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GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GAUTENG DEPARTMENT OF EDUCATION
GRADE 12
JUNE EXAMINATION 2022

10612

MATHEMATICS PAPER 2

TIME: 3 hours
MARKS: 150
23 pages

Answer all questions on this question paper.

LEARNER'S NAME:	

GRADE 12	

Marker/*Merker*					Moderator's Initials / *Moderator se paraaf*																
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INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of ELEVEN questions. Answer ALL the questions on this question paper.

2. Clearly show ALL calculations, diagrams, graphs, et cetera that you have used in determining your answer.

3. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.

4. Answers only will not necessarily be awarded full marks.

5. If necessary, round-off answers to TWO decimal places, unless stated otherwise.

6. Diagrams are NOT necessarily drawn to scale.

7. An information sheet with formulae is included at the end of the question paper.

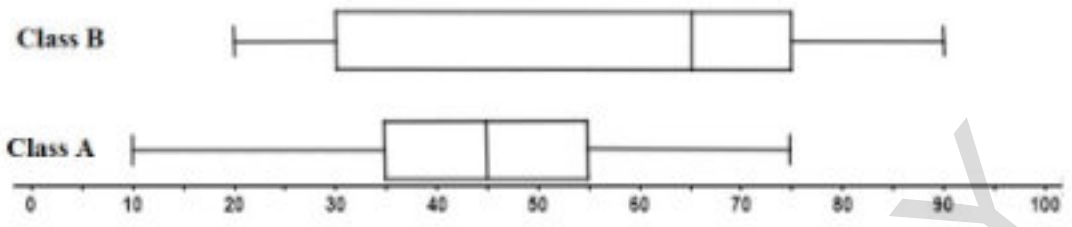
8. Write neatly and legibly.

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QUESTION 1

The box and whisker diagrams below show the Mathematics results of class A and class B in the June Examination. It is also given that class B has a Median of 65%.



1.1 Which class had the top learners?

(1)

1.2 Determine which class had the greatest Inter Quartile Range (IQR).

(1)

1.3 What percentage of class A scored lower than 60%?

(1)

1.4 If all the learners in class A were given an extra 5%, what would happen to the standard deviation of the marks in class A?

(1)

1.5 Determine the semi-interquartile range of class B.

(1)

[5]

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QUESTION 2

A group of 30 pupils was asked to complete an obstacle course at their Grade 11 camp. The times (in seconds) taken by the pupils to complete the obstacle course are given in the table below.

Time taken:	$60 \leq t < 90$	$90 \leq t < 120$	$120 \leq t < 150$	$150 \leq t < 180$	$180 \leq t < 210$
No. of pupils:	3	6	7	8	6

2.1 Complete the cumulative frequency table for the above data.

Time taken	No. of pupils	Cumulative frequency
$60 \leq t \leq 90$	3	
$90 \leq t \leq 120$	6	
$120 \leq t \leq 150$	7	
$150 \leq t \leq 180$	8	
$180 \leq t \leq 210$	6	

(1)

2.2 Draw a cumulative frequency curve for the above data on the grid provided.



(4)

2.3 Indicate on your graph where you would read off …

2.3.1 the number of pupils that took 135 seconds to complete the course. (Use the letter **A**)

(1)

2.3.2 the value of t if 60% of the pupils took less than t seconds to complete the obstacle course. (Use the letter **B**)

(1)

2.3.3 the 75th percentile. (Use the letter **C**)

(1)

[8]

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QUESTION 3

Consider the following set of four positive whole numbers and their frequency.

Scores	$x+3$	$2x$	$x-1$	6
Frequency	4	3	2	2

3.1 Determine the median score.

(1)

3.2 Determine the mean in terms of x.

(3)

3.3 If only the scores are taken into consideration (without the frequency), determine the standard deviation if it is given that $x = 5$.

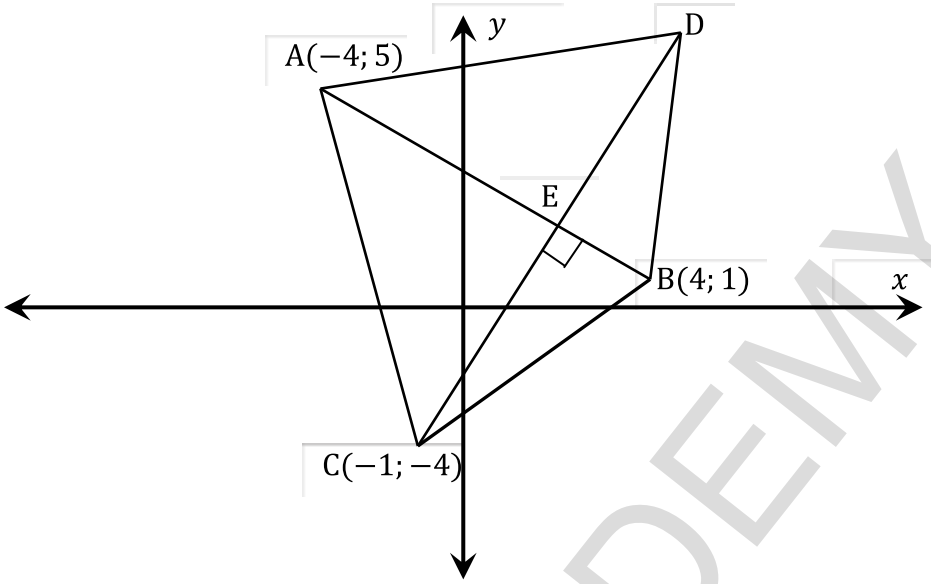
(2)
[6]

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QUESTION 4

In the diagram below, the coordinates of $A(-4; 5)$, $C(-1; -4)$ and $B(4; 1)$ are the vertices of a triangle in a Cartesian plane. $CE \perp AB$ with E on AB. E is the midpoint of straight line CD.



4.1 Determine the gradient of AB.

(2)

4.2 Determine the equation of CD.

(4)

4.3 Determine the coordinates of E.

(6)

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4.4 Determine the coordinates of D.

(2)

4.5 Determine the equation of the straight line passing through point D and parallel to AC.

(4)

4.6 Determine, by showing all calculations, whether the $x-$ intercept of the straight line CD also lies on the altitude (perpendicular height) from A to BC.

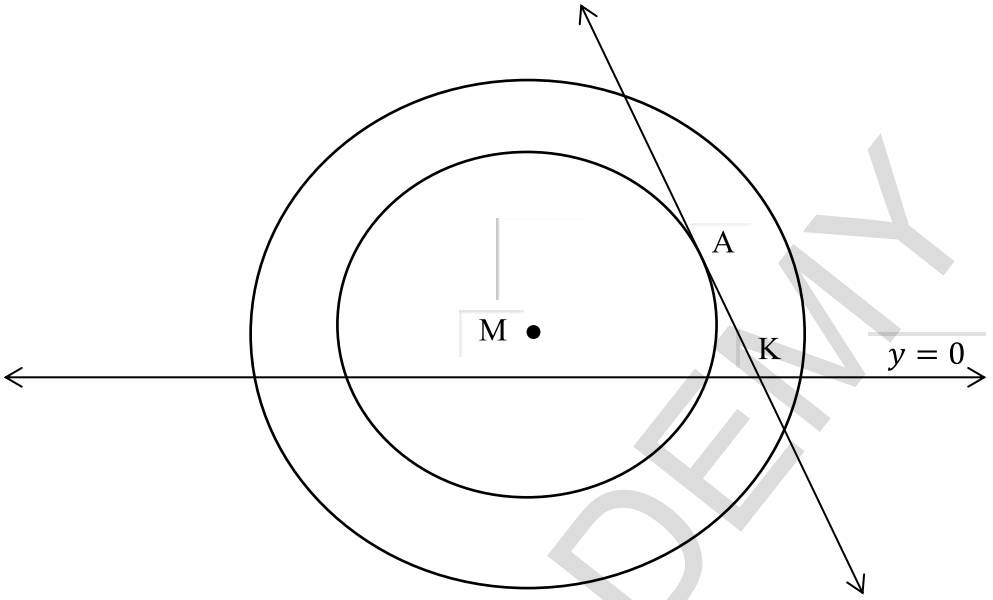
(6)
[24]

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QUESTION 5

In the figure below, M is the common centre of two circles. The larger circle has equation $x^2 + y^2 = 4y - 2x + 44$. The smaller circle touches the straight line $y = -x + 5$ at point A. The straight line $y = 0$ cuts both circles.



5.1 Determine the coordinates of M.

(4)

5.2 Determine the coordinates of A.

(5)

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5.3 Determine the equation of the smaller circle.

(3)

5.4 Write down the coordinates of K.

(1)

5.5 The straight line $y = -x + 5$ meets the straight line $y = 0$ at point K.
Determine the area of Δ AMK.

(3)
[16]

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QUESTION 6

6.1 If $\cos 26^{o} = \frac{1}{p}$. Determine the following in terms of p.

Draw your sketch here.	Do your calculations here.

6.1.1 Sin 26°

(3)

6.1.2 Cos 52°

(3)

6.1.3 $\text{Tan}^2 64° \times (p + 1)$

(4)

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6.2 Simplify: $\dfrac{\sin(-\beta) + \sin(360^\circ - \beta)}{\sin(180^\circ - \beta) + \sin 180^\circ}$

(5)

6.3 Determine the value of p, correct to two decimal places, if:
$\theta = 82^\circ$ and $2p \tan\left(\frac{\theta}{2}\right) = \sin(2\theta)$

(3)

6.4 Prove the identity: $4 \sin\theta \cdot \cos^3\theta - 4 \cos\theta \cdot \sin^3\theta = \sin 4\theta$

(6)
[24]

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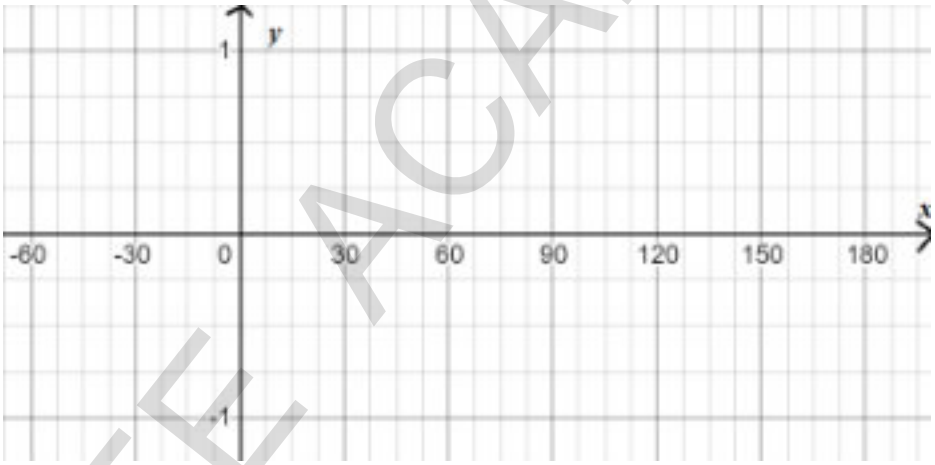
QUESTION 7

Given: $f(x) = \sin(x - 30^\circ)$ and $g(x) = \cos 3x$.

7.1 Solve for x: $\cos 3x = \sin(x - 30^\circ)$ for $x \in [-60^\circ; 180^\circ]$.

(7)

7.2 Draw the graphs of f and g for $x \in [-60^\circ; 180^\circ]$ on the grid provided.



(6)

7.3 Use your graph and your answers to Question 7.1 to answer the following question.

For which value(s) of x is $f(x) \times g(x) < 0$?

(4)

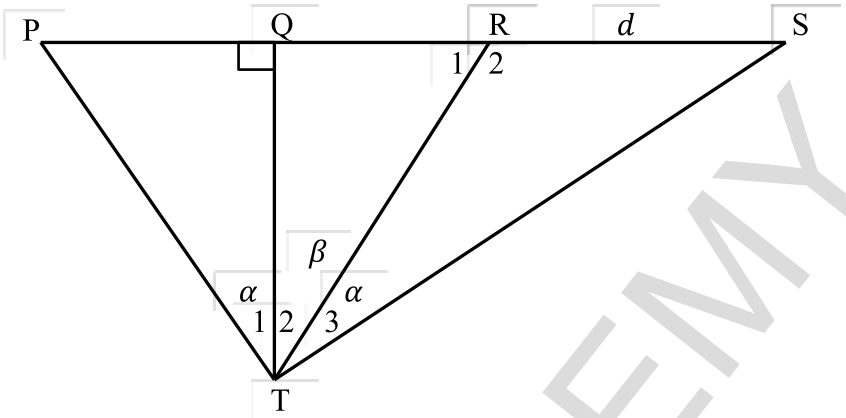
[17]

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QUESTION 8

In the figure below, PQRS forms a straight road. TQ, another road, is perpendicular to road PQRS. The distance RS $= d$ kilometres.
$\hat{T}_1 = \hat{T}_3 = \alpha$ and $Q\hat{T}S = \beta$



8.1 Write down the size of $Q\hat{T}R$ in terms of α and β.

(1)

8.2 In ΔSQT, write down the size of $\hat{S}$.

(1)

8.3 In ΔPQT, write down the size of $\hat{P}$.

(1)

8.4 Determine the length of RT in terms of α and β.

(3)

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8.5 Hence, or otherwise, show that:

$$PR = \frac{d \cos \beta \sin \beta}{\sin \alpha . \cos \alpha}$$

(3)
[9]

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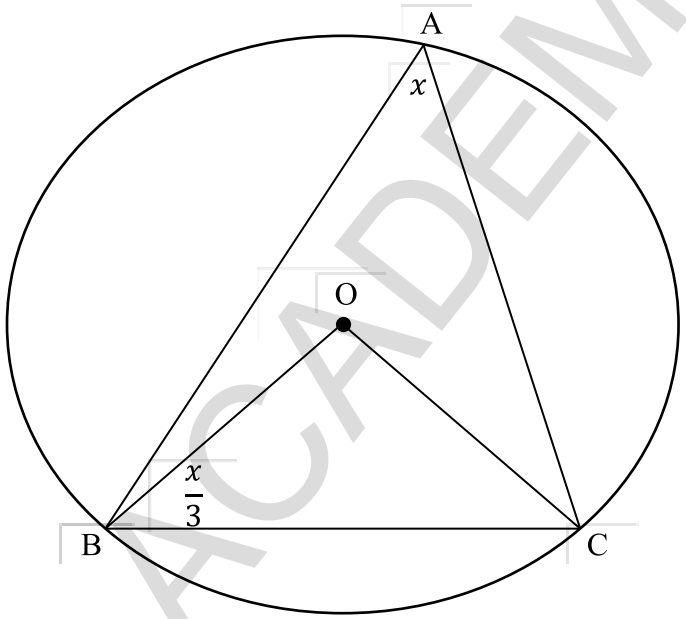
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QUESTION 9

9.1 Complete the statement: The angle at the ... is equal to two times the angle at the circumference of the circle.

(1)

9.2 In the diagram below, O is the centre of the circle with points A, B and C on the circumference of the circle. $\hat{BAC} = x$ and $\hat{OBC} = \frac{x}{3}$. Determine, with reasons, the value of x.

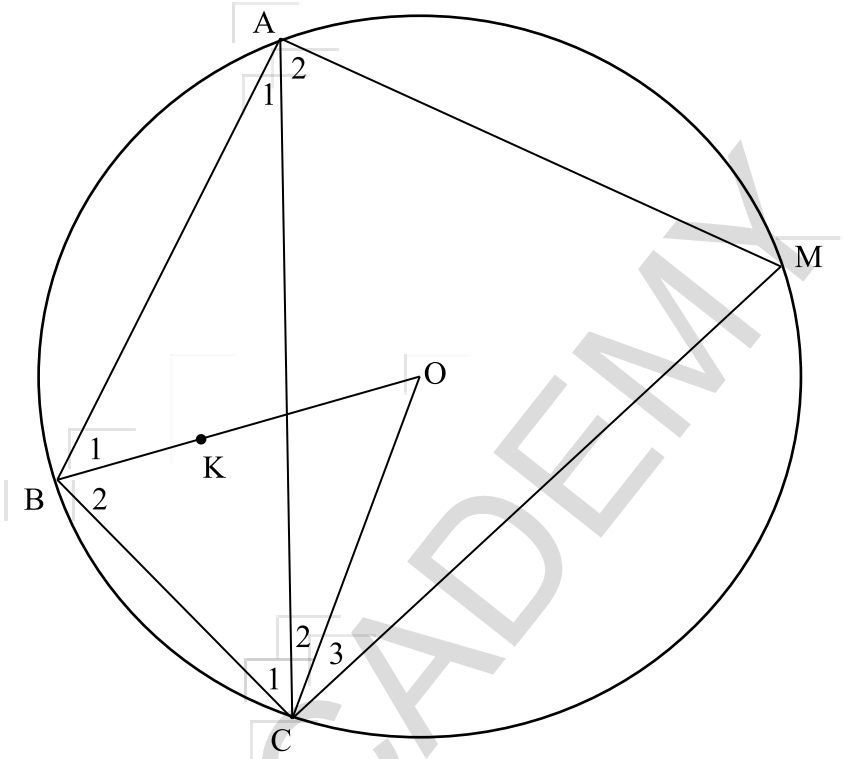


(6)

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9.3 In the diagram below, O is the centre of the circle passing through A, B, C and M. K is the centre of the circle (not drawn) passing through points A, B and C of Δ ABC such that K lies on radius BO. $\hat{A}_1 = 30^o$. BO bisects $\hat{ABC}$.



9.3.1 Determine the size of $\hat{B}_1$. (Give reasons for your answer.)

(5)

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9.3.2 Prove that $\hat{M} = 2\hat{A}_1$

(3)

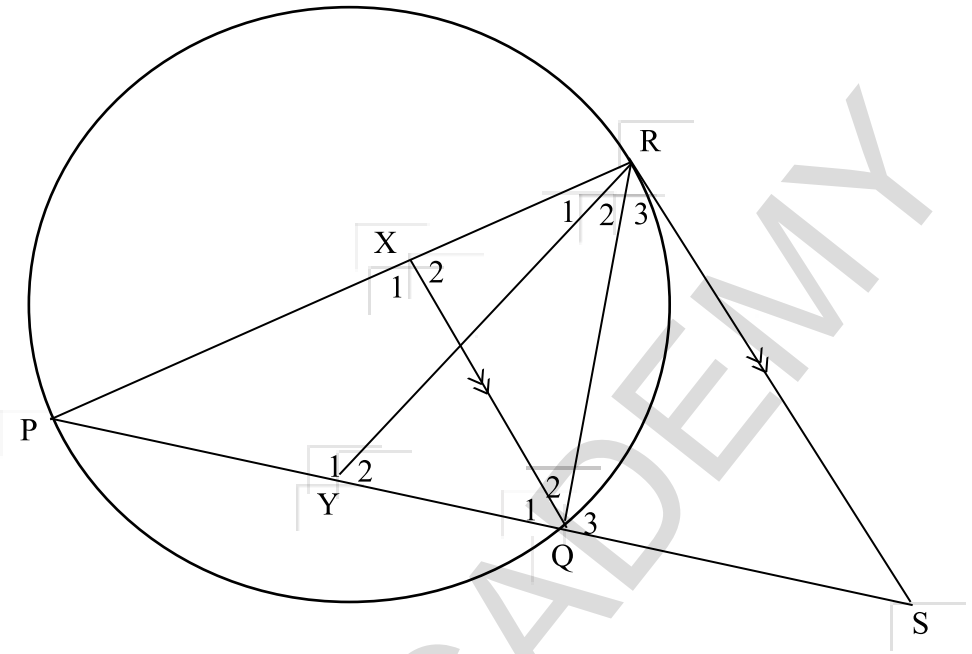
[15]

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QUESTION 10

In the diagram below, P, Q and R are points on a circle. YR bisects $\hat{P}RQ$ with Y on PQ. PQ is produced to meet RS at S such that SR = SY. QX ∥ SR.



10.1 Prove that SR is a tangent to the circle at R.

(6)

10.2 Prove that QR is a tangent to the circle passing through Q, X and P.

(3)
[9]

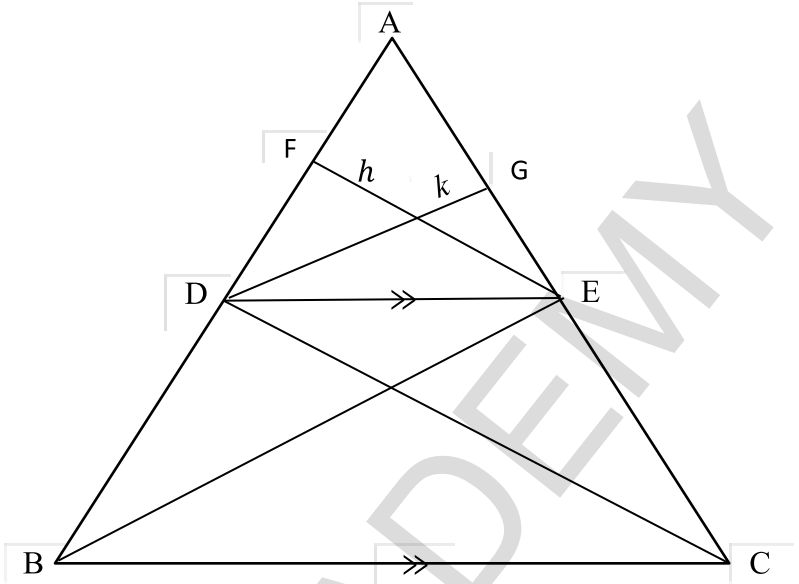
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QUESTION 11

11.1 In the diagram below D and E are points on sides AB and AC of ΔABC such that DE ∥ BC.

Use the diagram to prove the theorem which states that $\frac{AD}{DB} = \frac{AE}{EC}$.

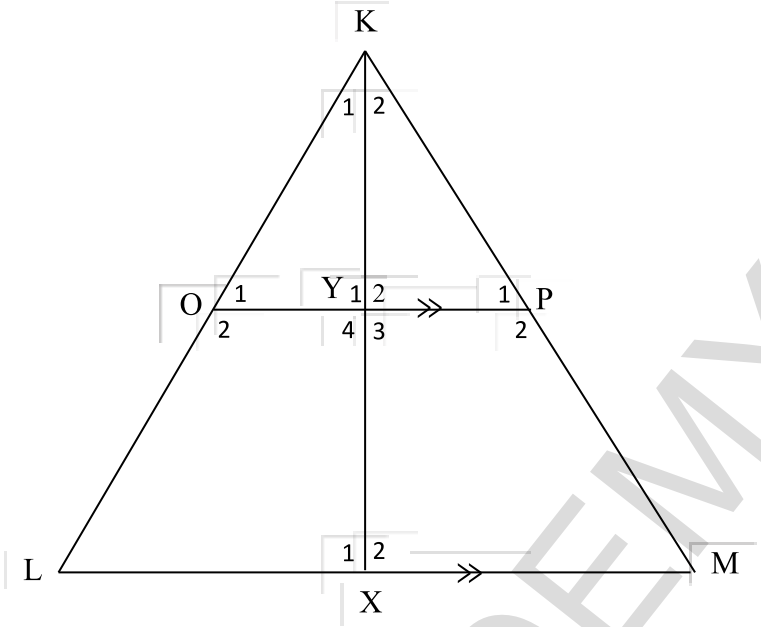


(6)

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11.2 In the diagram below, OP ∥ LM such that the area of Δ KOP = area of quadrilateral OLMP. KYX is perpendicular to OP and LM at Y and X respectively.



Prove that:

11.2.1 Δ KOP ||| Δ KLM

(3)

11.2.2 $\frac{KY}{KX} = \frac{OP}{LM}$

(2)

11.2.3 $\frac{KO}{KL} = \frac{1}{\sqrt{2}}$

(6)

[17]

TOTAL: 150

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Additional Space

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Additional Space

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END

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INFORMATION SHEET: MATHEMATICS

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$A = P(1+ni) \qquad A = P(1-ni) \qquad A = P(1-i)^n \qquad A = P(1+i)^n$$

$$F = \frac{x\left[(1+i)^n - 1\right]}{i} \qquad P = \frac{x\left[1-(1+i)^{-n}\right]}{i}$$

$$T_n = a + (n-1)d \qquad S_n = \frac{n}{2}\left(2a + (n-1)d\right)$$

$$T_n = ar^{n-1} \qquad S_n = \frac{a\left(r^n - 1\right)}{r-1} \;; \quad r \neq 1 \qquad S_\infty = \frac{a}{1-r}; \; -1 < r < 1$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \qquad \mathrm{M}\left(\frac{x_1 + x_2}{2}; \frac{y_1 + y_2}{2}\right)$$

$$y = mx + c \qquad y - y_1 = m(x - x_1) \qquad m = \frac{y_2 - y_1}{x_2 - x_1} \qquad m = \tan\theta$$

$$(x-a)^2 + (y-b)^2 = r^2$$

$$In\ \Delta ABC: \ \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} \qquad a^2 = b^2 + c^2 - 2bc.\cos A \qquad area\ \Delta ABC = \frac{1}{2}ab.\sin C$$

$$\sin(\alpha + \beta) = \sin\alpha.\cos\beta + \cos\alpha.\sin\beta \qquad \sin(\alpha - \beta) = \sin\alpha.\cos\beta - \cos\alpha.\sin\beta$$

$$\cos(\alpha + \beta) = \cos\alpha.\cos\beta - \sin\alpha.\sin\beta \qquad \cos(\alpha - \beta) = \cos\alpha.\cos\beta + \sin\alpha.\sin\beta$$

$$\cos 2\alpha = \begin{cases} \cos^2\alpha - \sin^2\alpha \\ 1 - 2\sin^2\alpha \\ 2\cos^2\alpha - 1 \end{cases} \qquad \sin 2\alpha = 2\sin\alpha.\cos\alpha$$

$$\bar{x} = \frac{\sum x}{n} \qquad \sigma^2 = \frac{\sum_{i=1}^{n}\left(x_i - \bar{x}\right)^2}{n} \qquad P(A) = \frac{n(A)}{n(S)} \qquad P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$$

$$\hat{y} = a + bx \qquad b = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sum(x - \bar{x})^2}$$

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