

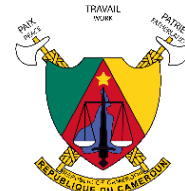


Scholars
Program



AIMS

African Institute for
Mathematical Sciences
CAMEROON



AIMS TEACHER TRAINING PROGRAM (TTP) IN PARTNERSHIP WITH
MASTERCARD FOUNDATION AND THE GOVERNMENT OF CAMEROON

MATHEMATICS OLYMPIAD

LEVEL: NATIONAL

DATE: 15th MAY 2021

DURATION OF PAPER: 2 hours

CANDIDATES: Form 5 students

PART A

INSTRUCTIONS TO CANDIDATES:

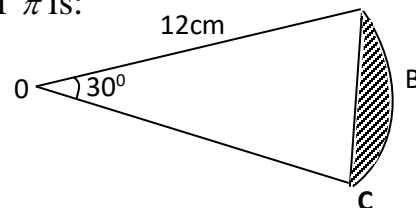
- Mobile phones are **NOT ALLOWED** in the examination room
- You should attempt to answer all questions.
- You are reminded of the necessity for orderly presentation and good English in your work.
- Each MCQ is 1 mark. Mark allocation for the other questions are indicated.
- In calculations, you are advised to show all steps in your work, and show answers at each stage
- Non-programmable electronic calculators are allowed

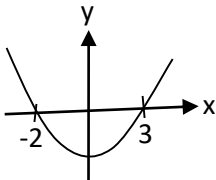
Instruction:

This question paper consists of 24 MCQs and 10 short answer questions. For the MCQs, each question has four suggested answers. Copy the question number and write down the letter corresponding to the correct answer. In calculations, for the short answer questions, you are advised to show all steps in your work, and show answers at each stage.

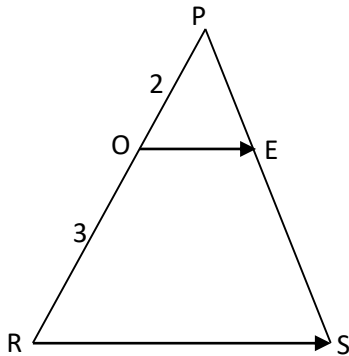
I- MCQs. Each correct answer is 1 mark

- 1 The sum of the first n th terms of a sequence is given by $S_n = n(n + 3)$.
The n th term of the sequence is:
A) $2(n + 1)$; B) $(n + 1)(n + 3)$;
C) $n(n + 3) - n(n + 2)$; D) $n + 1$
- 2 Given that $x+1, 2x - 1, x + 5, \dots$ are in an A.P, the value of x is:
A) -4; B) 0; C) -3; D) 4
- 3 A trader sells an article and makes a profit of 8% on the cost price. Given that the actual profit is 4000FCFA, the cost of the article is:
A) 46,000FCFA; B) 32,000FCFA;
C) 54,000FCFA; D) 50,000FCF
- 4 The point $(4, 3)$ is reflected in the $x - \text{axis}$ followed by a reflection in the $y - \text{axis}$. The final image is:
A) $(4, -3)$; B) $(-4, 3)$; C) $(-4, -3)$; D) $(-3, -4)$
- 5 Evaluating $\frac{12.78 \times 10^{-3}}{9 \times 10^{-1}}$ gives:
A) 1.42×10^{-4}
B) 14.2×10^{-2}
C) 1.42×10^{-2}
D) 142×10^2
- 6 In figure below, OABC is a sector of a circle of radius 12cm and centre O, given that angle AOC is 30° , the area of the sector OABC in terms of π is:
A) $36 - 12\pi$
B) $12\pi - 36$
C) $\frac{\pi}{6}$
D) None

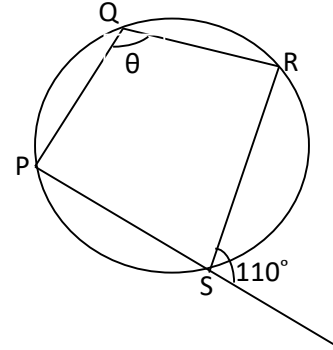


- 7 The next number in the sequence below.
6, 10, 19, 35, is:
A)60; B)54; C) 71; D) 51
- 8 The sum of two numbers is 3 and one of the numbers is twice the other. The numbers are
A) -1 and 4 B) 1 and 2
C) 2 and 4 D) -1 and -2
- 9 Two fair dice are tossed. The probability that the product of the scores is even is:
A) 0.5; B) 0.75; C) 0.25;
D)0.125
- 10 Fifteen new born babies were weighed and their masses recorded below. The mean is less than the mode by:
A) $\frac{3}{2}$; B) $\frac{1}{2}$; C) $-\frac{1}{2}$; D) $-\frac{3}{2}$
- | | | | | | |
|------------|---|---|---|---|---|
| Masses(kg) | 1 | 2 | 3 | 4 | 5 |
| frequency | 2 | 2 | 1 | 9 | 0 |
- 11 A rectangular plot measures 12m by 10m. The length of the plot is increased in the ratio 3:2, while the width is decreased in the ratio 4:5. The ratio of the area of the plot is increased by:
A)4:3 ; B) 5:4 ; C)6:5; D) 3:2
- 12 The distance between two villages is 6.4km. On the map of the region this distance is represented by a line 1.6 cm long. What is the scale of the map?
A)1: 400000; B)1: 40000 ;
C) 1: 4000 ; D) 1: 4
- 13 The graph below is the graph of the function
A) $y = x^2 - x - 6$
B) $y = x^2 - x + 6$
C) $y = x^2 + x + 6$
D) $y = x^2 + x - 6$
- 
- 14 The functions f and g are given by $f(x) = x^2 + 1$ and $h(x) = x + m$. The value of m for which $f \circ h(x) = x^2 - 12x + 37$ is:
A) -6; B)6; C)36; D)37

- 15 In the figure below, the area of PQE is 4 cm^2 . The area of triangle PRS is:
A) 9 cm^2 ; B) 20 cm^2 ; C) 25 cm^2 ; D) 36 cm^2



- 16 In the figure below, PQRS is a cyclic quadrilateral and angle TSR = 110° . The angle θ is: A) 55° ; B) 90° ; C) 120° ; D) 110°



- 17 Given that the polynomial $f(x)$ when divided by $(x - 3)$ gives the quotient $3x + 7$ and the remainder is 22, then $f(x)$ equals

- A) $3x^2 + 16x + 1$; B) $3x^2 - 2x + 21$
C) $3x^2 - 2x + 1$; D) $3x^2 - 2x + 43$

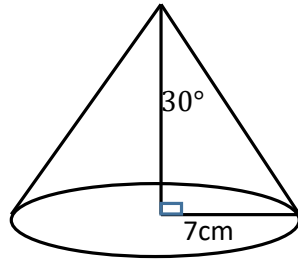
- 18 A cylindrical tank has a radius of 2m and a height of 1.5m. The tank was filled with water to a depth of 0.5m. What is the volume of water in the tank, in litres? ($\pi = 3.14$).
A) 6280; B) 628; C) 9240; D) 18840

- 19 The straight line $3x - 4y = 12$ cuts the axes at P and Q. The length of the line segment PQ is:
A) $\sqrt{7}$; B) $\sqrt{5}$; C) 5; D) 12

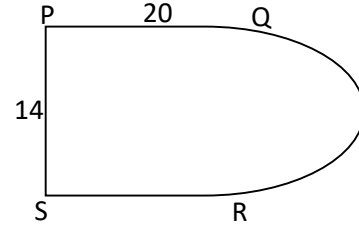
- 20 Given that $\log 3 = h$ and $\log 7 = k$. The value of $\log \left(\frac{1}{3} + \frac{1}{7} \right)$ in terms of h and k is:
A) $-(h + k)$; B) $h + k$
C) $1 - (h + k)$; D) $h + k - 1$

21 The total surface area in cm^2 of the cone below is:

- A) 308; B) 154;
C) 208; D) 462



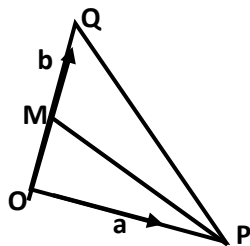
22



In the figure above, $PQ = 20$ cm and $PS = 14$ cm. taking $\pi = \frac{22}{7}$ and given that the arc QR is a semi-circle, the perimeter of the composite figure is:

- A) 90 cm; B) 76 cm; C) 98 cm; D) 68 cm

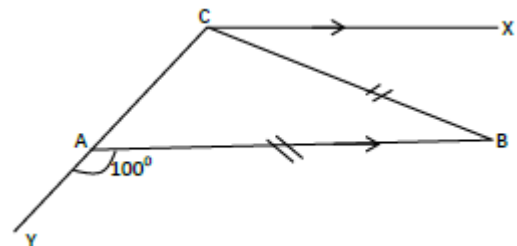
23 Given that M is the midpoint of OQ and $\overrightarrow{OP} = \mathbf{a}$, $\overrightarrow{OQ} = \mathbf{b}$



The vector \overrightarrow{MP} is:

- A) $\frac{-b+2a}{2}$;
B) $\frac{b+2a}{2}$
C) $-b + a$;
D) D) $\frac{-b-2a}{2}$

24 In the figure below $AB = BC$ and AB is parallel to CX.



If angle $BAY = 100^\circ$. The value of angle BCX is;

- A) 50°
B) 80°
C) 20°
D) 40°

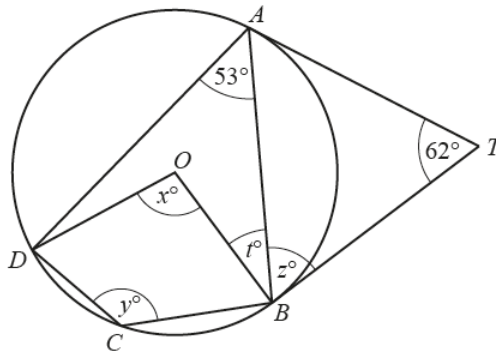
II- SHORT ANSWER QUESTIONS.

1. Solve the inequalities $x \leq 2x + 7 \leq \frac{1}{3}x + 14$ hence represent the solution on a number line. **3mks**

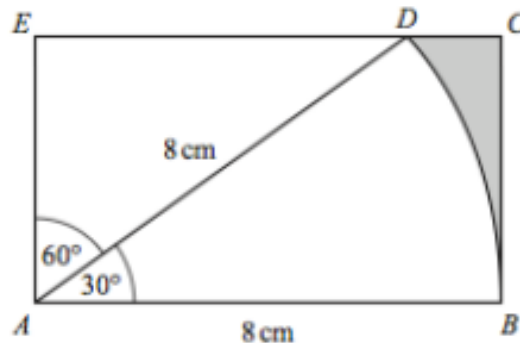
2. The diagram below shows a circle, centre O , that passes through the points A, B, C and D . The tangents at A and B meet at T . angle $ATB = 62^\circ$ and angle $DAB = 53^\circ$.

Find the values of the angles marked with the letters x, y, t and z .

4mks



3. The diagram below shows a rectangle $ABCE$. D lies on EC . DAB is a sector of a circle radius 8cm and sector angle 30° . Calculate the area of the shaded region. **4mks**



4. Inside a triangular park, there is a flower bed forming a similar triangle. Around the flower bed runs a uniform path of such a width that the sides of the park are exactly double of that of the corresponding sides of the flower bed. Find the ratio of the area of the path to that of the flower bed. **3mks**

- 5 An electric pole PN is such that $PN = 12$ m where P is the base and N is the top of the pole. At a given moment of the day, the shadow of the pole, $PN' = PN$. Find
- (a) The length NN' , leaving your answer as a surd.
(b) The bearing of N' from N . 4mks
- 6 Given that $\overline{OP} = 2\mathbf{i} - \mathbf{j}$ and $\overline{OR} = 3\mathbf{i} + 4\mathbf{j}$. Find
- (a) $|\overline{PR}|$
(b) Given that $\overline{OM} = 3\overline{OP}$, find \overline{OM} and show that \overline{OM} is perpendicular to the vector $\overline{OQ} = 3\mathbf{i} + 6\mathbf{j}$ 4mks
- 7 A certain strand of virus becomes three times in every 25mins. Find how much time it will take to be 729 times its initial value. 4mks
- 8 In this question you will use the expressions for the following identities: $a^2 - b^2$; $a^3 - b^3$; and $a^3 + b^3$ where a and b are real numbers.
- a) Consider the expression $E = x^6 - 1$. First use the expression for $a^2 - b^2$, followed by $a^3 - b^3$ and write E as a product of four factors. 2mks
- b) Factorize E using first $a^3 - b^3$ followed by $a^2 - b^2$. Hence deduce the factorization of $x^4 + x^2 + 1$. 2mks
- 9 On a Cartesian plane, the abscissa of the point A is -1 , that of the point B is $+2$ and that of point C is $+3$.
- a) Find AB , AC and BC . 2mks
- b) Find the abscissa of a point M such that the distance from A to M is 5. That is $AM = 5$. 2mks
- c) Express AM in terms of x where x is the abscissa of the point M . Hence, determine the point M such that $AM = \sqrt{2}$ 2mks

END