GRADE : 11

SUBJECT : Mathematics

TITLE : Paper I

EXAMINER : ~~Mr A Slaughter~~ Mrs Selkirk

TOTAL MARKS : 100

DATE : 2 / 6 /2014

**SOLUTIONS**

TIME : 2 hour(s)

**1.1.1** $x^2 - x - 20 = 0$ ✓ std form

$(x-5)(x+4) = 0$ ✓ factors

$x = 5$ or $-4$ ✓ (both) **3**

**1.1.2** $3x^2 - 2x - 4 = 0$ ✓ std form

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ✓ formula

$x = \frac{-(-2) \pm \sqrt{(-2)^2 - 4(3)(-4)}}{2(3)}$ ✓ subst

$x = 1,54$ or $-0,87$ ✓ ✓ **5**

**1.1.3** $\sqrt{2-x} = 4 + x$ ✓ isolate $\sqrt{}$

$2 - x = x^2 + 8x + 16$ ✓ square both sides

$x^2 + 9x + 14 = 0$ ✓ std form

$(x+7)(x+2) = 0$ ✓ factors

$\therefore x = -7$ or $-2$ ✓

reject [-1 if -7 not rejected] **5**

**1.1.4** $x^{-3/2} = \frac{32}{5}$ or $-4$ ✓ (both)

No solution ✓

$x = \left(\frac{32}{5}\right)^{-2/3}$ ✓

$x = 0,29$ ✓ **4**

**1.1.5** $x^3 - x = 0$ ✓ std form

$x(x^2 - 1) = 0$

$x(x-1)(x+1) = 0$ ✓ factors

$\therefore x = 0$ or $-1$ or $+1$ ✓ (all) **3**

**1.1.6** $(3^x - 9)(3^x - 1) = 0$ ✓

$3^x = 9$ or $3^x = 1$ ✓ both

$\therefore 3^x = 3^2$ or $3^x = 3^0$

$x = 2$ ✓ $x = 0$ ✓ **4**

**1.1.7** $x^3 - 5x^2 + 4x > 0$ ✓

$x(x^2 - 5x + 4) > 0$

$x(x-4)(x-1) > 0$ ✓ factors

− 0 + 0 − 0 +

0 1 4

$x \in (0;1)$ ✓ or $(4;\infty)$ ✓ **4**

[-1 no "or"]

**1.1.8** $3^x(x-5) < 0$

$3^x > 0$ always ✓

$\therefore x < 5$ ✓ [Answer only = full marks] **2**

⊖ 0 +

5

$3^x = 0$

no sol^n.

∴ no contribution

1.2. $y = 2x - 2$ ✓

Sub: $2x - 2 = x^2 - x - 6$ ✓

$x^2 - 3x - 4 = 0$ ✓ std form

$(x - 4)(x + 1) = 0$ ✓ factors

$\therefore x = 4$ or $x = -1$ ✓ both

$\therefore y = 6$ or $y = -4$ ✓ ✓ **7**

1.3 $x^2 - x - 2 = 0$ ✓ $[\div -2]$

$x^2 - x = 2$ ✓

$x^2 - x + \left(-\frac{1}{2}\right)^2 = 2 + \left(-\frac{1}{2}\right)^2$ ✓

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

$x - \frac{1}{2} = \pm\sqrt{\frac{9}{4}}$ ✓

$x = \frac{1}{2} \pm \frac{3}{2}$ **7**

$\therefore x = 2$ or $-1$ ✓ both [14]

[$\sqrt{}$ must be shown or 0 for line 2]

2.1 $\sqrt{49 \times 2}\left(\sqrt{25 \times 2} - \sqrt{9 \times 2}\right)$

$= 7\sqrt{2}\left(5\sqrt{2} - 3\sqrt{2}\right)$ ✓

$= 7\sqrt{2}\left(2\sqrt{2}\right)$ ✓

$= 14 \cdot 2$

$= 28$ ✓ **4**

2.2. $\dfrac{9 - 6\sqrt{3} + 3}{\sqrt{3} \times \sqrt{3} \times 2}$ ✓ ✓

$= \dfrac{12 - 6\sqrt{3}}{\sqrt{3} \times \sqrt{3} \times \sqrt{2}}$ [Must be shown or (=1)]

$= \dfrac{12 - 6\sqrt{3}}{3\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}}$ ✓ must be shown

$= \dfrac{12\sqrt{2} - 6\sqrt{3} \cdot \sqrt{2}}{3 \cdot 2}$

✓ HCF

$= \dfrac{6\left(2\sqrt{2} - \sqrt{3} \cdot \sqrt{2}\right)}{6}$

$= 2\sqrt{2} - \sqrt{3} \cdot \sqrt{2}$ ✓ **6**

[10]

3.1.1 $x = 2$ ✓ **1**

3.1.2 $x - 1 \geq 0$ ✓

$\therefore x \geq 1$ ✓ but $x \neq 2$ **2**

3.2.1 $\Delta = (-2)^2 - 4(8)(-1)$ ✓ subst

$= 36$ ✓ **2**

3.2.2 Real, Rational and unequal ✓ ✓ ✓ **3**

3.3 $mx^2 - x^2 + 2x - m + 3 = 0$

$(m - 1)x^2 + 2x + 3 - m = 0$ ✓ std form

$\Delta = (2)^2 - 4(m - 1)(3 - m)$ ✓ subst

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

$= 4m^2 - 16m + 16$ ✓

$= 4(m - 2)^2$ ✓

$(m - 2)^2 \geq 0$ for all $m \in R$

$\therefore 4(m - 2)^2 \geq 0$ ✓

$\therefore \Delta \geq 0$

$\therefore$ Roots will always be real. **5**

[13]

4.1 $-46$ ✓ ; $-67$ ✓ **2**

4.2.1 1st diff: $4(1) + 6 = 10$ ✓

2nd $4(2) + 6 = 14$ ✓

3rd $4(3) + 6 = 18$ ✓ **3**

4.1. $-46; -67$ ✓✓ 2

4.2.1. $10; 14; 18$ ✓✓ 3

4.2.2 1 $T_2$ $T_3$ $T_4$

10 14 18

4 4

$2a = 4$ ✓A

$a = 2$ ✓A **2**

4.2.3 $3(2) + b = 10$

$3a + b = (10)$ ✓A

$b = 4$ ✓CA

$2 + 4 + c = 1$

$a + b + c = 1$ ✓

$c = -5$ ✓ **4**

[11]

5.1 $\dfrac{(5.3^2)^{1-n} \times 5^{n+1} \times (3^4)^{-1}}{(2^2)^{n+2} \times (3^2.2^2)^{-n-1}}$ ✓pb.

✓✓ x brackets [-1 per error]

$= \dfrac{5^{1-n}.3^{2-2n}.5^{n+1}.3^{-4}}{2^{2n+4}.3^{-2n-2}.2^{-2n-2}}$

$= \dfrac{5^0.3^{-2-2n}}{2^2.3^{-2n-2}}$

$= \dfrac{1}{4}$ ✓ **4**

5.2 $\dfrac{2^{2n} - 2^2.2^n + 4}{2^n - 2}$ ✓

$= \dfrac{2^{2n} - 4.2^n + 4}{2^n - 2}$

$= \dfrac{(2^n - 2)(2^n - 2)}{2^n - 2}$ ✓factors **3**

$= 2^n - 2$ ✓ [7]

6 On Diagram Sheet. [7]

7.1 Sub $(-1;4)$: $4 = 2a^{-1}$ ✓subst

$2 = a^{-1}$

$(2)^{-1} = (a^{-1})^{-1}$ $2 = 1/a$ ✓

$a = 1/2$ **2**

$\therefore f(x) = 2\left(\frac{1}{2}\right)^x$

7.2 Sub $x = 0$: $y = 2\left(\frac{1}{2}\right)^0$

$= 2$

$\therefore$ $(0; 2)$ ✓✓ Not given as coords = 0/2 **2**

7.3 $g(x) = 2\left(\frac{1}{2}\right)^{-x}$ ✓ any one

OR $= 2.2^x$

OR $= 2^{x+1}$

$= 2a^{-x}$ **1**

7.4 See diagram Sheet A

$y = 2\left(\frac{1}{2}\right)^{x-1} - 4$

Let $x = 0$: $y = 2\left(\frac{1}{2}\right)^{-1} - 4$

$= 2.2 - 4$

$= 0$

$\therefore$ y-int $(0; 0)$

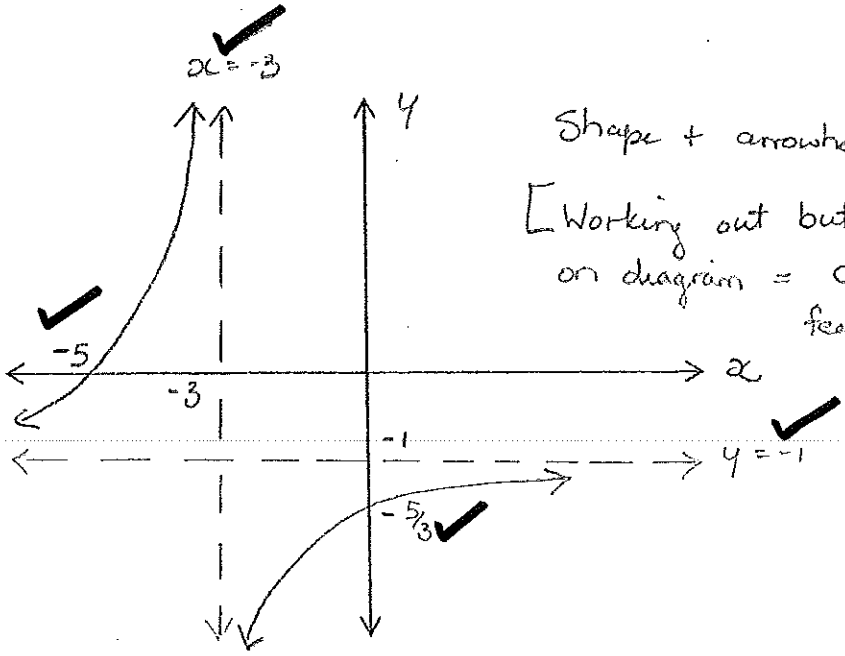
New asymptote at $y = -4$ 3

[8]

## Diagram Sheet A

**Question 6**

6.1




Shape + arrowheads ✓

[Working out but not indicated on diagram = 0 for that feature eg x-int.]

5

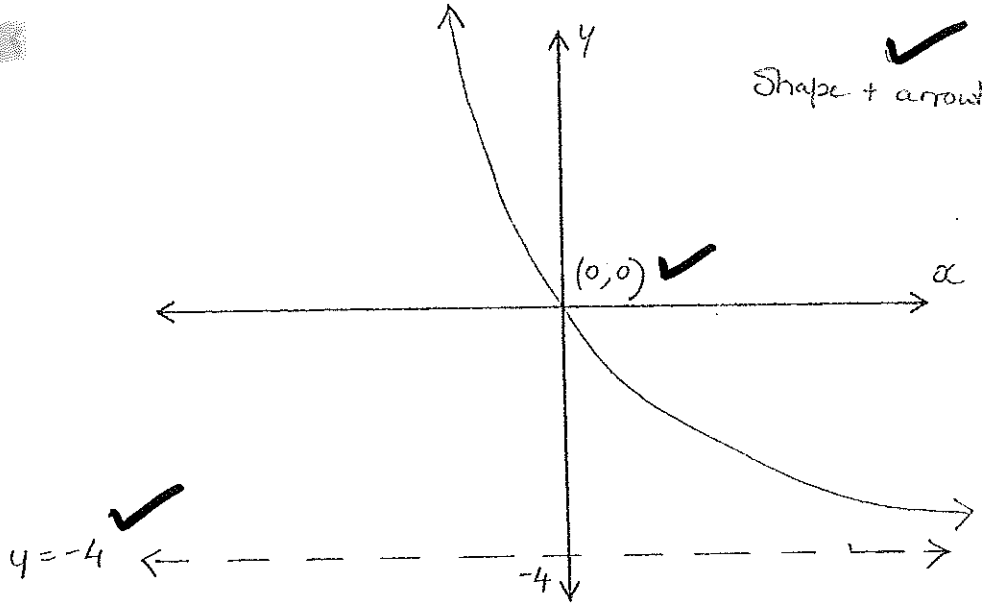
(5)

6.2 $y = -x - 4$ ✓ ✓

(2)

**Question 7**

7.4




Shape + arrowheads ✓

3

(3)