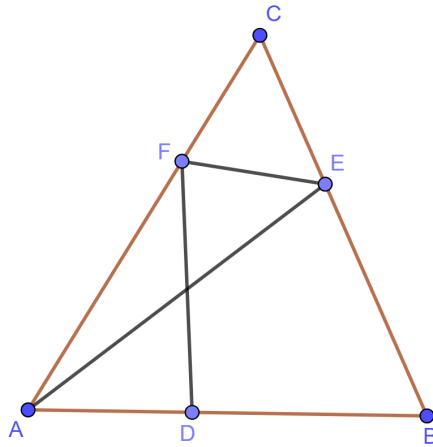


Figure 2: Problem 19 Figure.

Find the area of the triangle AEC in 40 cm^2 .

- A. 11 B. 12 C. 13 D. 14 E. 14

20. What is the value of

$$\frac{9 \times 11 + 18 \times 22 + 27 \times 33 + 36 \times 44}{22 \times 27 + 44 \times 54 + 66 \times 81 + 88 \times 108}$$

- A. $\frac{1}{6}$ B. $\frac{1}{2}$ C. 11 D. 9 E. $\frac{1}{3}$

END