GRADE : 11

SUBJECT : Mathematics

TITLE : Paper 1

EXAMINER : [redacted]

TOTAL MARKS : 100

DATE [redacted]

SOLUTIONS

TIME : 2 hour(s)

1.1. 1. $3x(x-4) = 5$

$3x^2 - 12x - 5 = 0$ ✓

$(\quad)(\quad) = 0$

$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(3)(-5)}}{2(3)}$ ✓

$= \frac{12 \pm \sqrt{204}}{6}$

$= 4{,}38$ or $-0{,}38$ ✓ ✓ 4

1.1. 2. $3\sqrt{2-x} + 2x = -5$

$(3\sqrt{2-x})^2 = (-2x-5)^2$

$9(2-x) = 4x^2 + 20x + 25$ ✓

$18 - 9x =$ ✓

$0 = 4x^2 + 29x + 7$ ✓

$= (4x+1)(x+7)$ ✓

$\therefore x = -\frac{1}{4}$ or -7 6

reject ✓ ✓

1.1. 3. $\frac{3x+1}{7x-1} = \frac{2x-1}{3x+1}$

$(3x+1)(3x+1) = (2x-1)(7x-1)$ ✓

$9x^2 + 6x + 1 = 14x^2 - 9x + 1$

$0 = 5x^2 - 15x$

$\div 5: \quad 0 = x^2 - 3x$ ✓

$= x(x-3)$ ✓

$\therefore x = 0$ or 3 ✓ 4

1.1. 4. $2^x - 5.2^{x-3} = 3\sqrt{2}$

$2^x - 5.2^x.2^{-3} = 3.\sqrt{2}$

$2^x(1 - 5.2^{-3}) =$

$2^x(1 - \frac{5}{2^3}) =$

$2^x(1 - \frac{5}{8}) =$ ✓

$2^x . \frac{3}{8}$ ✓ $= 3.(2^{\frac{1}{2}})$

$\times \frac{8}{3}: \quad 2^x = 2^{\frac{1}{2}}.8$

$= 2^{\frac{1}{2}}.2^3$

$= 2^{7/2}$

$\therefore x = 7/2$ ✓ 4

1.1. 5. $2x^{-3} - 3x^{-3/2} = 5$

$k = x^{-3/2}$

$(k)^2 = (x^{-3/2})^2$

$= x^{-3}$

$2k^2 - 3k - 5 = 0$

$(2k-5)(k+1) = 0$ ✓

$\therefore k = 5/2$ ✓ or $k = -1$ ✓ both

$x^{-3/2} = 5/2$ no solv ✓

$x = (\frac{5}{2})^{-2/3}$ ✓

$= 0{,}54$ ✓

no mark for $-3/2$ ✓

5

1.1. 6. $12 > x(6x+1)$

$0 > 6x^2 + x - 12$ ✓

$0 > (3x-4)(2x+3)$ ✓

$-3/2 < x < 4/3$ ✓ ✓

4

1.1. 7. $x \neq 2$ ✓

1

1.2. $x^2 - xy - y^2 = -1$

$2^x \cdot 32 = 4^y$

$2^x \cdot 2^5 = (2^2)^y$

$2^{x+5} = 2^{2y}$

$x + 5 = 2y$ ✓

$x = 2y - 5$ ✓

$(2y-5)^2 - (2y-5)y - y^2 = -1$ ✓

$4y^2 - 20y + 25 - 2y^2 + 5y - y^2 + 1 = 0$

$y^2 - 15y + 26 = 0$ ✓

$(y-13)(y-2) = 0$ ✓

$y = 13$ or $y = 2$ ✓ both

$x = 2(13) - 5$ $x = 2(2) - 5$

$= 21$ $= -1$ ✓ both

$\therefore x = 21$ and $y = 13$

or

$x = -1$ and $y = 2$

7

1.3. $49x^2 - 42x + 9 = 0$

$\Delta = (-42)^2 - 4(49)(9)$ ✓

$= 0$ ✓

$\therefore$ roots are

- real
- rational
- equal

✓ ans only (no Δ) 0/3 — 3

1.4. 1. $y = x + \frac{1}{x}$

LCD $= x \quad (\because x \neq 0)$

x-thru

$yx = x^2 + 1$

✓ $0 = x^2 - yx + 1$ — 1

4. 2. $\Delta = (-y)^2 - 4(1)(1)$ ✓

$= y^2 - 4$ ✓ — 2

1.4. 3. For a real graph

$\Delta \geq 0$

$y^2 - 4 \geq 0$ ✓

$(y-2)(y+2) \geq 0$ ✓

⊕ 0 ⊖ 0 ⊕ (−2, 2)

$y \leq -2$ or $2 \leq y$ — 4

✓ ✓ −1 no "or"

1.5. $\frac{(2-3\sqrt{5})^2}{\sqrt{5}}$

num $= (2-3\sqrt{5})(2-3\sqrt{5})$

$= 4 - 12\sqrt{5} + 9.5$

$= 49 - 12\sqrt{5}$ ✓

$\frac{49-12\sqrt{5}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}}$ ✓

$= \frac{49\sqrt{5} - 12.5}{5}$

$= \frac{49\sqrt{5}}{5} - 12$

$= -12 + \frac{49}{5}\cdot\sqrt{5}$ — 4

✓ ✓

2. A(−2; −4)

5 ↑, 3 ← → (−5; 1) ✓ ✓ — 2

3. $f(x) = -2.3^{x-1} + 5$

$y = -2.3^{x-1} + 5$

3.1. • exponential

• y int: $y = -2.3^{0-1} + 5$

$= \frac{13}{3}$ 4,33

• x int: $0 = -2.3^{x-1} + 5$

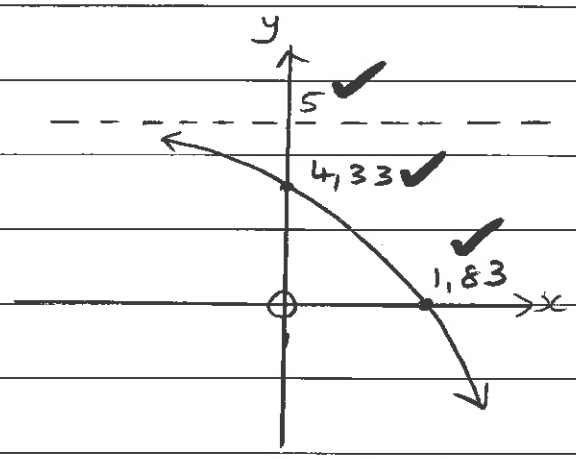
$2.3^{x-1} = 5$

$3^{x-1} = \frac{5}{2}$

$x - 1 = \frac{\log 5/2}{\log 3}$ ✓ log 5

$x = 1,83$

• ha: $y = 5$



✓ shape

5

3.2 $x = -1$ $y = -2.3^{-1-1} + 5$

$= \frac{43}{9}$ ✓

$\therefore (-1; \frac{43}{9})$

$x = 1$ $y = -2.3^{1-1} + 5$

$= 3$ ✓

$\therefore (1; 3)$

av grad

$= \frac{\Delta y}{\Delta x}$

$= \frac{3 - 43/9}{1 - (-1)}$

$= -\frac{8}{9}$ ✓ −0,89

3

4. $f(x) = \frac{3x-8}{x-2}$

$y = \frac{3x-8}{x-2}$

4.1.
$$x-2 \overline{)\ 3x-8\ } \quad 3$$
$$\ominus \quad \oplus$$
$$3x-6$$
$$-2$$

✓ method

$\therefore \frac{3x-8}{x-2} = 3 + \frac{-2}{x-2}$ 1

NO MARKS FOR :

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

$= \frac{-2+3x-6}{x-2}$

$= \frac{3x-8}{x-2}$

4.2. 1. ha : $y = 3$

va : $x = 2$

$\therefore A(2;3)$ ✓✓ 2

4.2. 2. y-int : $y = \frac{3(0)-8}{0-2}$

$= 4$

$\therefore B(0;4)$ ✓ 1

4.2. 3. x-int : $0 = -\frac{2}{x-2} + 3$

$\frac{2}{x-2} = 3$

LCD $= (x-3)$ $(\because x \neq 3)$

x thru

$2 = 3(x-2)$

$\frac{8}{3} = x$ 2,67

$\therefore C(\frac{8}{3};0)$ ✓✓ 2

4.3. 1. $y = -(x-2) + 3$

$= -x+2+3$

$= -x+5$ ✓✓ 2

-1 if no y = ...

4.3. 2. $(-\sqrt{2};\sqrt{2})$

$\therefore P(-\sqrt{2}+2;\sqrt{2}+3)$ (OK)

$= P(0,59;4,41)$ ✓✓ 2

4.4. $f: y = -\frac{2}{x-2} + 3$

Reflect x axis

- $x \to x$
- $y \to -y$

$-y = -\frac{2}{x-2} + 3$ ✓

$y = \frac{2}{x-2} - 3$ ✓ ⟶

(OR)

$-y = \frac{3x-8}{x-2}$ ✓

$y = -\frac{3x-8}{x-2}$ ✓ **2**

4.5. $x \cdot f(x) \geq 0$

$x \cdot y_f \quad 0 +$

$x \in [0;2)$ or $[\frac{8}{3};\infty)$ ⟶ **2**

✓ val + notⁿ ✓ val + notⁿ

5. $f: y = ax^2 + bx + c$

$g: y - 2x - 10 = 0$

ie $y = 2x + 10$

5.1. 1. y int: $y = 10$

$\therefore C(0;10)$ ✓ ⟶ **1**

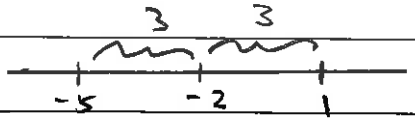
5.1. 2. x int: $0 = 2x + 10$

$-5 = x$

$\therefore A(-5;0)$ ✓ ⟶ **1**

5.1. 3. $\frac{x_B + (-5)}{2} = -2$

$\therefore x_B = 1$



$\therefore B(1;0)$ ✓ ⟶ **1**

5.2 $y = a(x+5)(x-1)$ ✓

Snb $C(0;10)$

$10 = a(5)(-1)$ ✓

$-2 = a$ ✓

$\therefore y = -2(x+5)(x-1)$ ✓

$= -2(x^2 + 4x - 5)$ ✓

$= -2x^2 - 8x + 10$ **4**

5.3 $x = -2$

$y = -2(-2)^2 - 8(-2) + 10$

$= 18$

$\therefore M(-2; 18)$ ✓ **1**

5.4 $f(x) \cdot g(x) \leq 0$

$y_f \cdot y_g \leq 0$

$x \leq -5$ or $x \in [1; \infty)$ **2**

✓ ✓

5.5. 1. HL

$= y_H - y_L$ ✓ method ✓ y_{line}

$= -2x^2 - 8x + 10 - (2x + 10)$

$= -2x^2 - 8x + 10 - 2x - 10$

$= -2x^2 - 10x$ **2**

5.5. 2. $x = -\frac{(-10)}{2(-2)}$

$= -\frac{5}{2}$ ✓ **1**

5.5. 3. HL_{max}

$= -2\left(-\frac{5}{2}\right)^2 - 10\left(-\frac{5}{2}\right)$

$= \frac{25}{2}$ ✓ 12,5 **1**

5.6. $2k - 5 = 2x^2 + 8x$

$-2x^2 - 8x + 2k - 5 = 0$

$-2x^2 - 8x + 2k - 5 = y$

✓ y_{int}

$10 - 18 < y_{int} < 0$

$-8 < 2k - 5 < 0$

$-3 < 2k < 5$

$-\frac{3}{2} < k < \frac{5}{2}$ **3**

✓ ✓

6.1. $-7 \; ; -15 \; ; -23$

$-8 \quad -8$

$D_n = a + (n-1)d$

$= -7 + (n-1)(-8)$

$= -7 - 8n + 8$

$= -8n + 1$ ✓ ✓ → **2**

6.2. $D_n = -8n + 1$

$-1199 = -8n + 1$ ✓

$8n = 1200$

$n = 150$ ✓

$\therefore T_{150}$ and T_{151} ✓ → **3**

6.3. $d_2 = 2a \qquad d_1 = 3a + b$

$-8 = 2a \qquad -7 = 3(-4) + b$

$-4 = a$ ✓ $\qquad 5 = b$ ✓

$T_{38} = -5576$ $n=38$ ✓

$a(38)^2 + b(38) + c = -5576$

$-4(38)^2 + 5(38) + c = -5576$

$\therefore c = 10$ ✓

$\therefore T_n = -4n^2 + 5n + 10$ ✓ → **5**