HILLCREST HIGH SCHOOL

HILLCREST HIGH SCHOOL
INTERNAL ASSESSMENT

GRADE 11

MATHEMATICS
Paper 2
November 2022

MARKS: 150 **TIME:** 3 hours

NAME : _____

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EXAMINER	MODERATOR		

This question paper consists of 20 pages.

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
MARK	11	14	14	13	25	10	13	10	14	8	6	12	150
MARKS													

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This question paper consists of **12** questions.
2. Answer ALL the questions.
3. Answer the questions correctly according to the numbering system used in this question paper.
4. Clearly show ALL calculations, diagrams, graphs, etc. that you have used in determining your answers.
5. Answers only will NOT necessarily be awarded full marks.
6. You may use an approved scientific calculator (non-programmable and non-graphical), unless stated otherwise.
7. If necessary, round off answers to TWO decimal places, unless stated otherwise.
8. Diagrams are NOT necessarily drawn to scale.
9. Formulae is included at the beginning of the question paper.
10. Write neatly and legibly.

INFORMATION SHEET: MATHEMATICS

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

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

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

$$In\ \Delta ABC: \qquad \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc.\cos A$$

$$area\ \Delta ABC = \frac{1}{2}ab.\sin C$$

QUESTION 1

Mr Ngwane is the sales manager for a furniture shop. Every month his 15 staff members report on the number of customers who visited during the previous month.

The results were given as follows:

12 15 15 19 22 23 26 26 32 33 33 33 33 35 35

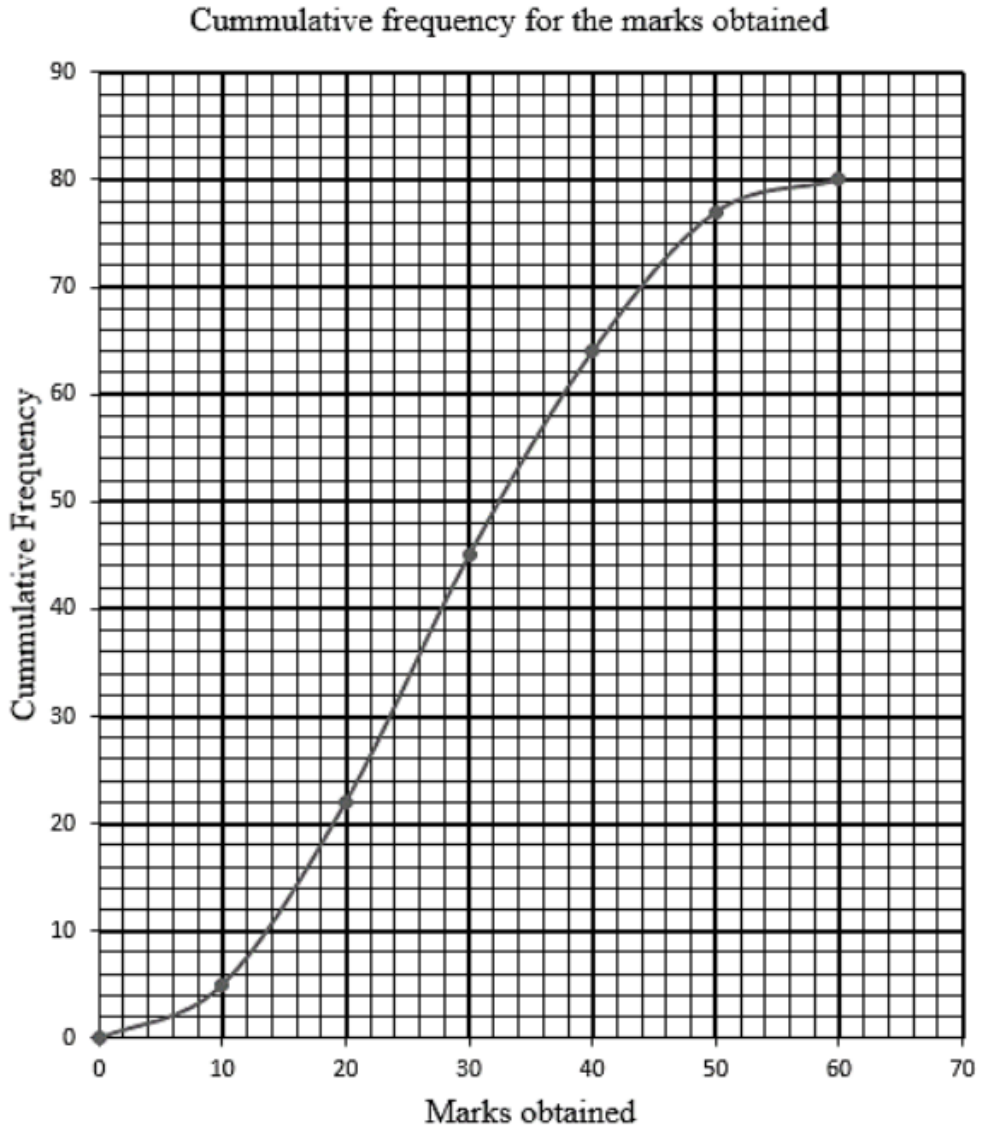
Determine the:

1.1	Median of the data	(1)
1.2	Interquartile range	(3)
1.3	Mean of the data	(2)
1.4	Standard deviation of the data.	(2)
1.5	Percentage of customers who visited the furniture shop that are outside one standard deviation of the mean.	(3)
		[11]

QUESTION 2

2.1 A group of learners wrote a standardised English test that was scored out of 60.

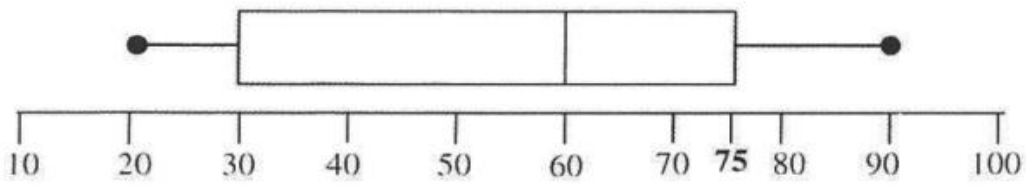
The results were represented in a cumulative frequency graph below.



2.1.1	How many learners wrote the test?	(1)
2.1.2	How many learners scored at least 20 out of 60?	(2)
2.1.3	Using the graph, estimate the median test score, and present it as a percentage.	(2)
	(Also indicate on your graph)	

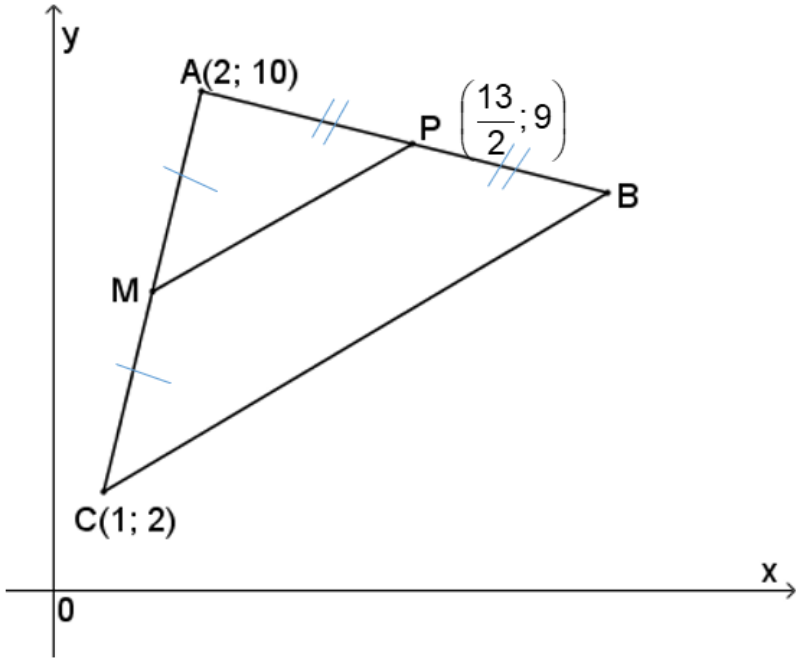
2.1.4	Use the graph above to complete the frequency table below:	(3)

Marks obtained	Frequency
$0<x\leq10$	
$10<x\leq20$	
$20<x\leq30$	
$30<x\leq40$	
$40<x\leq50$	
$50<x\leq60$	

2.1.5	Write down the modal group from the above table.	(1)
2.1.6	How many learners achieved more than 40 out of 60 for the test?	(1)
2.2	The box and whisker diagram below shows the marks obtained by a class of 19 learners in a Mathematics test. The test was out of 100 marks.  	
2.2.1	Describe the skewness of the data.	(1)
2.2.2	If the pass requirement for the test is 30% and only one learner obtained 30% in the test, estimate the number of learners who failed the test.	(3)
		[14]

QUESTION 3

3.1 Consider the sketch below. M is the **midpoint** of AC and P is the midpoint of AB. The ⊥height of ΔAMP is 3 units.



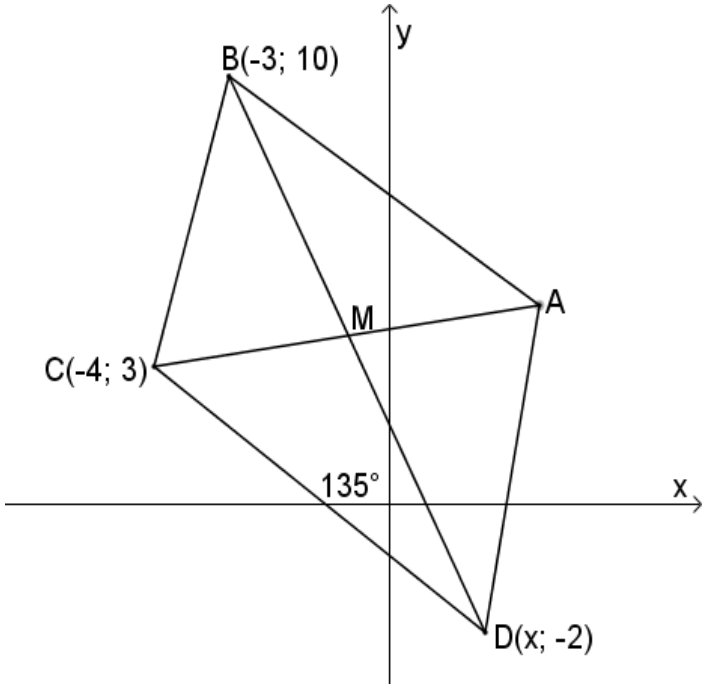
3.1.1	Calculate the length of MP, if M is the midpoint of AC.	(4)
3.1.2	Hence, give the length of BC, with a reason.	(2)
3.1.3	Determine the area of ΔAMP.	(3)

3.2	Calculate the value(s) of k, if points A (–1; 1), B (k; 7) and C (5; $k + 11$) are collinear.	(5)
		[14]

QUESTION 4

Drawn below is **parallelogram** ABCD with M as the midpoint of AC and BD.

The equation of AD is $y = 7x - 9$ and the inclination of CD is 135° with the x-axis as shown.



4.1	Prove that the equation of line DC is $y = -x - 1$	(3)

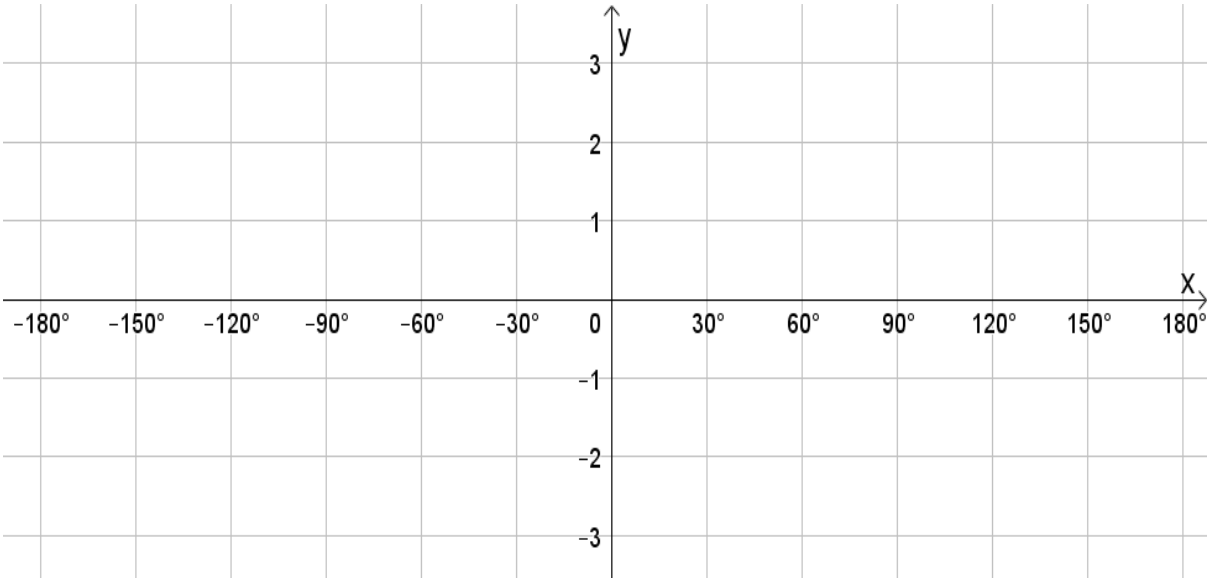
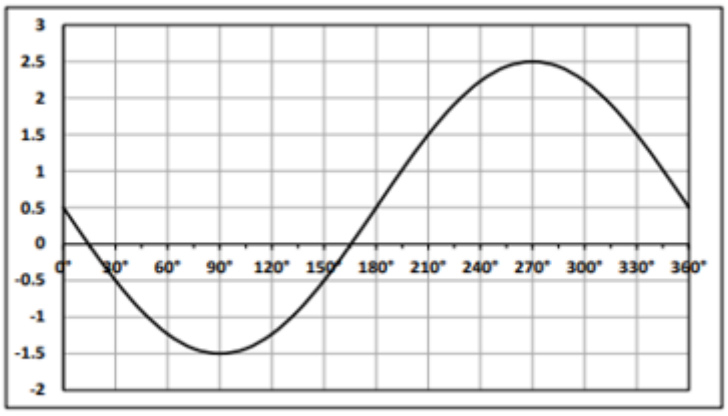
4.2	If the equation of AD is $y = 7x - 9$, determine the value of the *x*-coordinate of D.	(2)
4.3	Determine the coordinates of A.	(2)
4.4	Calculate the size of angle ADC, showing all your calculations.	(3)
4.5	If the gradient of AC is $\frac{1}{3}$, and it is given that $D(1;-2)$. Show that BD ⊥ AC, to prove ABCD a rhombus.	(3)
		[13]

QUESTION 5

5.1	If $\cos\theta = t$, without a calculator, and with the aid of a diagram shown, express each of the following in terms of t.		
	5.1.1	$\sin(90^\circ + \theta)$	(2)
	5.1.2	$cos(180^\circ + \theta)$	(2)
	5.1.3	$tan^2\theta$	(3)
5.2	If $sin\beta = \frac{4}{p}$ and $cos\beta = \frac{-3}{p}$ where $p > 0$, explain why $\beta \in [90°; 180°]$		(3)

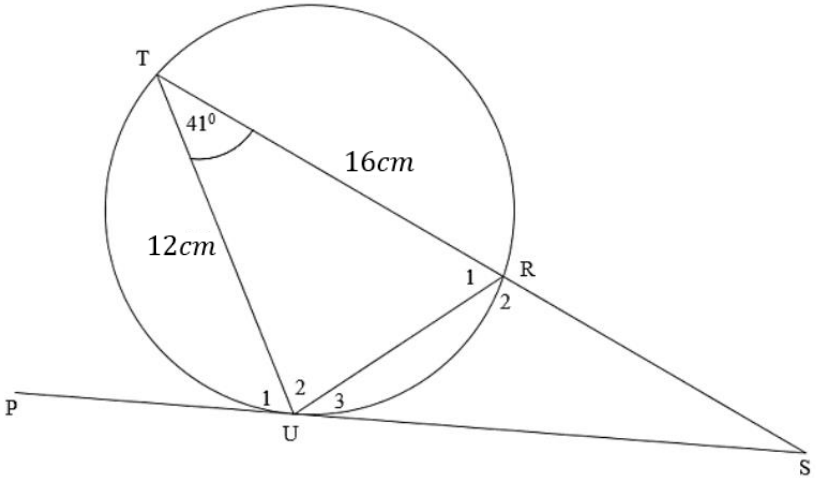
5.3	Simplify as far as possible, without a calculator:	(6)
	$\frac{sin(-\theta).cos(-120°).tan(180°-\theta)}{sin^2 225°.tan\theta.cos(90°-\theta)}$	
5.4	Prove the identity: $\frac{1}{(1+cos\,x)(1-cos\,x)} = \frac{1}{tan^2 x.cos^2 x}$	(4)
5.5	Determine the general solution for $2\,sin\,\theta - 1 = 0$.	(5)
		[25]

QUESTION 6

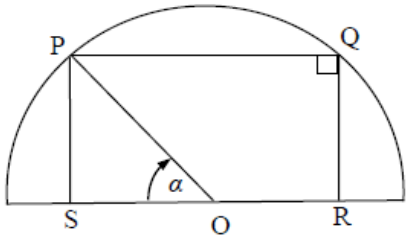
6.1	On the axes provided, sketch the graphs of $f(x) = cos(x - 30°)$ and $g(x) = \sin 3x$ where $-180° \leq x \leq 180°$.	(5)
		
6.1.1	Use the graphs above to determine the range of $g(x)$.	(2)
6.1.2	Use the graphs above to determine the period of $g(x)$.	(1)
6.2	Determine the equation of the following function f.	(2)
		
	$f(x) =$	**[10]**

QUESTION 7

7.1	Complete: $\ldots\ldots = a^2 + b^2 - 2ab\ cos\hat{C}$	(1)
7.2	SU is a tangent at U. $TU = 12cm$, $TR = 16cm$ and $\hat{T} = 41°$.	



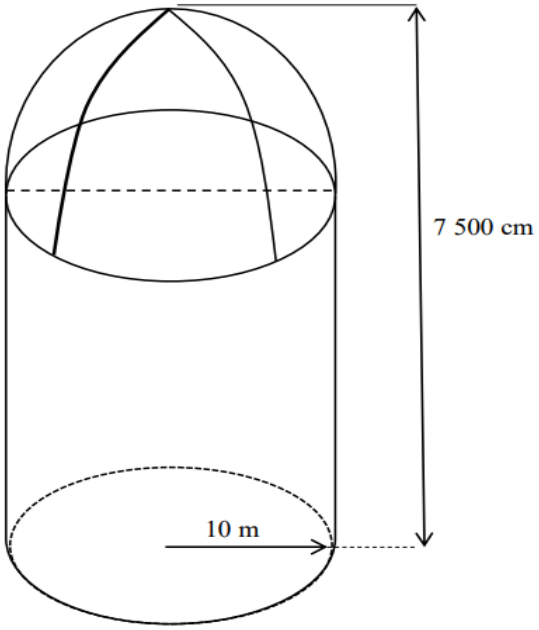
7.2.1	Calculate the length of UR (correct to 2 decimals)	(3)
7.2.2	Size of $\widehat{U}_2$	(2)
7.2.3	State the reason why $\widehat{U}_3 = 41°$ ( )	(1)
7.2.4	Total length of TRS	(4)

7.3	In the diagram, O is the centre of a semi-circle. PQRS is a rectangle drawn inside the semi-circle such that O lies on RS. $\hat{POS} = \alpha$. Calculate the size of α, for which PQRS will be a square. 	(2)
		[13]

QUESTION 8

$$\textbf{Volume of sphere} = \frac{4}{3}\pi r^3 \qquad \textbf{Surface Area of sphere} = 4\pi r^2$$

The picture shows a storage tank in which a farmer store his grain. The tank is made up of a right cylinder with a hemisphere on top. The perpendicular height of the tank to the top is 7 500 cm and the radius of the tank is 10 m.



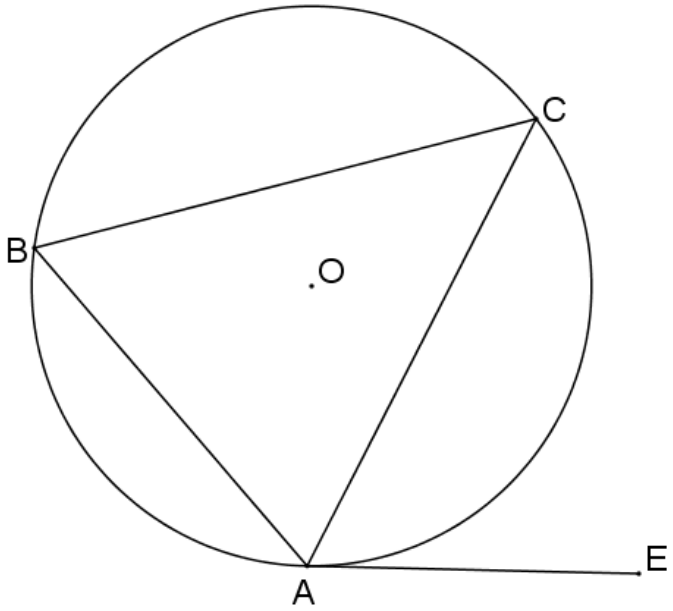
8.1	Calculate the height of the cylinder.	(2)
8.2	Calculate the volume of the tank.	(5)

8.3	Calculate the total surface area of the closed tank.	(3)
		[10]

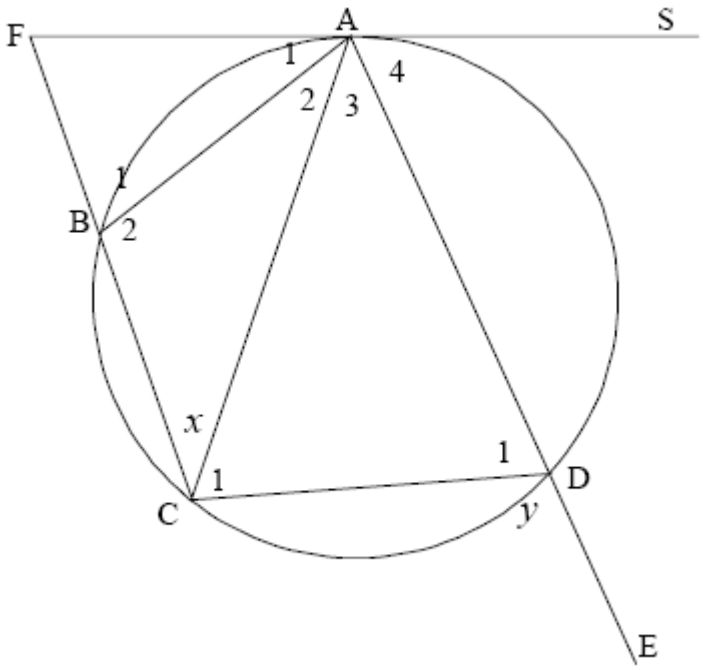
QUESTION 9

9.1

Prove the theorem that states the angle between a tangent and a chord is equal to the angle in the alternate segment.

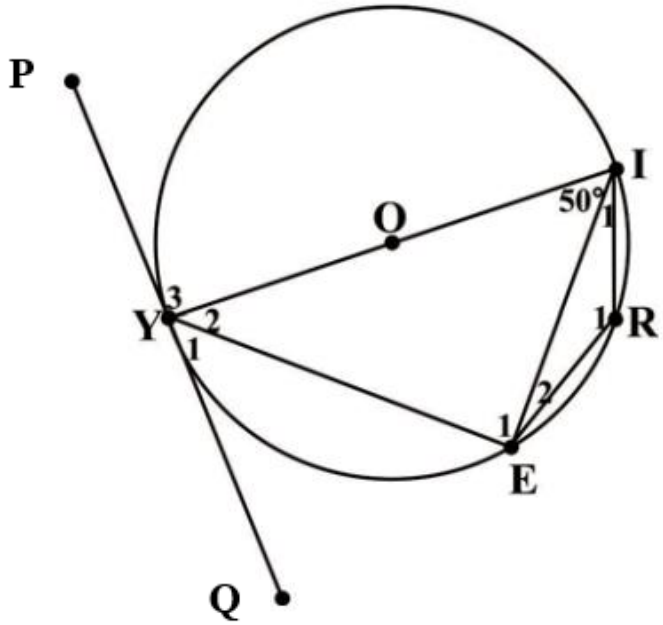


Given: Circle with centre O and tangent AE at A. B and C are points on the circumference of the circle.	(6)
Required to prove:	
Construction:	
Proof:	

9.2	In the figure below, ABCD is a cyclic quadrilateral and FAS is a tangent meeting CB produced at F. AD is produced to E. $E\hat{D}C = y$ and $A\hat{C}B = x$.  	
9.2.1	State, giving a reason, one other angle equal to *x*.	(2)
9.2.2	State, giving reasons, two other angles each equal to *y*.	(4)
9.2.3	Write down $\hat{F}$ in terms of *x* and *y*, with a reason.	(2)
		[14]

QUESTION 10

In the diagram, O is the centre of the circle and angle $YIE = 50°$. PYQ is a tangent to the circle.



Determine, with the reasons, the size of the following angles:

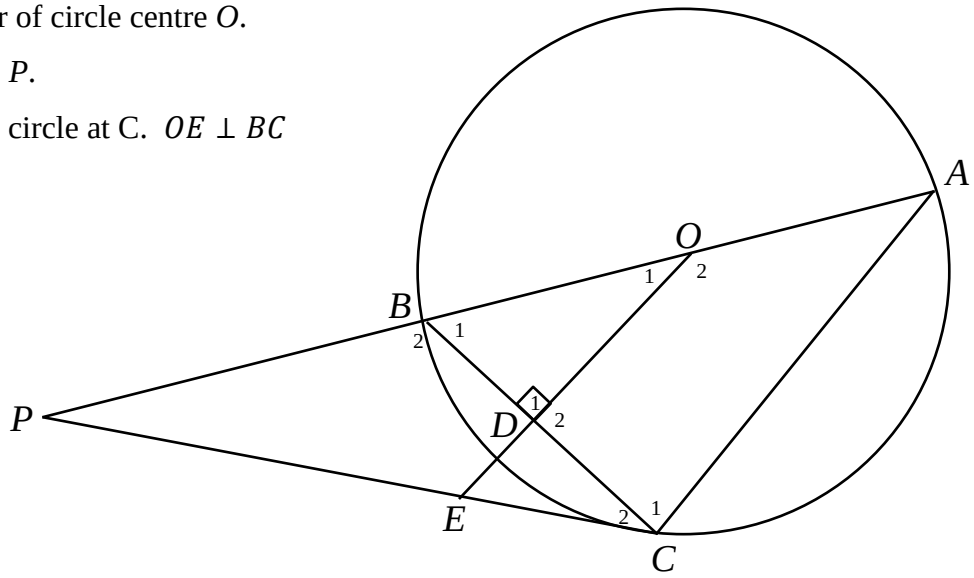
10.1	$\hat{E}_1$	(2)
10.2	$\hat{Y}_1$	(2)
10.3	$\hat{Y}_2$	(2)
10.4	$\hat{R}_1$	(2)
		[8]

QUESTION 11

AB is the diameter of circle centre *O*.

AB is produced to *P*.

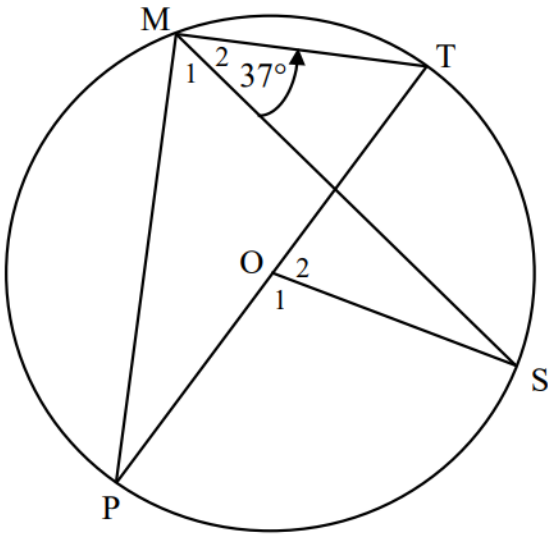
PC is a tangent to circle at C. $OE \perp BC$



11.1	Prove that $OE \parallel AC$	(2)
11.2	If $\hat{C}_2 = 23°$, name (with reasons) 2 other angles equal to $\hat{C}_2$.	(2)
11.3	Calculate the size of $\hat{P}$.	(2)
		[6]

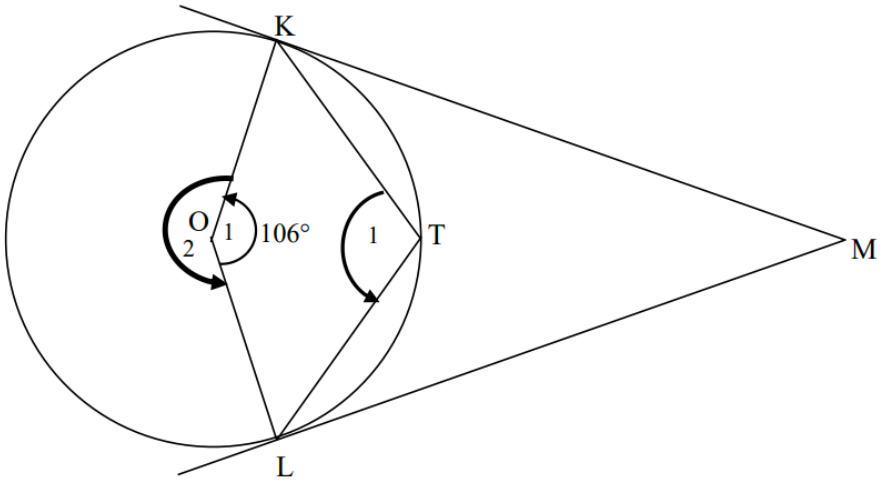
QUESTION 12

12.1
In the diagram below, PT is a diameter of the circle with centre O. M and S are points on the circle on either side of PT.
$\widehat{M}_2$ = 37°



Calculate, with reasons, the size of:

12.1.1	$\widehat{M}_1$	(2)
12.1.2	$\hat{O}_1$	(2)

12.2	In the diagram O is the centre of the circle. KM and LM are **tangents** to the circle at K and L respectively. T is a point on the circumference of the circle. KT and TL are joined and $\hat{O}_1 = 106°$.  	
12.2.1	Calculate, with reasons, the size of $\hat{T}_1$.	(2)
12.2.2	Prove that quadrilateral OKML is a kite.	(3)
12.2.3	Prove that quadrilateral OKML is a cyclic quadrilateral.	(3)

		[12]
	TOTAL = 150	