Prelim Paper 2
Memorandum

Question 1

a) $\text{Dist} = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Dist AQ $= \sqrt{37}$ ✓ $\approx 6,1$

QP $= \sqrt{13}$ ✓ $\approx 3,6$

PA $= 2\sqrt{17}$ ✓ $\approx 8,2$

Perimeter AQP = 17,9 units ✓ (4)

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b) If $m_{PS} = m_{SR}$ P, S and R are collinear

$$m_{PS} = \frac{6-2}{5-4\frac{1}{2}} = 8 \checkmark$$

$$m_{SR} = \frac{-2-2}{4-4\frac{1}{2}} = 8 \checkmark$$

$\therefore m_{PS} = m_{SR}$ ✓ (3)

$\therefore$ P, S and R are collinear

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c)

$$\text{midpt}_{AP} = \left(\frac{-3+4}{2}; \frac{4-2}{2}\right) \checkmark$$

$$= \left(\frac{1}{2}; 1\right) \checkmark$$

$\text{midpt}_{QT} = \left(\frac{1}{2}; 1\right)$ ✓ diags of parm bised ✓

T $\left(\frac{x+3}{2} = \frac{1}{2}; \frac{y+3}{2} = 1\right)$ T(-2;1) ✓ (5)

Question 2

a) $O\hat{T}R = 90°$ ✓ (line from centre bisects chord) ✓ (2)

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b)

$$m_{OT} = \frac{-6-0}{4-0} = -\frac{3}{2} \checkmark$$

$$\therefore m_{PR} = \frac{2}{3} \checkmark$$

Eq of PR:

Subst (4; -6) ✓

$$y + 6 = \frac{2}{3}(x - 4)$$

$$3y = 2x - 26$$ (3)

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c) For R: $0 = 2x - 26$ ✓

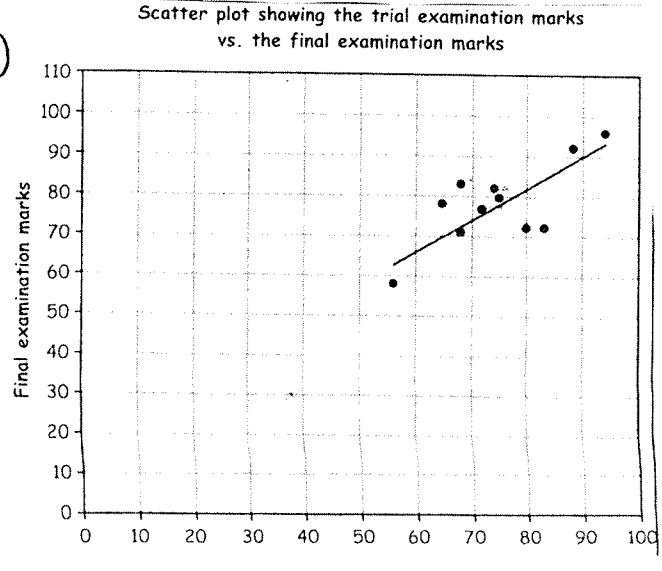
$\therefore x = 13$ ✓

R(13; 0)

$\therefore$ Radius = 13 ✓ (3)

Question 3

a)



(3)

Question 3

b)

$a = 25,38$ ✓ $\quad b = 0,71$ ✓

$y = a + bx$

$y = 25,38 + 0,71x$ ✓ (3)

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c) see a) (3)

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d) $r = 0,7$ ✓

Moderately strong, positive correlation ✓ (3)

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e) $y = 25,38 + 0,71(x)$ ✓

$= 25,38 + 0,71(50)$

$= 60,9\%$ ✓ (2)

Question 4

a) True ✓

b) True ✓

c) False ✓ (3)

Question 5

a) D ✓✓ (2)

b) i) $\frac{1220}{20}$ ✓ $= 61$ ✓ (2)

ii) $s^2 = \frac{1560}{20}$ ✓

$s = \sqrt{78}$ ✓ $= 8,8$ (3)

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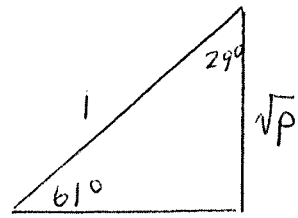
c) A

Question 6



$\sin 61° = p$

a) $\sin 241°$

$= \sin(180° + 61°)$ ✓

$= -\sin 61°$ ✓

$= -\sqrt{p}$ ✓ (3)

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b) $\cos 61° = \sqrt{1-p}$ ✓✓ (2)

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c) $\cos 73° \cos 44° + \sin 73° \sin 44°$

$= \cos(73° - 44°)$ ✓

$= \cos 29°$ ✓

$= \sin 61°$ ✓

$= \sqrt{p}$ ✓ (3)

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d) $\text{LHS} = \frac{\cos 2x - 1}{\sin 2x} - \tan x$

$= \frac{1 - 2\sin^2 x - 1}{2 \sin x \cos x} - \tan x$ ✓

$= \frac{-\sin 2x}{\sin x \cos x} - \tan x$ ✓

$= -\tan x - \tan x$ ✓

$= -2 \tan x$ ✓ (5)

$\therefore$ LHS = RHS

Question 7

a) i) $\sin 75^\circ . \cos 15^\circ - \cos 75^\circ \sin 15^\circ$

$= \sin(75^\circ - 15^\circ)$

$= \sin 60^\circ$

$= \frac{\sqrt{3}}{2}$ (3)

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ii) $\sin^2 260^\circ + \sin^2 10^\circ$

$= [\sin(180^\circ + 80^\circ)]^2 + [\cos(90^\circ - 10^\circ)]^2$

$= (-\sin 80^\circ)^2 + (\cos 80^\circ)^2$

$= \sin^2 80^\circ + \cos^2 80^\circ$

$= 1$ (3)

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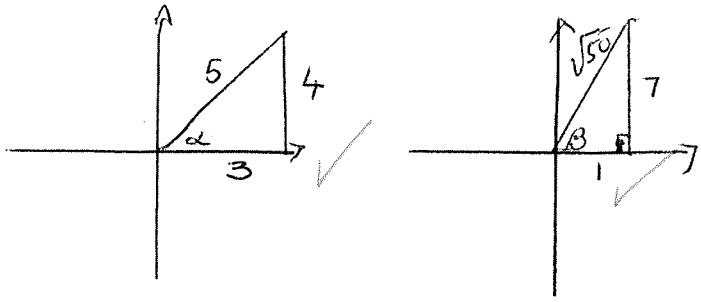
b)



$\sin^2(\alpha + \beta)$

$= (\sin\alpha \cos\beta + \cos\alpha \sin\beta)^2$

$= \left[\left(\frac{4}{5} \times \frac{1}{5\sqrt{2}}\right) + \left(\frac{3}{5} \times \frac{7}{5\sqrt{2}}\right)\right]^2$

$= \left(\frac{4}{25\sqrt{2}} + \frac{21}{25\sqrt{2}}\right)^2$

$= \left(\frac{25}{25\sqrt{2}}\right)^2$ (6)

$= \frac{1}{2}$

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c) $2\tan(2\theta - 12^\circ) = 0{,}936$

$\tan(2\theta - 12^\circ) = 0{,}468$

$2\theta - 12^\circ = 25{,}1^\circ + k180^\circ \; k \in \mathbb{Z}$

$2\theta = 37{,}1^\circ + k180^\circ$

$\theta = 18{,}6^\circ + k90^\circ \; k \in \mathbb{Z}$ (6)

Question 8

a) $[-1; 1]$ (1)

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b) $\theta = -60^\circ$ (1)

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c) $\cos(x - 60^\circ) = -\sin 2x$

$\cos(x - 60^\circ) = \sin(-2x)$

$\cos(x - 60^\circ) = \cos(90^\circ - (-2x))$

$x - 60^\circ = 90^\circ + 2x + k360^\circ$

$x = 150^\circ + k360^\circ$

or for C: $x = 110^\circ$

$x - 60^\circ = -90^\circ - 2x + k360^\circ$ (7)

$3x = -30^\circ + k360^\circ$

$x = -10^\circ + k120^\circ \; k \in \mathbb{Z}$

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d) $90^\circ < x < 150^\circ$ (2)

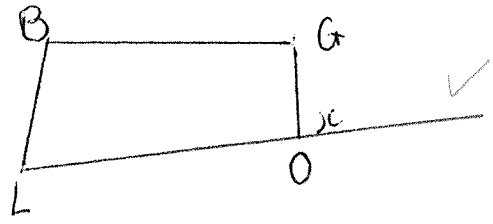
OR

$x \in (90^\circ; 150^\circ)$

Section B

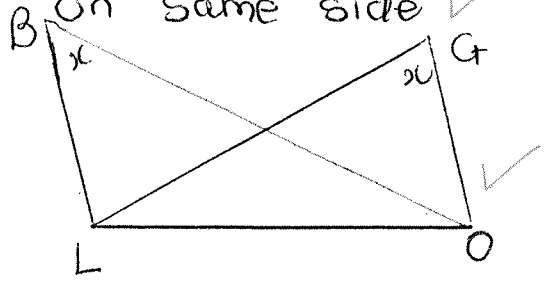
Question 9

a) ext ∠ equals int opp ∠



(2)

Line subtends equal angles on same side



(2)

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b) i) $\hat{A}_1 = \hat{A}_2$ (vert opp ∠s)

$\hat{A}_2 = \hat{D}$ (isos Δ)

$\therefore \hat{A}_1 = \hat{D}$

But $\hat{A}_1 = \hat{B}_1$ (tan chord theorem)

$\therefore$ ABED is a cyclic quad (ext ∠ = int opp ∠)

(5)

ii) Join BD

$B\hat{D}E = B\hat{A}E$ (∠s in same segment)

$B\hat{A}E = \hat{C}$ (tan chord th)

$\therefore B\hat{D}E = \hat{C}$

$\therefore$ DE is a tangent to circle CBD

(4)

Question 10

Reason

Ext ∠ of cyclic quad

Opp ∠s of cyclic quad

Tan chord theorem

Not correct

Not correct

(5)

Question 11

a) line ‖ to one side of Δ

(2)

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b) $\frac{AD}{DB} = 4$

$\therefore \frac{AE}{EC} = 4$

$\therefore AE = 4EC$

$GE = 2EC$

$\therefore \frac{GE}{EC} = \frac{2EC}{EC} = 2$

$\therefore \frac{GF}{FB} = 2$

(3)

Question 12

P.T.O

Question 12

a) $x^2 - 4x + y^2 - 7y = 0$

$(x-2)^2 + (y - \frac{7}{2})^2 = (-2)^2 + (\frac{-7}{2})^2$

$(x-2)^2 + (y - \frac{7}{2})^2 = \frac{65}{4}$

Centre $(2; \frac{7}{2})$

Radius $\frac{\sqrt{65}}{2} = 4,0$ (4)

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b) Y int let $x = 0$

$y^2 - 7y = 0$

$y(y-7) = 0$

$y = 0$ or $y = 7$

$H(0;7)$ (3)

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c) $H(0;7)$ $E(2; \frac{7}{2})$

$m_{HE} = \frac{\frac{7}{2} - 7}{2 - 0} = -\frac{7}{4}$

$\tan\theta = -\frac{7}{4}$

$\theta = 60,3^\circ$

$E\hat{H}O = 180^\circ - (90^\circ + 60,3^\circ)$

$= 29,7^\circ$ (4)

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d) $E(2; \frac{7}{2})$ $G(4;7)$

$m_{GE} = \frac{7 - \frac{7}{2}}{4 - 2} = \frac{7}{4}$

$m_{IJ} = -\frac{4}{7}$ (radius $\perp$ tan)

$\therefore y = mx + c$

$c = \frac{33}{7}$

$y = -\frac{4}{7}x + \frac{33}{7}$

or $y - 7 = -\frac{4}{7}(x - 4)$

$y = -\frac{4}{7}x + \frac{16}{7} + 7$

$y = -\frac{4}{7}x + \frac{65}{7}$ (5)

Question 13

a) In Δ BCD

$BC^2 = 22^2 + 55^2 - 2(22)(55)\cos 33^\circ$

$BC^2 = 1479,417226$

$BC = 38,46m$

In Δ ACD

$\frac{AB}{BC} = \tan 44^\circ$

$AB = 38,46 \times \tan 44^\circ$

$= 37,14m$ (6)

b) $V = \frac{\pi r^2 h}{3}$

$= \frac{\pi (3)^2 \times 35,14}{3}$

$= 331,22\ m^3$ (4)

Question 14

$A\hat{P}B = 90°$ ✓ (∠ in semicircle)

Let $\hat{P}_2 = \theta$ then $\hat{P}_1 = 90° - \theta$

$\therefore \hat{A} = \theta \quad \hat{O}_1 = 90°$ (∠s of Δ)

In Δ AOP and Δ POB

$\hat{A} = \hat{P}_2$ ✓

$\hat{O}_1 = \hat{O}_2$ ✓

$\therefore$ Δ AOP ||| Δ POB (∠∠∠)

$\therefore \frac{AO}{PO} = \frac{OP}{OB} = \frac{AP}{PB}$ ✓

$\therefore \frac{OP}{OB} = \frac{OA}{OP}$ ✓

$\therefore OP^2 = OA \cdot OB$ (6)

Question 15

a) $\frac{1 - \cos 60°}{1 + \cos 60°} = \tan 30° \times \tan 210°$ ✓ ✓ (2)

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b) $\frac{1 - \cos 2A}{1 + \cos 2A} = \tan A \times \tan(180° + A)$ ✓ ✓ (2)

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c) $LHS = \frac{1 - \cos 2A}{1 + \cos 2A}$

$= \frac{1 - (1 - 2\sin^2 A)}{1 + (2\cos^2 A - 1)}$ ✓ ✓

$= \frac{2\sin^2 A}{2\cos^2 A}$ ✓

$= \tan^2 A$ ✓

$= \tan A \times \tan(180° + A)$ ✓

$= RHS$ (5)