

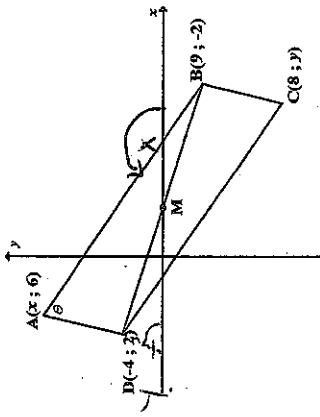
SECTION A

[33]

NAME: _____ TEACHER'S NAME: _____

QUESTION 1

In the diagram below ABCD is a parallelogram. A is the point (x; 6) and C is the point (8; y)



1) Calculate the coordinates of M, the midpoint of DB. (2)

$$\left(\frac{-4+9}{2}, \frac{3+(-2)}{2} \right)$$

$$\left(\frac{5}{2}, 0 \right)$$

2) Show that $x = -3$ and $y = -6$. (show all your working) (4)

$$\frac{x+8}{2} = \frac{5}{2} \Rightarrow x+8 = 5 \Rightarrow x = -3$$

$$\frac{y+(-2)}{2} = \frac{3}{2} \Rightarrow y+(-2) = 3 \Rightarrow y = -6$$

3) Calculate the equation of the line AB in the form $y = \dots$ (3)

$$m_{AB} = \frac{6-(-2)}{-3-9} = \frac{8}{-12} = -\frac{2}{3}$$

$$y - 6 = -\frac{2}{3}(x - x_1)$$

$$y - 6 = -\frac{2}{3}(x - (-3))$$

$$y - 6 = -\frac{2}{3}(x + 3)$$

$$y - 6 = -\frac{2}{3}x - 2$$

$$y = -\frac{2}{3}x + 4$$

4) Determine θ . (3)

$$m_{AB} = -\frac{2}{3}$$

$$m_{AD} \parallel m_{BC}$$

$$\tan \theta = 4$$

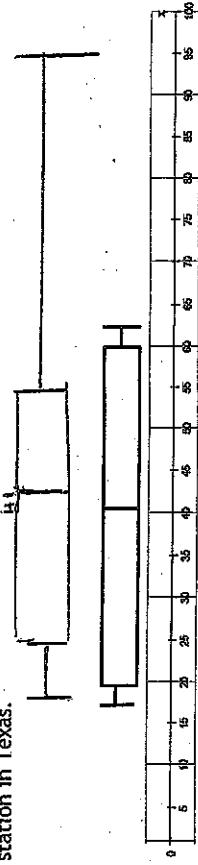
$$x = 146, 31^\circ$$

$$y = 75, 96^\circ$$

[12]

QUESTION 2

The following box and whisker plot represents the ages of the first 12 people at a polling station in Texas.



The following are the ages of the first 12 people at a different polling station in Florida.

- 18 ; 19 ; 25 ; 31 ; 36 ; 38 ; 44 ; 49 ; 53 ; 55 ; 60 ; 95

a) Draw the box and whisker of this data on the number line above with the Texas polling station information. 18 ; 25 ; 41 ; 65 ; 95. (3)

b) At which station does the middle 50% of the data have a smaller range? (2)

Florida.

c) Which station will have the lower mean age? Give a reason for your answer. (2)

Florida 43, 58 Texas - less than 10 data close

d) Are there any outliers in the ages of the people at the Florida station? If so identify them. (3)

$$LB = Q_2 - \frac{3}{2}IQR = 41 - \frac{3}{2}(20) = 11$$

$$UB = Q_2 + \frac{3}{2}IQR = 65 + \frac{3}{2}(20) = 80$$

U.B = 41 + 30 = 71 ; 95 is the outlier.

e) Is the data from the Florida polling station skewed? If it is skewed, state how it is skewed. (2)

Yes, skewed to the right.

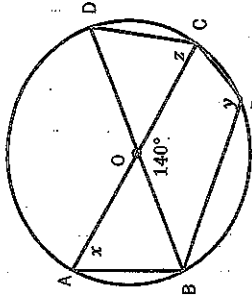
\bar{x} - median

$$43, 58 - 41 = 2, 58$$

[12]

QUESTION 3

- a) In the diagram below O is the centre of the circle. AC and BD are straight lines with A, B, P, C and D on the circumference of the circle. $\widehat{BOC} = 140^\circ$.



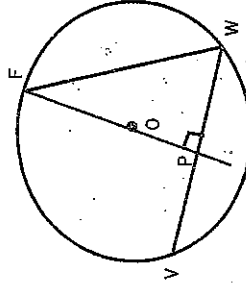
Determine, giving reasons, the value of x, y , and z .

$x = 70^\circ$ \angle at centre = $2x$ \angle at circumf. \checkmark

$y = 110^\circ$ opp \angle s of cyclic quad. \checkmark

$\widehat{D} = 70^\circ$ sub by BC; $\widehat{C} = 70^\circ$ isos Δ $CD = OC$. \checkmark (4)

- b) In the diagram below VW and FW are equal chords of the circle with centre O. FOP is a straight line with $FP \perp VW$. $PW = x$ units.



- i) Express PF in terms of x . $PF = (2x)^2 - x^2 = 3x^2$ (3)

$PW = VP$ \checkmark $PF = \sqrt{3}x$ \checkmark Pythag \checkmark
Line from O \perp to chord.

- ii) If $x = \sqrt{12}$ units, and the radius of the circle is 4 units. Calculate the length of OP. (2)

$PF = \sqrt{3} \times \sqrt{12} = \sqrt{36} = 6$

$\therefore r = 4$

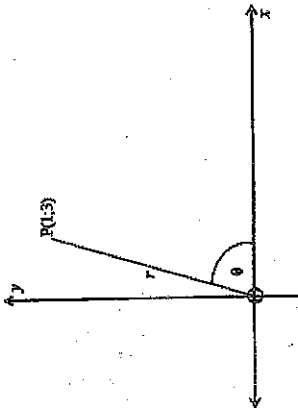
$\therefore OP = 2 \text{ units } \checkmark$ c.a. (9)

SECTION B

NAME: _____ TEACHER'S NAME: _____

[28]

QUESTION 4



You may not use a calculator for this question.

Making use of the diagram, calculate:

a) The value of r $r^2 = 1^2 + 3^2$ Pythag.
 $r = \sqrt{10}$ (2)

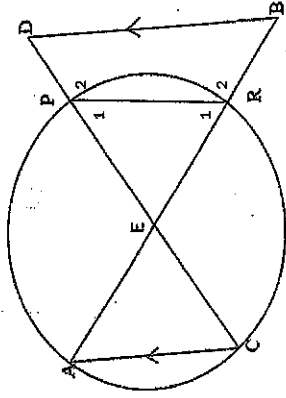
b) $\sin \theta = \frac{3}{\sqrt{10}}$ (1)

c) $\tan \theta = 10 \sin \theta \cos(180^\circ + \theta)$
 $\frac{3}{1} = 10 \times \frac{3}{\sqrt{10}} \times \frac{-1}{\sqrt{10}}$
 $3 + 3 = 6$ (4)

[7]

QUESTION 5

In the diagram, chords AR and CP intersect at E inside the circle. AR and CP are produced to B and D so that $AC \parallel BD$.



a) Prove that PDDBR is a cyclic quadrilateral. (4)

$\hat{A} = \hat{P}$, is in same seg.

$\hat{A} = \hat{B}$ alt. \angle s. $AC \parallel BD$.

$\therefore \hat{B}_1 = \hat{B}$

\therefore PDDBR cyclic converse \angle of cyclic quad.

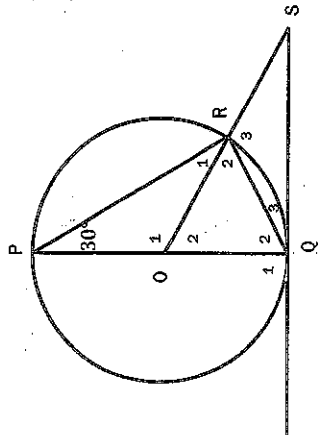
b) What property must E have so that $PR \parallel AC$? (2)

It must be the centre of the circle

[6]

QUESTION 6

In the diagram below PQ is the diameter of the circle. QS is a tangent to the circle at Q and OR produced meets the tangent at S. $\angle PQR = 30^\circ$

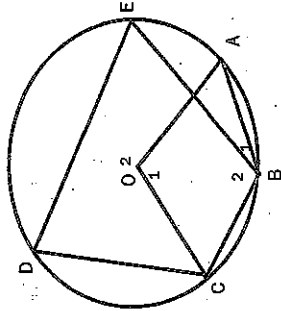


- a) Prove that ROQ is an equilateral triangle. (6)
- $\hat{C}_2 = 30^\circ$ tan / chord. $\hat{C}_3 = 90^\circ$ tan / rad
 $\hat{C}_1 = 60^\circ$ \angle is on str line
 $\therefore R_2 = 60^\circ$ $OQ = OR$ radii
 $\therefore \hat{O}_2 = 60^\circ$ \angle at centre = $2 \times \angle$ at circum.
 (or \angle sum of Δ)
 $\therefore OQR$ is equilateral.

- b) OR = RS (4)
- $\hat{S} = 90^\circ - 60^\circ = 30^\circ$. \angle sum of Δ ORS.
 $\hat{C}_2 = 30^\circ$
 $\therefore OR = RS$.
 but $OR = OQ$
 $\therefore OR = RS$. [10]

QUESTION 7

In the diagram below DCBE is a cyclic quadrilateral in the circle with centre O. $\hat{D} = 105^\circ$ and $\hat{B}_1 = 30^\circ$



Calculate the size of \hat{O}_1

$\hat{B} = 75^\circ$. opp \angle is cyclic quad
 $\therefore \hat{O}_2 = 2(175 + 30^\circ)$ \angle at centre
 $= 310^\circ$
 $\therefore \hat{O}_1 = 150^\circ$ reflexion.

[5]

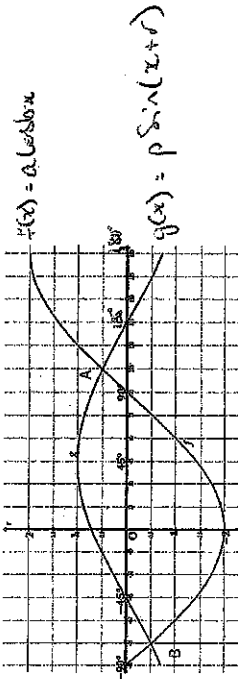
SECTION C

[32]

NAME: _____ TEACHER'S NAME: _____

QUESTION 8

- a) The diagram below shows the sketch graph of $f(x) = a \cos bx$ and $g(x) = p \sin(x+r)$ $x \in [-90^\circ; 180^\circ]$



- i) Write down the values of a, b, p and r .

$a = 2$ $b = 1$ $p = 1$ $r = 45^\circ$ (4)

- ii) What is the period of f 360° (1)

- iii) If A is the point $(105^\circ; \frac{1}{2})$ determine the co-ordinates of B. $(-75^\circ; -\frac{1}{2})$ (1)

- iv) Use the graph to determine the value(s) of x where $f(x) - g(x) = 0$ (2)

- v) Find x so that $f(x), g(x) < 0$. $x \in (-45^\circ; 90^\circ)$ $x \in (135^\circ; 180^\circ)$ (3)

- vi) Write down the equation of h if h is obtained by first moving the graph of g 45° to the right and the doubling the period. 45° shift $y = \sin x$
double period $y = \sin \frac{1}{2}x$ (2)

- vii) Give the value(s) for k such that $f(x) + k$ will have no roots. $k < -2$ $k > 2$ (2)

- b) Determine the general solution to:

$2 \cos^2 x + 5 \sin x = 4$ (6)

$2(1 - \sin^2 x) + 5 \sin x - 4 = 0$
 $2 - 2 \sin^2 x + 5 \sin x - 4 = 0$
 $2 \sin^2 x - 5 \sin x + 2 = 0$
 $(2 \sin x - 1)(\sin x - 2) = 0$
 $\sin x = \frac{1}{2}$ OR $\sin x = 2$
 keep 30° invalid

$x = 30^\circ + 360k$ OR $x = 150^\circ + 360k$ $k \in \mathbb{Z}$ (2)

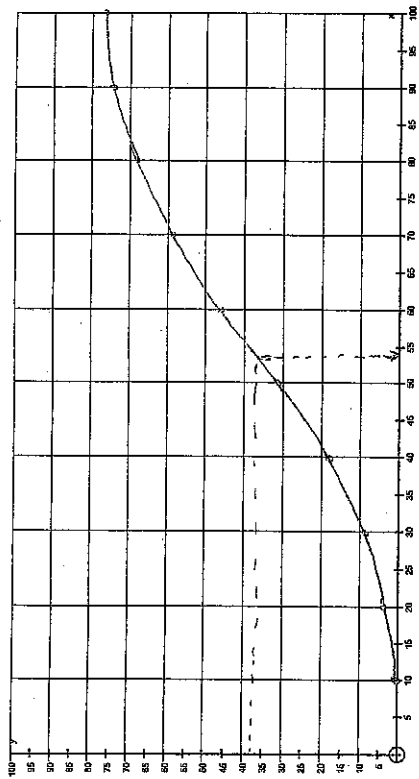
QUESTION 9

The following table represents the percentages, achieved in mathematics, of 75 of the grade 11 learners at a school.

- a) Complete the cumulative frequency table. (3)

Interval	Frequency	Cumulative frequency
$10 \leq x < 20$	3	3
$20 \leq x < 30$	6	9
$30 \leq x < 40$	10	19
$40 \leq x < 50$	12	31
$50 \leq x < 60$	15	46
$60 \leq x < 70$	13	59
$70 \leq x < 80$	9	68
$80 \leq x < 90$	5	73
$90 \leq x < 100$	2	75

b) Use the grid below to draw the ogive for the above data.



marks

c) The school decides that the pass mark for this test should be 50%. How many students passed the test?

44

d) The Ogive is used to determine the median of the data. The school decides that the marks are too low and that 5% should be added onto each mark. What is the new median.

$$\frac{75}{2} = 37.5 \quad \text{The median is } 55\%$$

\therefore new median 60%

[11]

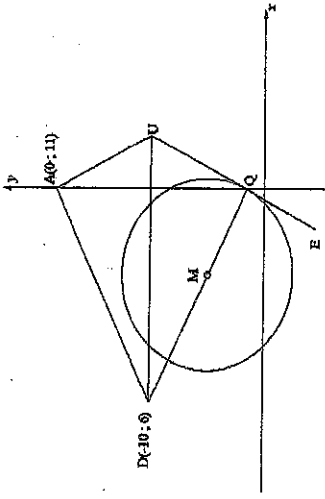
SECTION D

[32]

NAME: _____ TEACHER'S NAME: _____

QUESTION 10

$x^2 + y^2 + 8x - 6y = -5$ is the equation of the circle with centre M. UE is a tangent to the circle at Q, a point on the Y axis. QMD, AD, AQ and UQE are all straight lines. DU is parallel to the x-axis.



a) Calculate the co-ordinates of M, the centre of the circle. (4)

$$x^2 + 8x + 16 + y^2 - 6y + 9 = -5 + 16 + 9$$

$$(x+4)^2 + (y-3)^2 = 20$$

$$M(-4, 3)$$

b) Calculate the co-ordinates of Q if $y < 2$. (3)

$$(y-3)^2 = 4$$

$$y - 3 = \pm 2$$

$$\therefore y = 5 \text{ or } y = 1$$

$$\therefore (0, 1)$$

c) Calculate the equation of the tangent UE. (3)

$$M_{DE} = \frac{b-1}{-10-0} = -\frac{1}{10} \quad \therefore M_{DE} = 2$$

$$y = 2x + 1$$

d) Write down the equation of DU

$y = 6$

e) Calculate the co-ordinates of U.

$b = 2x + 1$
 $5/2 = x$ $u = (5/2, 6)$

f) Is M equidistant from P and U? Give evidence to support your answer.

$DM = \sqrt{(-10 - 4)^2 + (6 - 3)^2}$ [17]

$= \sqrt{145}$

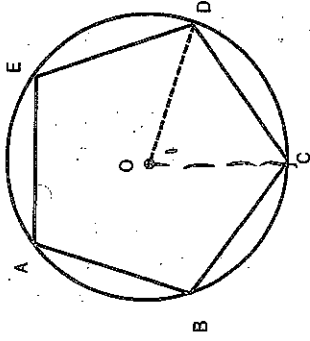
$MU = \sqrt{(-4 - 5/2)^2 + (6 - 6)^2}$
 $= \sqrt{51.25}$

No.

P.T.O

QUESTION 11

The figure shows a regular pentagon which is inscribed in a circle of radius 5cm.



Find the area and perimeter of this pentagon.

$\frac{360}{5} = 72^\circ$; $\hat{C} = 72^\circ$ reg pentagon.

$CO^2 = 5^2 + 5^2 - 2(5)(5) \cos 72^\circ$

$CO = 5.87$.

\therefore Perimeter = 29.35.

Area = $OCO = \frac{1}{2}(5)(5) \sin 72^\circ$
 $= 11.88 \text{ units}^2$

Area of pentagon = 5×11.88
 $= 59.44$

[7]

P.T.O