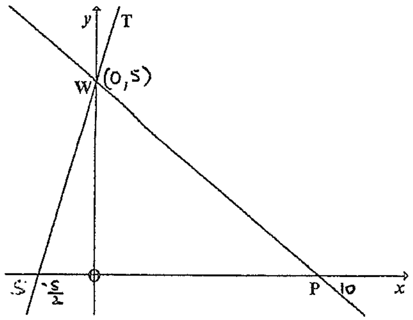
Adjusted !!

SECTION A

QUESTION 1

Refer to the sketch below:



In the diagram, straight lines TW and PW intersect at W.

The equation of TW is $y = 2x + 5$

Point W lies on the y-axis. Point P lies on the x-axis

(a) Determine the coordinates of W. (1)

$W(0;5)$ ✓A

(b) Given TW ⊥ WP, determine the equation of the straight line WP. (2)

$m_{TW} = 2 \quad \therefore \quad m_{WP} = -\frac{1}{2} \qquad W(0,5)$

$y - 5 = -\frac{1}{2}(x - 0) \qquad$ OR $\qquad y = mx + c$

$y = -\frac{1}{2}x + 5$ ✓✓A $\qquad y = -\frac{1}{2}x + 5$

(c) Determine the coordinates of P. (1)

(1)

$-\frac{1}{2}x + 5 = 0.$

$-\frac{1}{2}x = -5$

$x = 10 \qquad \therefore P(10,0)$ ✓✓A

(d) Calculate the area of △ WOP. (4)

(4)

Xint of TW : $0 = 2x + 5$

$x = -\frac{5}{2}$ ✓A $\qquad S(-\frac{5}{2};0)$

Area $= \frac{1}{2}(SP)(WO) \qquad SP = 10 - (-\frac{5}{2})$

$= \frac{1}{2}(\frac{25}{2})(5)$ ✓M $\qquad = \frac{25}{2}$ ✓A

$= 31,25u^2$ OR $\frac{125}{4}$

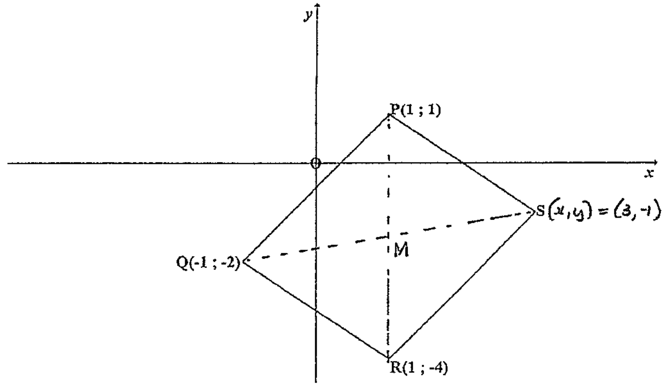
$= 31,3$ ✓CA

[8]

QUESTION 2

Refer to the sketch below:

Points P (1 ; 1), Q (–1 ; –2), and R (1 ; –4) are given. PQRS is a parallelogram.



(a) Determine the coordinates of point S. (4)

$M(\frac{1+1}{2};\frac{1-4}{2})$

$M(1;-\frac{3}{2})$

$S(x,y)$

$(1,-\frac{3}{2}) = (\frac{x-1}{2};\frac{y-2}{2})$

$\frac{x-1}{2} = 1 \qquad \frac{y-2}{2} = \frac{-3}{2}$

$x = 2+1 \qquad y = -3+2$

$x = 3 \qquad y = -1 \qquad \therefore S(3,-1)$

alt method

$x_Q \rightarrow x_P \rightarrow$ 2 right.

$x_R \rightarrow x_S \rightarrow$ 2 right

$x_S = 1+2 = 3$

$y_Q \rightarrow y_P \rightarrow$ 3 up.

$y_S \rightarrow -4+3 = -1$

(b) Prove that PQRS is **not** a Rhombus. (4)

$PQ = \sqrt{(1+1)^2+(1+2)^2}$

$= \sqrt{4+9}$

$= \sqrt{13}$

$QR = \sqrt{(1+1)^2+(-4+2)^2}$

$= \sqrt{4+4}$

$= \sqrt{8}$

$= 2\sqrt{2}$

$PQ \neq QR$

adj sides not eq

$\therefore$ Not Rhombus

$m_{QS} = \frac{-2+1}{-1-3}$

$= \frac{-1}{-4}$

$m_{PR} = \frac{1+4}{1-1}$

undef

$\therefore m_{QS} \times m_{PR} \neq -1$

$\therefore$ not ⊥

diag do not intersect @ 90°

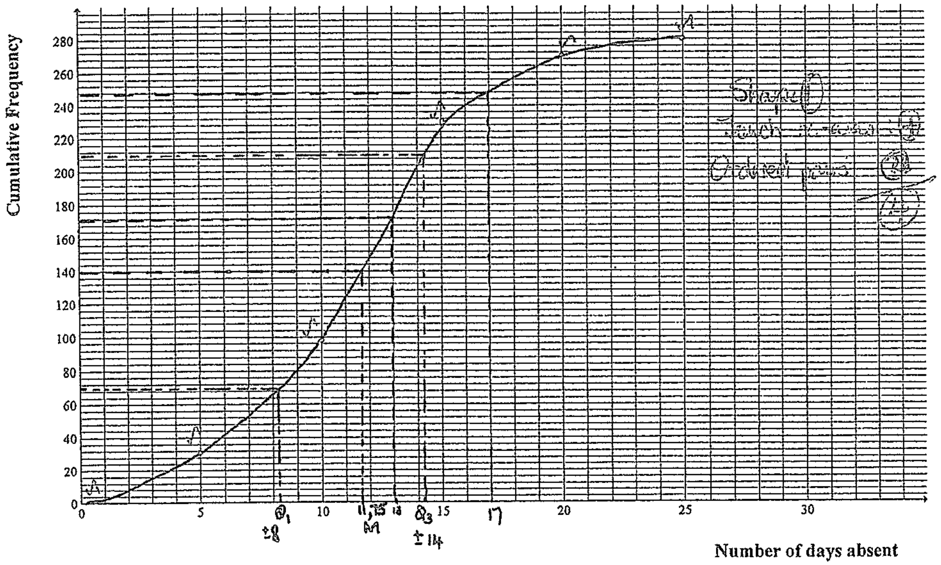
[8]

QUESTION 3

The following table shows the absenteeism of 280 employees of a company in one year.

Number of Days Absent	Frequency	Cumulative Frequency
$0 < d \leq 5$	32	32
$5 < d \leq 10$	67	99
$10 < d \leq 15$	131	230
$15 < d \leq 20$	43	273
$20 < d \leq 25$	7	280

(a) On the grid below, draw an Ogive, using the information in the table above. (4)



(b) Using the given information, determine the approximate number of employees absent:

(i) 13 days or less. (1)

230 or less (table) 172 or less (ogive)

(ii) more than 17 days. (1)

50 or less (table) $280 - 248 = 32$ or less (ogive)

(c) Determine:

(i) the median number of days absent. (1)

± 11 days (from graph)

In the interval $10 < d \leq 15$ (from table)

$\therefore \frac{15+10}{2} = 12{,}5$ days.

(ii) the inter-quartile range of days absent. (3)

$Q_1 = \pm 8$

$Q_3 = \pm 14$

$IQR = \pm 6$

(iii) the percentage of workers absent for more than 20 days. (2)

$\frac{7}{280} \times 100$

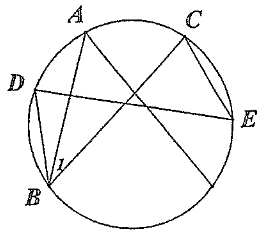
$= 2{,}5\ \%$

[12]

QUESTION 4

Circle the correct solution only.

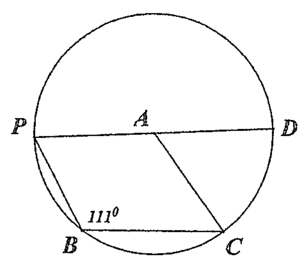
(a)



A, B, C, D, and E are points on the circumference of the circle.
Which statement is true? (1)

A. $\hat{A} = \hat{C}$ B. $\hat{D} = \hat{C}$
C. $\hat{A} = \hat{D}$ D. $\hat{B}_1 = \hat{E}$

(b)

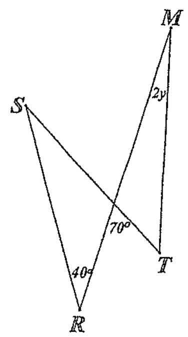


A is the centre of the circle, PAD is a straight line, and $\hat{B} = 111°$.

Determine the magnitude of $C\hat{A}D$. (2)

A. 69° B. 62°
C. 59° D. 42°

(c)

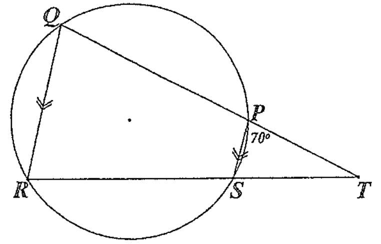


S, R, T and M lie on the circumference of a circle.
Determine the numerical value of y. (2)

A. 35° B. 30°
C. 20° D. 15°

[5]

(e)



In the figure, PS // QR and $T\hat{P}S = 70°$.

Determine the magnitude of $\hat{T}$. (2)

A. 70° B. 10°

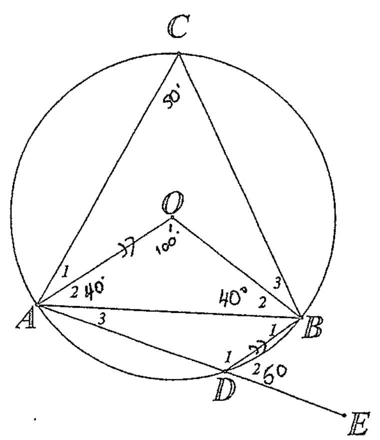
C. 40° D. 15°

C

[10]

QUESTION 5

Refer to the figure below:



O is the centre of the circle CADB. $\hat{B}_2 = 40°$.

Determine the following, **stating all necessary reasons:**

(a) $\hat{D}_2$. (5)

$OA = OB$ radii

$\hat{A}_2 = \hat{B}_2 = 40°$ isos Δ; given $\hat{B}_2$

$\hat{O}_1 = 100°$ 3 <'s Δ

$\hat{C} = 50°$ $\angle$ centre = 2 $\angle$ circum.

$\hat{D}_2 = 50°$ ext $\angle$ cycl. qd.

(5)

(b) $Q\hat{A}D$, if AO // DB. (2)

$\hat{A}_2 + \hat{A}_3 = 50°$ corres <'s AO || DB

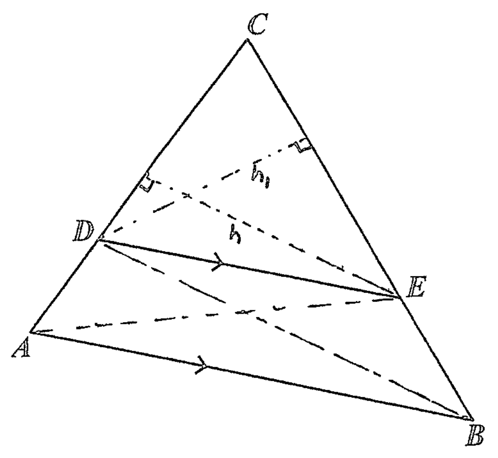
$\therefore \hat{A}_3 = 10°$

(2)

[7]

QUESTION 6

(a) Refer to the diagram below, and prove the theorem that states:
The line drawn parallel to one side of the triangle, divides the other two sides proportionally.



Given: $\triangle ABC$ with DE // AB

Prove: $\frac{CD}{DA} = \frac{CE}{EB}$, with reasons. (5)

Constr: Join AE; DB

Proof:

$\frac{\text{Area } \triangle CDE}{\text{Area } \triangle ADE} = \frac{\frac{1}{2}(CD)k}{\frac{1}{2}(AD)k}$ ✓ A

$\frac{\text{Area } \triangle CDE}{\text{Area } \triangle DEB} = \frac{\frac{1}{2}(CE)h_1}{\frac{1}{2}(EB)h_1}$ ✓ A

$= \frac{CE}{EB}$

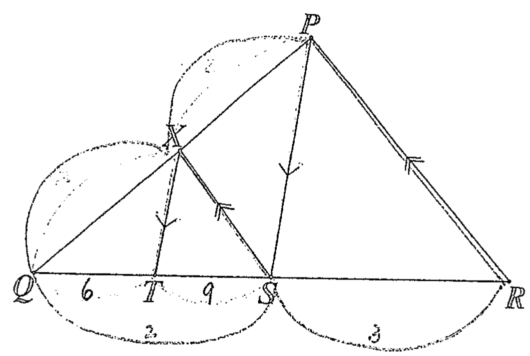
But Area $\triangle CDE$ is constant ✓

Area $\triangle ADE$ = Area $\triangle DEB$ ✓ ; same base DE; same ∥'el lines (DE∥AB) ∴ same height.

$\therefore \frac{CD}{AD} = \frac{CE}{EB}$

QUESTION 6

b)



In $\triangle$PQR, SP // XT; XS // PR; QT = 6 units; TS = 9 units.

(i) Determine, with reasons, the ratio: $\frac{QX}{XP}$ (2)

In $\triangle$QSP

XT ∥ SP ✓ given.

$\therefore \frac{QT}{TS} = \frac{QX}{XP} = \frac{6}{9} = \frac{2}{3}$ ✓ prop thm (2)

(ii) Hence, calculate, with reasons, the length of SR. (3)

In $\triangle$ QRP

∵ XS ∥ PR given

$\therefore \frac{QX}{XP} = \frac{QS}{SR} = \frac{2}{3}$ ✓ prop thm

But $\frac{QS}{SR} = \frac{2}{3} = \frac{15}{SR}$ QS = 15 ✓

∴ 2SR = 45 ✓ m

SR = $\frac{45}{2}$ ✓ A

SR = 22,5 units

[5]

 [10]

QUESTION 7

A random sample of test results (as percentages) was taken from three Grade 12 classes:

Grade 12 A	35; 43; 56; 62; 76
Grade 12 B	25; 37; 52; 68; 87
Grade 12 C	26; 47; 38; 91; 65

(a) For each of the classes determine the:

(i) mean. (2)

(ii) median. (2)

(iii) standard deviation. (2)

Fill in your solutions in the table below:

	Mean ✓✓m	Median ✓✓m	Standard Deviation ✓✓m
Grade 12 A	54,4 ✓A	56 ✓A	14,37... ≈ 14,4 ✓A
Grade 12 B	53,8 ✓A	52 ✓A	21,99... ≈ 22 ✓A
Grade 12 C	53,4 ✓A	47 ✓A	22,7 ✓A

(b) Compare and discuss the results of the three classes. (2)

✓✓ for two good reasons, flexible!!

Mean : similar for all three classes

Grd 12 A: marks closely scattered round mean in comparison to grades 12 B and C

Grd 12 C : Median not truly reflective of marks achieved.

(c) If 5 marks are added to each mark in Grade 12 B, determine which of the measures: mean, median, and / or standard deviation will change.
No further calculation is required. (2)

Mean ✓R : Change by 5 marks (58,8)

Median ✓R : " " " (57)

Not s.d.

(−1) for any incorrect solution.

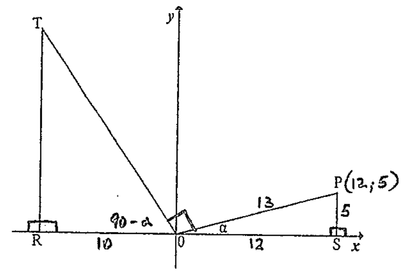
[10]

QUESTION 8

In the diagram below, P is the point (12 ; 5). OT ⊥ OP.

PS and TR are perpendicular to the x-axis.

$\hat{POS} = \alpha$. OR = 10 units.



Determine without the use of a calculator:

(a) $\cos\alpha$ (2)

In ΔOPS, OP = 13 ✓✓m Pythag

$\therefore \cos\alpha = \frac{12}{13}$ ✓A

(b) $\hat{TOR}$, in terms of α. (2)

$\hat{TOR} = 180 - (90 + \alpha)$ ✓m

$= 90 - \alpha$ ✓A

(c) the length of OT. (4)

In Δ TOR

$\cos(90 - \alpha) = \frac{OR}{OT}$ ✓m

$\therefore \sin\alpha = \frac{10}{OT}$ ✓A

$\sin\alpha = \frac{5}{13}$ ✓✓A from ΔPOS

$\therefore$

$\frac{10}{OT} = \frac{5}{13}$ ✓m

$\therefore 5OT = 130$

$OT = 26$ units. ✓A

OR Ratio ΔPOS $5:12:13 = y:x:r$. Ratio ΔTOR $x:y:r = 10:y:r$

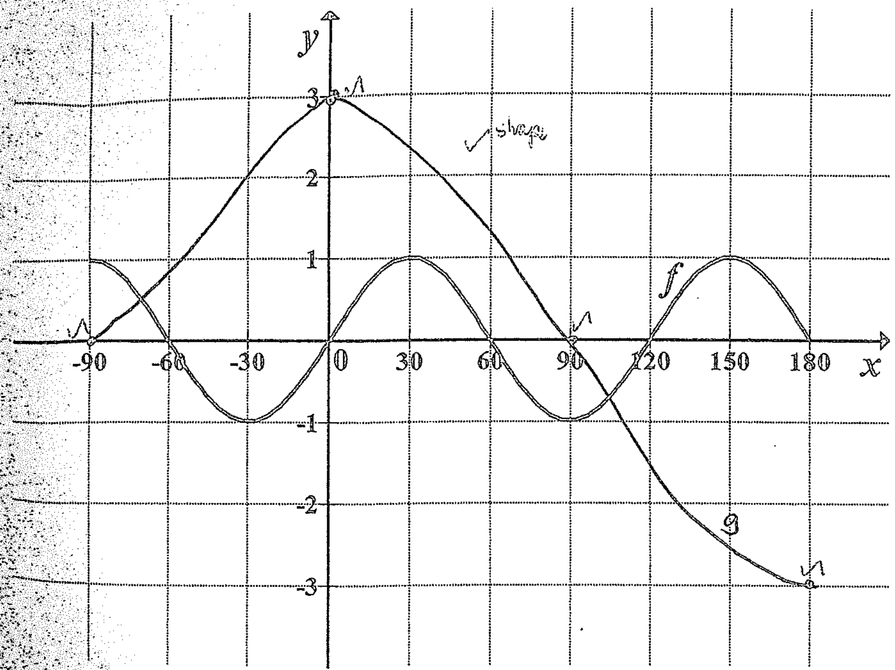
$\therefore$ Ratio doubles

$\therefore OT = 13 \times 2 = 26$.

[8]

QUESTION 9

(a) The graph $f(x) = \sin 3x;\ x \in [-90^\circ ; 180^\circ]$, is drawn below.



(a) Write down the period of f. (1)

120° ✓A

(b) Write down the solutions for $\sin 3x = -1$ in the interval $x \in [-90^\circ ; 180^\circ]$ (2)

$x = -30^\circ$ ✓A $x = 90^\circ$ ✓A

(c) If $h(x) = f(x) - 2$, determine the maximum value of h. (2)

$y = 1 - 2$ ✓M

Max value of h : $y = -1$ ✓A

(d) Draw the graph of $g(x) = 3\cos x$ for $x \in [-90^\circ ; 180^\circ]$ on the same system of axes. (3)

(e) Use the graphs to determine the number of solutions that exist for the equation $\frac{\sin 3x}{3} - \cos x = 0$ on the interval $x \in [-90^\circ ; 180^\circ]$. (2)

$\sin 3x - 3\cos x = 0$

$\therefore \sin 3x = 3\cos x$ ✓M

$\therefore$ Two ✓A solutions

(f) Use the graphs to solve: (4)

$f(x) \times g(x) \leq 0$

$x \in [-60^\circ ; 0^\circ]$ or $[60^\circ ; 90^\circ]$ or $[120^\circ ; 180^\circ]$

or $x = -90^\circ ; 0^\circ$

[14]

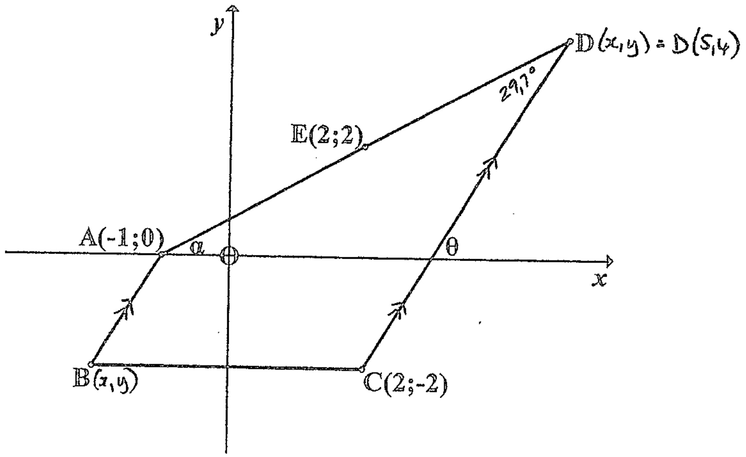
TOTAL FOR SECTION A = 70 MARKS

QUESTION 10

Refer to the sketch below, not drawn to scale:

Points A(-1; 0), C(2; -2), E(2; 2), and B lie in the Cartesian Plane.
E is the midpoint of AD. AB // DC; and 3AB = DC.

The angle of inclination of AD with the x-axis at A is α and
the angle of inclination of DC with the x-axis is θ



Determine:

(a) the coordinates of D. (2)

$E(2,2) = \left(\frac{x-1}{2} ; \frac{y+0}{2}\right)$ ✓M

$\therefore \frac{x-1}{2} = 2$ or $\frac{y}{2} = 2$

$\therefore x - 1 = 4$ $\quad y = 4$

$x = 5$ $\quad D(5,4)$ ✓A (2)

(b) the value of $A\hat{D}C$. (5)

$\tan\alpha = m_{AD}$ $\qquad \tan\theta = m_{DC}$

$= \frac{4}{6}$ $\qquad = \frac{6}{3}$

$= \frac{2}{3}$ ✓M $\qquad = 2$ ✓M

$\alpha = 33,69\ldots$ ✓A Ⓐ $\qquad \theta = 63,43\ldots$ ✓A Ⓑ

$\therefore A\hat{D}C = Ⓑ - Ⓐ$

$= 29,74\ldots$

$= 29,7°$ ✓A

(c) the coordinates of B, given $3AB = DC$ (8)

$AB = \sqrt{(x+1)^2 + (y)^2}$ ✓M $\qquad DC = \sqrt{(5-2)^2 + (4+2)^2}$

$= \sqrt{3^2 + 6^2}$

$= \sqrt{45}$ ✓M

$3AB = DC$

$\therefore 9AB^2 = DC^2$ ✓M

$9[(x+1)^2 + y^2] = 45$

$(x+1)^2 + y^2 = 5$ ✓A

$m_{AB} = \frac{y}{x+1}$ ✓M $\qquad m_{CD} = \frac{6}{3}$

$m_{CD} = 2$ ✓M

$AB \parallel CD$

$\therefore m_{AB} = m_{CD} = 2$

$\therefore \frac{y}{x+1} = 2$

$\therefore y = 2x + 2$ ✓A

[15]

Simult:

$(x+1)^2 + (2x+2)^2 - 5 = 0$ ✓M

$x^2 + 2x + 1 + 4x^2 + 8x + 4 - 5 = 0$

$5x^2 + 10x = 0$

$5x(x+2) = 0$ ✓A

$x = 0$ $\quad x = -2$

$y = 2$ $\quad y = -2$ $\qquad \therefore B(-2,-2)$ ✓A

QUESTION 11

The equation of AB is $ky + 3x = k - 1$.

Determine the numerical value of k:

(a) given that AB // CD and the equation of CD is $2y + 3x = 4$. (3)

AB: $ky = -3x + k - 1$

$y = -\frac{3}{k}x + \frac{(k-1)}{k}$ ✓M

AB: $\therefore m = \frac{-3}{k}$

$c = \frac{k-1}{k}$

CD: $y = -\frac{3}{2}x + 2$ ✓A

$\therefore$ AB∥CD $\Rightarrow m_{AB} = m_{CD}$

$-\frac{3}{k} = -\frac{3}{2}$ ✓M

$\therefore k = 2$ ✓A

(b) given that AB ⊥ CD. (2)

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

AB⊥CD $\therefore m_{AB} = +\frac{2}{3}$

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

$m_{CD} \times m_{AB} = -1$ ✓M

$\left(-\frac{3}{2}\right)\left(-\frac{3}{k}\right) = -1$ ✓M

$\frac{9}{2k} = -1$

$9 = -2k$

$k = -\frac{9}{2}$ ✓A

or/

$\therefore \frac{2}{3} = \frac{-3}{k}$

$2k = -9$

$k = -\frac{9}{2}$

(c) given that AB has the same y-intercept as CD. (2)

y-int CD : $y = 2$ y-int AB : $y = \frac{k-1}{k}$

$\therefore \frac{k-1}{k} = 2$ ✓M

$k - 1 = 2k$

$-1 = k$ ✓A

(d) given that AB // y-axis. (2)

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

AB∥y-axis ✓M

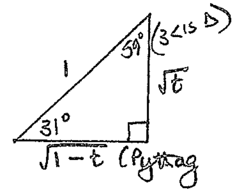
$\therefore$ m is undefined.

$\therefore k = 0$. ✓A

[9]

QUESTION 12

If $\sin 31^\circ = \sqrt{t}$, determine the following in terms of p:



(a) $\sin 211^\circ$. (2)

$= -\sin 31^\circ$ ✓M

$= -\sqrt{t}$ ✓A

(b) $\cos 31^\circ$. (2)

$= \sqrt{1 - \sin^2 31}$ ✓A

$= \sqrt{1 - t}$ ✓A

(c) $\cos 62^\circ$. (3)

$= \cos 2(31)$ ✓M

$= 2\cos^2 31 - 1$ ✓M

$= 2(\sqrt{1-t})^2 - 1$

$= 2(1-t) - 1$ ✓A

$= 2 - 2t - 1$

$= 1 - 2t$ ✓A

or

$\cos^2 31 - \sin^2 31$ ✓M

$= (\sqrt{1-t})^2 - (\sqrt{t})^2$ ✓A

$= 1 - t - t$

$= 1 - 2t$ ✓A

or

$1 - 2\sin^2 31$ ✓M

$= 1 - 2(\sqrt{t})^2$ ✓A

$= 1 - 2t$ ✓A

(d) $\sin 61^\circ$. (3)

$= \sin(30^\circ + 31^\circ)$ ✓M

$= \sin 30 \cos 31^\circ + \cos 30 \sin 31^\circ$ ✓A

$= \frac{1}{2}(\sqrt{1-t}) + \frac{\sqrt{3}}{2}(\sqrt{t})$ ✓A

$= \frac{\sqrt{1-t} + \sqrt{3t}}{2}$

[10]

QUESTION 13

(a) Solve for θ: $\sin(2\theta+10^\circ)=\cos\theta$, $\theta\in[-90^\circ;270^\circ]$ (6)

$\sin(2\theta+10^\circ) = \sin(90-\theta)$ ✓A

KEZI

$\therefore 2\theta+10^\circ = 90^\circ-\theta+360k$ ✓✓M OR $2\theta+10^\circ = 180-(90-\theta)+360k$ ✓✓M

$3\theta = 80+360k$ $2\theta+10^\circ = 90+\theta+360k$

$\theta = \frac{80}{3}+120k$ $\theta = 80+360k$ ✓A

$\theta = 26,6\ldots+120k$ ✓A

$\theta = 26,7^\circ$ ✓✓; $146,7^\circ$ ✓; $266,7^\circ$ ✓ $\theta = 80^\circ$ ✓✓ A (6)

OR

$\cos\theta = \sin(2\theta+10^\circ)$

$\cos\theta = \cos(90-(2\theta+10))$ ✓A

$\theta = \pm(90-2\theta-10^\circ)+360k$ ✓M

$\theta = \pm(80-2\theta)+360k$ ✓M

$\theta = 80-2\theta+360k$ OR $\theta = -80^\circ+2\theta+360k$

$3\theta = 80+360k$ $-\theta = -80^\circ+360k$

as above $\theta = 80^\circ-360k$ as above etc

(b) Prove that: $\sin 3x-\sin x = 2\cos 2x\sin x$ (5)

LHS $= \sin 3x - \sin x$ RHS $= 2\cos 2x\sin x$

$= \sin(2x+x)-\sin x$ ✓M

$= \sin 2x\cos x+\cos 2x\sin x-\sin x$ ✓A

$= 2\sin x\cos x\cos x-\sin x+\cos 2x\sin x$

$= \sin x(2\cos^2 x-1)+\cos 2x\sin x$ ✓M

$= \sin x(\cos 2x)+\cos 2x\sin x$ ✓A

$= 2\sin x\cos 2x$ ✓A

$=$ RHS

(c) Determine, without the use of a calculator, the value of:

$\tan 1^\circ\times\tan 2^\circ\times\tan 3^\circ\times\tan 4^\circ\times\ldots\ldots\times\tan 87^\circ\times\tan 88^\circ\times\tan 89^\circ$.

Show all your working. (4)

$= \frac{\sin 1}{\cos 1}\times\frac{\sin 2}{\cos 2}\times\frac{\sin 3}{\cos 3}\times\ldots\times\frac{\sin 87}{\cos 87}\times\frac{\sin 88}{\cos 88}\times\frac{\sin 89}{\cos 89}$ ✓M

use co-functions ✓A

$= \frac{\sin 1}{\cos 1}\times\frac{\sin 2}{\cos 2}\times\frac{\sin 3}{\cos 3}\times\ldots\times\frac{\cos 3}{\sin 3}\times\frac{\cos 2}{\sin 2}\times\frac{\cos 1}{\sin 1}$

cancel.

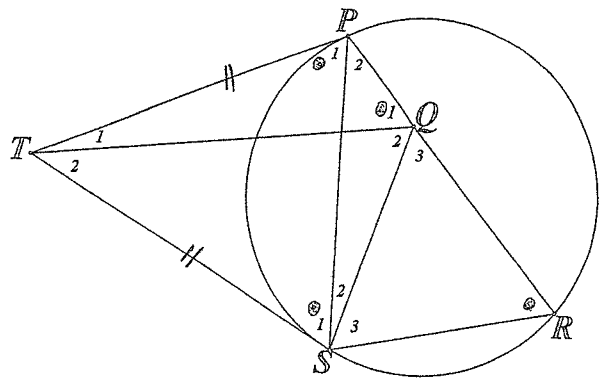
$= 1\times1\times1\times\ldots\frac{\sin 45}{\cos 45}\ldots\times1\times1\times1)$ ✓A ✓A

$= 1\times1\times1\times1\times\ldots1\ldots\times\ldots1\times1\times1)$

$= 1$ ✓A

[15]

QUESTION 14



TP and TS are tangents to the circle. Q is a point on PR such that $\hat{Q}_1 = \hat{P}_1$.

Prove the following, **stating all necessary reasons:**

(a) TQ // SR. (4)

TP = TS tang same pt.
$\therefore \hat{P}_1 = \hat{S}_1$ isos Δ
$\hat{P}_1 = \hat{Q}_1$ given.
$\therefore \hat{P}_1 = \hat{Q}_1 = \hat{S}_1$

$\hat{S}_1 = \hat{R}$ tang chd.
$\therefore \hat{S}_1 = \hat{R}_1 = \hat{P}_1 = \hat{Q}_1$

$\hat{Q} = \hat{R}$ proved.
$\therefore$ TQ || SR corres <'s eq.

Brief: Sol.
$\hat{P}_1 = \hat{Q}_1$ given.
$\hat{P}_1 = \hat{R}$ tang chd
$\therefore \hat{P}_1 = \hat{Q}_1 = \hat{R}$
$\therefore \hat{Q}_1 = \hat{R}$
$\therefore$ TQ || SR corres. <'s eq (4)

(b) QPTS is a cyclic quadrilateral. (2)

TP = TS tang same pt
$\hat{P}_1 = \hat{S}_1$ isos
But $\hat{P}_1 = \hat{Q}_1$ given.
$\therefore \hat{P}_1 = \hat{S}_1 = \hat{Q}_1$
$\therefore \hat{Q}_1 = \hat{S}_1$

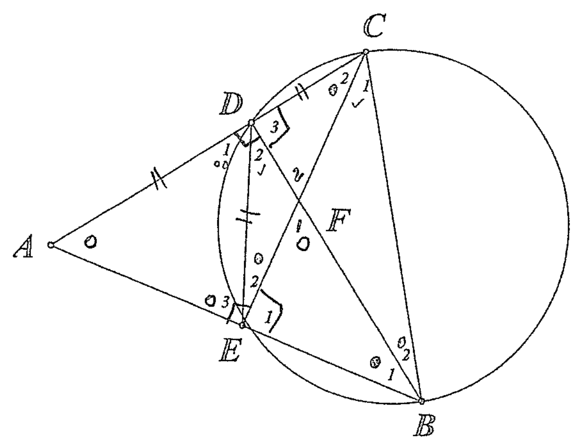
$\therefore$ QPTS cyclic qd <'s same seg CONV

(c) TQ bisects $S\hat{Q}P$. ie $\hat{Q}_1 = \hat{Q}_2$ (3)

$\hat{P}_1 = \hat{S}_1 = \hat{Q}_1$ proved above (b)
$\hat{P}_1 = \hat{Q}_2$ <'s same seg (QPTS cyclic qd) (6)
$\therefore \hat{P}_1 = \hat{Q}_2 = \hat{S}_1 = \hat{Q}_1$
$\therefore \hat{Q}_1 = \hat{Q}_2$

[9]

QUESTION 15



In the diagram, BC is the diameter of the circle.

BD bisects $A\hat{B}C$, and $\hat{A} = \hat{E}_3$

Prove:

(a) $BE.BA = BF.BD$ $\left(\frac{BE}{BF} = \frac{BD}{BA}\right)$ (ΔBEF) (ΔBAD) (5)

BC diameter — given.

$\therefore \hat{E}_1 = \hat{D}_3 = 90°$ — $\angle$ semi-circle.

$\therefore \hat{D}_1 + \hat{D}_2 = \hat{E}_2 + \hat{E}_3 = 90°$ — adj $\angle$'s st line.

In ΔBEF and ΔBAD.

$\hat{B}_1 = \hat{B}_1$ — ✓ common.

$\hat{E}_1 = \hat{D}_1 + \hat{D}_2 = 90°$; ✓ $\angle$ semi ⊙ and adj st line.

$\therefore \hat{F}_1 = \hat{A}$ — ✓ 3 $\angle$'s Δ.

$\therefore \Delta BEF \,|||\, \Delta BDA$ — ✓ AAA.

$\therefore \frac{BE}{BD} = \frac{EF}{DA} = \frac{BF}{BA}$ ✓ sides in prop.

$\therefore BE.BA = BD.BF$

(b) $AD^2 = DF.DB$ $\frac{AD}{DF} = \frac{DB}{AD}$ DC ✓ ΔDAB (5)

$\hat{C}_2 = \hat{B}_1$ — $\angle$'s same seg

$\hat{B}_1 = \hat{B}_2$ — given.

$\hat{B}_2 = \hat{E}_2$ — $\angle$'s same seg

$\therefore \hat{C}_2 = \hat{B}_1 = \hat{B}_2 = \hat{E}_2$ ✓ (*A)

$\therefore DE = DC$ — isos Δ; $\hat{C}_2 = \hat{E}_2$ proved

$AD = DE$ — given. $\hat{A} = \hat{E}_3$ isos Δ.

$\therefore DE = DC = AD$

$\frac{\cancel{BD}\ DC}{DF} = \frac{DC}{DF}$ — $AD = DC$

$\therefore \Delta DFC$ and ΔDAB

$\hat{C}_2 = \hat{B}_1$ — proved in *(A)

$\hat{D}_3 = \hat{D}_1 + \hat{D}_2 = 90°$ ✓ proved.

$\therefore \hat{F}_2 = \hat{A}$ — ✓ 3 $\angle$'s Δ

$\therefore \Delta CDF \,|||\, \Delta BDA$ — AAA

$\therefore \frac{CD}{BD} = \frac{DF}{DA} = \frac{CF}{BA}$ — sides in prop

$AD = CD$ ✓ — proved

$\therefore \frac{AD}{BD} = \frac{DF}{DA}$

$\therefore AD^2 = BD.DF$

[10]

TOTAL FOR SECTION B = 88 MARKS

Total: 159 marks