GRADE 12 STANDARDISATION PROJECT
SEPTEMBER 2014

MATHEMATICS: PAPER I

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.

SECTION A

QUESTION 1

(a) $\dfrac{(x-2)(x^2+2x+4)}{-3(x-2)}$ ✓m ✓a

$= \dfrac{x^2+2x+4}{-3}$ ✓ca

(3)

(b) $\dfrac{3^x(3+1)}{3^x(m+4)}$ ✓a $-$ $\dfrac{3(m-4)}{(m+4)(m-4)}$ ✓a

$= \dfrac{4}{m+4} - \dfrac{3}{m+4}$ ✓m

$= \dfrac{1}{m+4}$ ✓a (5)

(c) $\sqrt{(x-5)^2}+5$ ✓m

$= x-5+5$ ✓a

$= x$ ✓a (3)

[11]

QUESTION 2

(a) $x^2 = \dfrac{m}{3}$ ✓a

$x = \pm\sqrt{\dfrac{m}{3}}$ ✓a (2)

(b) $x = \dfrac{-1}{m}$ ✓a or $x = m$ ✓a (2)

(c) $x - 3 = \log_5 m$ ✓m

$x = \log_5 m$ ✓a $+ 3$ ✓a (3)

(d) $x >$ ✓a $-2 +$ ✓a $5m$ (2)

[9]

QUESTION 3

(a) (1) $4x + 1 – (2x + 3) = 2x + 3 – (10 – x)$ ✓m✓a
$4x + 1 – 2x – 3 = 2x + 3 – 10 + x$
$–x = –5$
$x = 5$ ✓a (3)

(2) $S_{23} = \frac{23}{2}\left[2(5) + (23 - 1)8\right]$ ✓m ✓a
$S_{23} = 2\,139$ ✓ca (3)

(b) (1) $T_{15} = S_{15} – S_{14}$ ✓m
$T_{15} = 495 – 434$ ✓a
$T_{15} = 61$ ✓a (3)

(2) $T_n = 2n^2 + 3n – [2(n – 1)^2 + 3(n – 1)]$ ✓m
$T_n = 2n^2 + 3n – [2n^2 – 4n + 2 + 3n – 3]$ ✓a
$T_n = 2n^2 + 3n – 2n^2 + 4n – 2 – 3n + 3$
$T_n = 4n + 1$ ✓a✓a (4)

(c) $17 + 31 + 49 + 71$ ✓m✓a
$= 168$ ✓ca (3)

(d) $\frac{40}{3} = \frac{a}{1 - r}$ ✓m
$40 – 40r = 3a$
$\frac{5}{2} = ar$ ✓m
$a = \frac{5}{2r}$

sub into equation

$40 – 40r = \frac{15}{2r}$ ✓m
$80r – 80r^2 = 15$
$0 = 80r^2 – 80r + 15$
$0 = 16r^2 – 16r + 3$
$0 = (4r – 1)(4r – 3)$
$r = \frac{1}{4}$ or $r = \frac{3}{4}$ ✓a
$T_1 = 10$ ✓a or $T_1 = \frac{10}{3}$ ✓a (6)

[22]

QUESTION 4

(a) $f'(x) = -9x^2 + 2$ ✓m
$f'(-1) = -9(-1)^2 + 2$ ✓m
$f'(-1) = -7$ ✓a (3)

(b) $y = -7x + c$
Find point
$f(-1) = -3(-1)^3 + 2(-1)$ ✓m
$f(-1) = 1$ ✓a
Sub in point
$+1 = -7(-1) + c$ ✓m
$c = -6$
$y = -7x - 6$ ✓a (4)
[7]

QUESTION 5

(a) $$A = \frac{500\left[\left(1+\frac{0,15}{12}\right)^{120}\overset{\checkmark a}{-1}\right]}{\frac{0,15}{12}} \checkmark m$$
A = R137 608,53 ✓a✓a (4)

(b) Loan amount =1 205 000 – 135 000
= R1 070 000 ✓a
$$1\,070\,000 = \frac{x\left[1-\left(1+\frac{0,09}{12}\right)^{-240}\right]}{\frac{0,09}{12}} \begin{matrix}\checkmark a \\ \checkmark m\end{matrix}$$
x = R9 627,07 ✓m (4)

(c) (i) $$A = \frac{\overset{\checkmark ca}{9\,627,07}\left[1-\left(1+\frac{0,09}{12}\right)^{\overset{\checkmark a}{-144}}\right]}{\frac{0,09}{12}}$$
A = R845 941,15 ✓a✓a

OR

ALTERNATE SOLUTION

$$\text{B.O.} = 1\,070\,000\overset{\checkmark a}{\left(1+\frac{0,09}{12}\right)^{96}} - \overset{\checkmark ca}{9\,627,07}\left[\frac{\left(1+\frac{0,09}{12}\right)^{\overset{\checkmark a}{96}}-1}{\frac{0,09}{12}}\right]$$

B.O. = R845 940,64 ✓a (4)

(ii) $845\,941{,}15 \overset{\checkmark ca}{=} \dfrac{25\,000\left[\overset{\checkmark ca}{1-\left(1+\dfrac{0{,}09}{12}\right)^{-n}}\right]}{\dfrac{0{,}09}{12}}$

$-0{,}746217655 = -\left(1+\dfrac{0{,}09}{12}\right)^{-n}$ ✓m

$-n = \log_{\left(1+\frac{0{,}09}{12}\right)} 0{,}746217655$

$-n = -39{,}18$

$n = 39{,}18$ months

Round up to 40 months ✓a (4)

[16]

QUESTION 6

(a) $y = x^{\frac{1}{2}} \overset{\checkmark a}{+} 3\pi^2$

$\dfrac{dy}{dx} = \dfrac{1}{2}x^{-\frac{1}{2}}$ ✓a

$= \dfrac{1}{2\sqrt{x}}$ ✓a (3)

(b) $h(x-3)+4 = (x-3)^3 + 6$ ✓m

$= (x-3)(x^2 - 6x + 9) + 6$

$= x^3 - 6x^2 + 9x - 3x^2 + 18x - 27 + 6$

$= x^3 - 9x^2 + 27x - 21$

$a = 1$ $b = -9$ ✓a $c = 27$ ✓a $d = -21$ ✓a (4)

(c) $x = -9y^2$ ✓m

$y = \pm\sqrt{-\dfrac{x}{9}}$; $x < 0$ ✓a (3)

[10]

75 marks

SECTION B

QUESTION 7

(a) -5 ✓a (1)

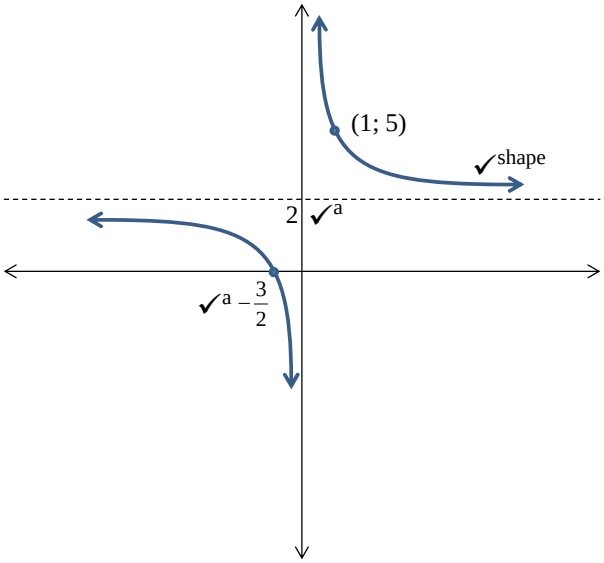
(b) $x < 3$ ✓a (1)

(c) $x^2 - 8x + 16 - 5 < -2x + 6$ ✓m
$x^2 - 6x + 5 < 0$ ✓a
$(x-5)(x-1) < 0$ ✓m
$1 < x < 5$ ✓a✓a (5)
[7]

QUESTION 8

(a) $g(x) = \frac{3}{x} + 2$
$g(x) = 3x^{-1} + 2$
$g'(x) = -3x^{-2}$ ✓m
$g'(x) = \frac{-3}{x^2}$ ✓a (2)

(b)



(3)

(c) $h(x) = -\overset{\checkmark a}{x} + 2$ ✓a (2)

(d) $\frac{-3}{x^2} = -1$ ✓m

$x = \sqrt{3}$ ✓a

$y = \frac{3}{\sqrt{3}} + 2$

$2 + \frac{3}{\sqrt{3}} = -\sqrt{3} + c$ ✓m

$\therefore c = 2 + 2\sqrt{3}$

$\therefore$ tangent equation is

$y = -x + 2 + 2\sqrt{3}$ ✓a

Hence $k = 2\sqrt{3}$ ✓ca (5)

[12]

QUESTION 9

(a) $f^{-1}(x) = \log_2 x$ ✓m✓a (2)

(b) $3 = \log_2 x$ ✓m

$x = 8$ ✓a

$3 = 2^x$ ✓m

$x = 1{,}6$ ✓a

$AB = 8 - 1{,}6$

$AB = 6{,}4$ units ✓a (5)

(c) $y = 2^8$ ✓m
$y = 256$

therefore $BC = 256 - 3$ ✓ca
$BC = 253$ ✓a (3)

(d) $x \in (0; \infty)$ ✓a (1)

[11]

QUESTION 10

(a) $(0,47)^3$ ✓a $= 0,1038$ ✓a (2)

(b) 1✓m $- (0,53)^3$ ✓a $= 0,8511$ ✓a (3)

[5]

QUESTION 11

(a) $3 \times 2 \times 1$
$= 6$ ✓a (1)

(b) $2 \times 1 \times 2 \times 1$ ✓m
$= 4$ ✓a (2)

(c) $\frac{10!}{2!2!2!2!}$ ✓m ✓a
$= 226\,800$ ✓a (3)

(d) $226\,800$ ✓m $- \frac{9!2!}{2!2!2!2!}$ ✓m ✓a
$= 181\,440$ ✓a (4)

[10]

QUESTION 12

(a) $-36 = 343 + 49m + 7p - 36$ ✓m
$-343 = 49m + 7p$
$-49 = 7m + p$ ✓a

$\frac{dy}{dx} = 3x^2 + 2mx + p$ ✓m✓a
$3(7)^2 + 2m(7) + p = 0$
$147 + 14m + p = 0$
$p = -147 - 14m$ ✓a

$-49 = 7m - 147 - 14m$ ✓m
$98 = -7m$
$m = -14$ ✓a

$p = -147 - 14(-14)$
$p = 49$ ✓a (8)

(b) $x^3 - 14x^2 + 49x - 36 = 0$
$(x - 1)(x^2 - 13x + 36) = 0$ ✓m
$(x - 1)(x - 4)(x - 9) = 0$ ✓a
$x = 1$ or $x = 4$ or $x = 9$ ✓

Area of campsite = $5 \times 36 = 180$ units^2 ✓m✓a (5)

(c) $\frac{dy}{dx} = 3x^2 - 28x + 49$ ✓m
$3x^2 - 28x + 49 = -8$ ✓m
$3x^2 - 28x + 57 = 0$
$(3x - 19)(x - 3) = 0$
$x = 3$ or $x \neq \frac{19}{3}$
$y = 12$ ✓a

$12 = -8(3) + k$
$k = 36$ ✓a

$x^3 - 14x^2 + 49x - 36 = -8x + 36$ ✓m
$x^3 - 14x^2 + 57x - 72 = 0$
$(x - 3)(x^2 - 11x + 24) = 0$
$(x - 3)(x - 3)(x - 8) = 0$
$x = 8$ is where the bridge crosses ✓a
$y = (8)^3 - 14(8)^2 + 49(8) - 36$
$y = -28$

Bridge $(8; -28)$ ✓a (7)

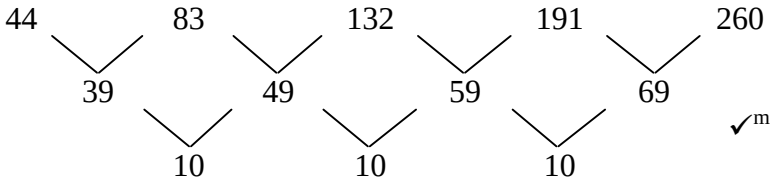
[20]

QUESTION 13

(a) $A + B + C = 2(m^2 + 3m)$ ✓m $+ 2(m^2 + 5m) + (m + 3)(m + 5)$ ✓a
$= 2m^2 + 6m + 2m^2 + 10m + m^2 + 8m + 15$
$= 5m^2 + 24m + 15$ ✓a✓a✓a

OR

ALTERNATE METHOD



$2a = 10$
$\therefore\ a = 5$ ✓a
$3a + b = 39$
$3(5) + b = 39$
$\therefore\ b = 24$ ✓a
$a + b + c = 44$
$5 + 24 + c = 44$
$\therefore\ c = 15$ ✓a A + B + C = 5 m^2 + 24 m + 15 ✓a

(5)

(b) ✓m $1\,512 = m(m + 3)(m + 5)$ ✓a
$1\,512 = m(m^2 + 8m + 15)$
$0 = m^3 + 8m^2 + 15m - 1\,512$
$0 = (m - 9)(m^2 + 17m + 168)$
$m = 9$ ✓a

$SA = 5(9)^2 + 24(9) + 15$ ✓m
$SA = 636\ m^2$ ✓a (5)

[10]

75 marks

Total: 150 marks