GRADE 12 STANDARDISATION PROJECT
NOVEMBER 2014

MATHEMATICS: PAPER II

MARKING GUIDELINES

Time: 3 hours 150 marks

These marking guidelines are prepared for use by examiners and sub-examiners, all of whom are required to attend a standardisation meeting to ensure that the guidelines are consistently interpreted and applied in the marking of candidates' scripts.

The IEB will not enter into any discussions or correspondence about any marking guidelines. It is acknowledged that there may be different views about some matters of emphasis or detail in the guidelines. It is also recognised that, without the benefit of attendance at a standardisation meeting, there may be different interpretations of the application of the marking guidelines.

QUESTION 1

(a) E(7;2) ✓a✓a (2)

(b) $m_{BE} = \frac{7-12}{2+3} = -1$ ✓m

$y - 12 = -1\ (x + 3)$ ✓a

$y = -x + 9$ ✓a (3)

(c) $\frac{p+5-2}{p-7} = \frac{5}{-5}$ ✓a or $p + 5 = -p + 9$ ✓a

$-5(p+3) = 5(p-7)$ $\therefore 2p = 4$

$p = 2$ ✓a $\therefore p = 2$ ✓a (2)

(d) (1) $\tan\theta = \frac{6}{2} = 3$ ✓m $m_{AC} = \frac{5+1}{8-6} = 3$ ✓a

$\theta = 71,6°$ ✓a (3)

(2) $m_{BC} = \frac{8}{-4} = -2$ ✓m

$\tan\beta = -2$ ✓a

$\therefore \beta = 116,6°$ ✓a (3)

(3) $\therefore A\hat{C}B = 45°$ ✓a (1)

(e) (1) $m_{AC} \times m_{EB} = 3 \times -1 = -3$

$\therefore m_{AC} \times m_{BE} \neq -1$ ✓a

$\therefore A\hat{E}B \neq 90^o$ (1)

(2) ABCD is not a rhombus because diagonals do not intersect at 90^o ✓a (1)

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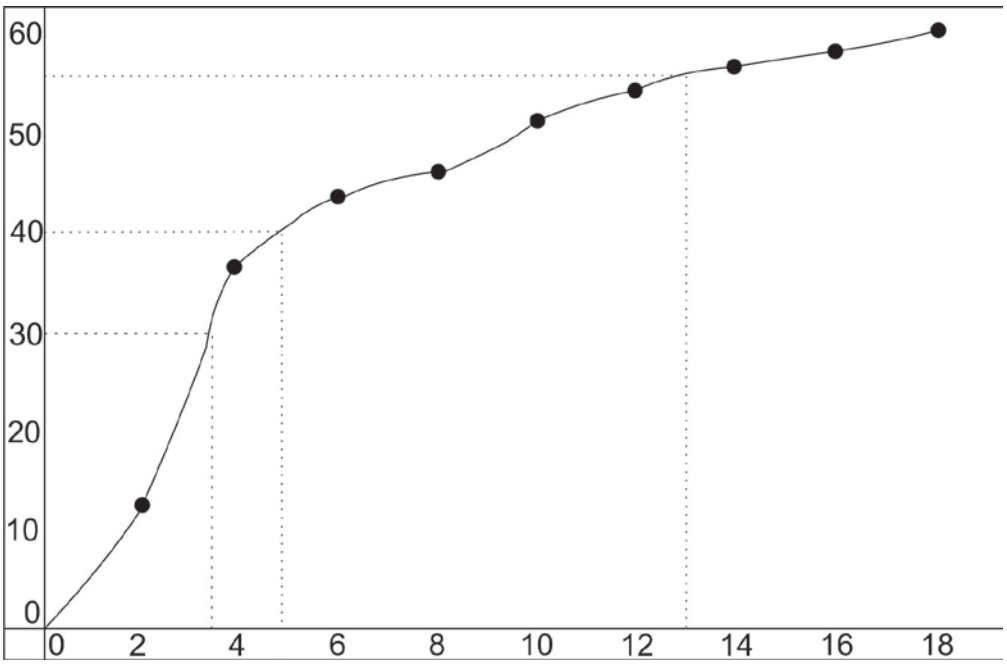
QUESTION 2

(a) (1) True ✓[a] (1)

(2) True ✓[a] (1)

(3) False ✓[a] (1)

(b) (1)



(4)

Estimated median $3\frac{1}{2}$ ✓[a] (1)

(2) 5 is at about 40
13 is at about 57
So 17 people ✓[a] about 28% ✓[a] (2)

(3) (i) ✓[a] (1)

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QUESTION 3

(a) (1) $\hat{B}_1 = x$ isosceles Δ ✓[a] (1)

(2) $\hat{B}_1 = x$

$\hat{B}_1 = C + \hat{K}_2$ ext $\angle$ of Δ ✓[a]

but $\hat{C} = \hat{K}_2$ $\angle$'s opp equal radii ✓[a]

$\therefore B_1 = 2\hat{C}$ ✓[a]

$\therefore \hat{C} = \frac{x}{2}$ (3)

(3) $\frac{x}{2} + x = 108°$ ✓a ext angle of Δ

$\therefore x + 2x = 216^o$

$3x = 216^o$

$\therefore x = 72°$ ✓a (2)

(b) $\hat{B}_1 = 90°$; angle in semi-circle ✓a

$\therefore \hat{B}_2 = 28°$

$\hat{A} + \hat{K} + \hat{B}_1 + \hat{B}_2 = 180°$ ✓a ; angles of a Δ

$\therefore \hat{A} = 28°$ ✓a

$\therefore \hat{B}_2 = \hat{A}$ ✓a

$\therefore$ BK is a tangent; converse of tan chord ✓a (5)

(c) (1) line parallel to one side of Δ ✓a (1)

(2) $\frac{AE}{EC} = 4$ ✓a

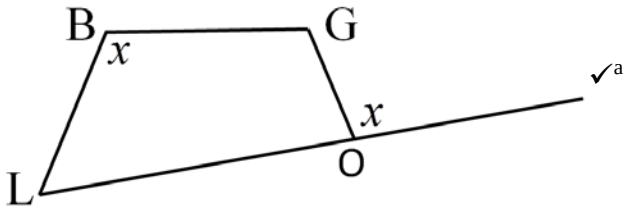
$\therefore AE = 4EC$

$\therefore GE = 2EC$

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

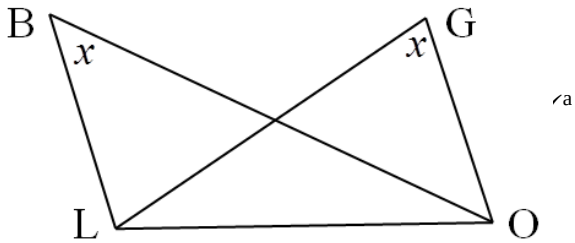
$\therefore \frac{GF}{FB} = 2$ ✓a (3)

(d) ext angle equals int opp angle ✓a



✓a

Line subtends equal angles ✓a on same side.



✓a (4)

(e) (1) $\hat{A}_1 = \hat{Q}_1$ ✓a tan chord ✓a

$\hat{Q}_1 = \hat{P}$ ✓a corr angles AQ / / EP ✓a

$\therefore \hat{A}_1 = \hat{P}$ (4)

(2) $\hat{A}_1 = \hat{P}$; proved

$\therefore$ ABPE is cyclic ext angle ✓a = int opp angle (1)

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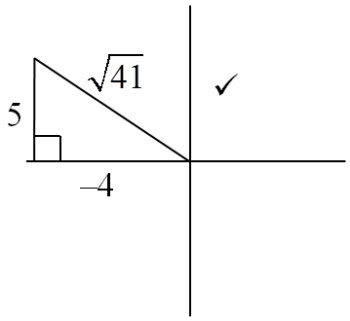
QUESTION 4

(a) $4\tan\theta + 5 = 0 \quad \text{and} \quad \theta \in [0°;180°]$



$\sqrt{41}\cos\theta - 4\sin(-150°)\cos 180°$

$= \sqrt{41}\left(\frac{-4}{\sqrt{41}}\right)$ ✓a $- 4(\sin 210°)\cos 180°$

$= -4 - 4(-\sin 30°)\cos 180°$

$= -4 - 4\left(-\frac{1}{2}\right)(-1)$ ✓a ✓a

$= -4 - 2$

$= -6$ ✓a (6)

(b) $\tan 50^o = k$

$$\frac{4\cos^2 25° - 2}{2\sin 25\cos 25}$$

$$= \frac{2(2\cos^2 25° - 1)}{2\sin 25\cos 25°} \checkmark^a$$

$$= \frac{2\cos 50°}{\sin 50°} \checkmark^a \checkmark^a$$

$$= \frac{2}{k} \checkmark^a \quad (4)$$

(c) (1) [-1;1] ✓a (1)

(2) $\theta = -60°$ ✓a (1)

(3) $\cos(x - 60°) = -\sin 2x$ ✓a

$\cos(x - 60°) = \sin(-2x)$

$\cos(x - 60°) = \cos(90° - (-2x))$

$x - 60° = 90° + 2x + k360°$ ✓a **or** $x - 60° = -90° - 2x + k360°$ ✓a

$x = 150° + k360°$ ✓a $3x = -30° + k360°$

for C : $x = 110°$ ✓a $x = -10° + k120°$ ✓a ; K ∈ Z ✓a (7)

(4) $90° < x < 150°$ ✓a ✓a or $x \in (90^o;150^o)$ (2)

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QUESTION 5

(a) As the number of games for KO-JAY increases the number of wins for PONG K1 decreases. ✓a (1)

(b) Morag ✓a (1)

(c) $\hat{y} = 21,0360$ ✓a $+ -1,4324x$ ✓a form ✓a (3)

(d) $y = 21,0360 - 1,4324\ (6)$ ✓a

$= 12,4416$

$\therefore$ about 12 games ✓a (2)

(e) Very strong neg correlation ✓a (1)

[8]

QUESTION 6

(a) (1) R(30^o ✓a ; 0^o ✓a) (2)

(2) $b = -30^o$ ✓a (1)

(3) 120^o ✓a (1)

(4) f(x) = 4cos(3(x – 30)) or f(x) = 4sin3x ✓a (1)

(5) 1 ✓a (1)

(b) (1)
$$\frac{\cos 3x}{\cos x} = \frac{\cos(2x + x)}{\cos x}$$
$$= \frac{\cos 2x\cos x - \sin 2x\sin x}{\cos x} \checkmark^a$$
$$= \frac{\cos 2x\cos x - 2\sin^2 x\cos x}{\cos x} \checkmark^a$$
$$= \cos 2x - 2\sin^2 x \checkmark^a$$
$$= \cos 2x - (1 - \cos 2x) \checkmark^a$$
$$= 2\cos 2x - 1$$ (4)

(2) (i) In Δ JML:
$$\frac{ML}{2} = \sin x \checkmark^a$$
$$ML = 2\sin x \checkmark^a$$
In Δ JML: ✓m sine rule
$$\frac{KL \checkmark^a}{\sin(90 + x)} = \frac{2\sin x}{\sin 2x} \checkmark^a$$
$$KL = \frac{2\sin x\cos x}{\sin 2x} \checkmark^a$$
$$KL = 1$$ (6)

(ii) In Δ MKL:
$$\frac{MK}{\sin(90 - 3x)} = \frac{1}{\sin(90 + x)} \checkmark^m \text{ sine rule } \checkmark^a \checkmark^a$$
$$MK = \frac{\cos 3x}{\cos x} \checkmark^a$$
$$MK = 2\cos 2x - 1 \text{ from (b)(1)}$$ (4)

(iii) $2\cos 2x - 1 > 0$ ✓a
$2\cos 2x >$
$\cos 2x > ½$
$0^o < 2x < 60^o$
$0^o < x < 30^o$ ✓a ✓a (3)

[23]

QUESTION 7

(a) 1 A $(x + 3)^2 + (y + 2)^2 = 4$ ✓a
$(x - 1)^2 + (y - 1)^2 = 9$ (1)

1 B (1; 1) ✓a (3) ✓a (2)

(2) $m_{AB} = \frac{3}{4}$ ✓a

Equation AB $\Rightarrow y = \frac{3}{4}x + c$

sub (1; 1)

$y = \frac{3}{4}x + \frac{1}{4}$ ✓a

Solve with $x^2 + y^2 - 2x - 2y - 7 = 0$

$x^2 + (\frac{3}{4}x + \frac{1}{4})^2 - 2x - 2(\frac{3}{4}x + \frac{1}{4})$ ✓m $- 7 = 0$

$x^2 + \frac{9x^2}{16} + \frac{6}{16}x + \frac{1}{16} - 2x - \frac{3}{2}x - \frac{1}{2} - 7 = 0$

$16x^2 + 9x^2 + 3x - 32x - 24x - 119 = 0$

$25x^2 - 50x - 119 = 0$ ✓a

$(5x - 17)(5x + 7) = 0$

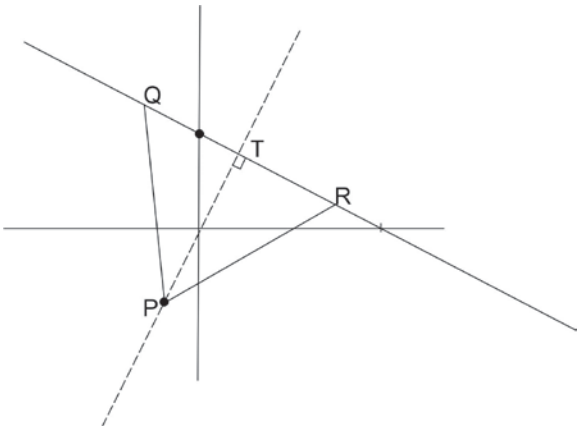
$x = \frac{-7}{5}$ ✓a or $x = \frac{17}{5}$ N/A ✓a

$\therefore y = \frac{-4}{5}$ ✓a (7)

(3) $m_{EF} = \frac{-4}{3}$ ✓a

$y + \frac{4}{5} = \frac{-4}{3}(x + \frac{7}{5})$ ✓a (2)

(b)



$2y = -x + 5$

$y = -\frac{x}{2} + \frac{5}{2}$ ✓a

Line PT : m = 2 ✓a

$y = 2x + c$

$-2 = 2(-1) + c$ ✓a

$0 = c$

$y = 2x$ ✓a (4)

(2) For T: ✓m

$x + 2(2x) - 5 = 0$

$5x = 5$

$x = 1$ ✓a

$\therefore y = 2$ ✓a

Length PT $= \sqrt{(1-(-1))^2 + (2-(-2))^2}$ ✓m

$= \sqrt{4 + 16}$

$= \sqrt{20}$ ✓a (5)

(3) $\theta = 60° \therefore \frac{PR}{PT} = \frac{1}{\sin 60°}$ ✓a

$\therefore PR = \frac{\sqrt{20}}{\sin 60°} = \frac{4\sqrt{15}}{3} = 5,2$ ✓a (2)

[23]

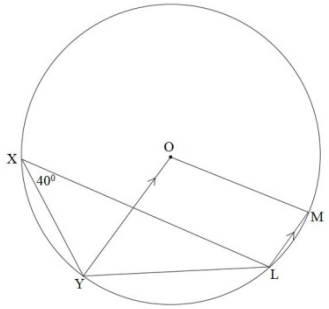
QUESTION 8

(a) $\hat{T} = 90^o$ ✓a ; line from centre bisects chord
PS = SR ✓a ; line from centre is perpendicular to chord ✓a
$\therefore OP = 12^2 + 5^2$ ✓m ; pythagoras
$\therefore OP^2 = 169$
$\therefore OP = 13$ ✓a
$\therefore 13^2 = 12,5^2 + x^2$ ✓m ; pythagoras
$x^2 = 12,75$
$x = 3,6$ ✓a (7)

(b) (1) in proportion ✓a (1)

(2) In ΔSRT and ΔPQT
$\hat{T} = \hat{T}$; common ✓a
$T\hat{S}R = Q\hat{P}T$; ext angle of cyclic quad ✓a
$\therefore \Delta SRT /// \Delta PQT$ (AAA) ✓a
$\therefore \frac{ST}{RT}$✓a $= \frac{PT}{QT}$✓a
$\therefore \frac{10}{12} = \frac{3x + 12}{4x + 10}$ ✓a
$\therefore 40x + 100 = 36x + 144$
$\therefore 4x = 44$
$x = 11$ ✓a
PR = 33 ✓a (8)

(c) Join O to L ✓a✓a
$Y\hat{O}L = 80^o$ ✓a angle at centre ✓a
$O\hat{L}M = 80^o$; alternate angles OY // ML ✓a
$\hat{M} = 80^o$; isosceles Δ ✓a
$L\hat{O}M = 20^o$; angles of a Δ ✓a
$Y\hat{O}M = 100^o$ ✓a (8)



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Total: 150 marks