

GRADE : 11

DATE

SUBJECT : Mathematics

TITLE : Paper 1

SOLUTIONS

EXAMINER :

TOTAL MARKS : 100

TIME : 2 hour(s)

1.1.	1. $3x(x-4) = 5$		1.1.	3. $\frac{3x+1}{7x-1} = \frac{2x-1}{3x+1}$	
	$3x^2 - 12x - 5 = 0$ ✓			$(3x+1)(3x+1) = (2x-1)(7x-1)$ ✓	
	$(\quad) = 0$			$9x^2 + 6x + 1 = 14x^2 - 9x + 1$	
	$x = \frac{-(-12) \pm \sqrt{(-12)^2 - 4(3)(-5)}}{2(3)}$ ✓			$0 = 5x^2 - 15x$	
	$= \frac{12 \pm \sqrt{204}}{6}$			$\div 5: 0 = x^2 - 3x$ ✓	
	$= 4,38 \text{ or } -0,38$ ✓ ✓ → 4			$= x(x-3)$ ✓	
				$\therefore x = 0 \text{ or } 3$ ✓ ✓ → 4	
1.1.	2. $3\sqrt{2-x} + 2x = -5$		1.1.	4. $2^x - 5 \cdot 2^{x-3} = 3\sqrt{2}$	
	$(3\sqrt{2-x})^2 = (-2x-5)^2$			$2^x - 5 \cdot 2^x \cdot 2^{-3} = 3\sqrt{2}$	
	$9(2-x) = 4x^2 + 20x + 25$ ✓			$2^x(1 - 5 \cdot 2^{-3}) =$	
	$18 - 9x =$			$2^x(1 - \frac{5}{2^3}) =$	
	$0 = 4x^2 + 29x + 7$ ✓			$2^x(1 - \frac{5}{8}) =$ ✓	
	$= (4x+1)(x+7)$ ✓			$\checkmark 2^x \cdot \frac{3}{8} \checkmark = 3 \cdot (2^{\frac{1}{2}})$	
	$\therefore x = -\frac{1}{4} \text{ or } -7$ ✓ ✓ → 6			$\times \frac{8}{3}: 2^x = 2^{\frac{1}{2}} \cdot 8$	
	reject ✓			$= 2^{\frac{1}{2}} \cdot 2^3$	
				$= 2^{7/2}$	
				$\therefore x = 7/2$ ✓ ✓ → 4	

1.1.	5.	$2x^{-3} - 3x^{-3/2} = 5$		1.2.	$x^2 - xy - y^2 = -1$	
		$k = x^{-3/2}$			$2^x \cdot 32 = 4^y$	
		$(k)^2 = (x^{-3/2})^2$			$2^x \cdot 2^5 = (2^2)^y$	
		$= x^{-3}$			$2^{x+5} = 2^{2y}$	
		$2k^2 - 3k - 5 = 0$			$x + 5 = 2y \checkmark$	
		$(2k - 5)(k + 1) \checkmark = 0$			$x = 2y - 5 \checkmark$	
		$\therefore k = \frac{5}{2}$ or $k = -1$ ^{both}				
		$x^{-3/2} = \frac{5}{2}$ no soln				
		$x = \left(\frac{5}{2}\right)^{-2/3} \checkmark \checkmark$			$(2y-5)^2 - (2y-5)y - y^2 \checkmark = -1$	
		$= 0,54 \checkmark$	5		$4y^2 - 20y + 25 - 2y^2 + 5y - y^2 + 1 = 0$	
		no mark for $^{-3/2}\sqrt{\quad}$			$y^2 - 15y + 26 = 0 \checkmark$	
					$(y-13)(y-2) = 0 \checkmark$	
1.1.	6.	$12 > x(6x+1)$			$y = 13$ or $y = 2$ ^{both}	
		$0 > 6x^2 + x - 12 \checkmark$			$x = 2(13) - 5$ $x = 2(2) - 5$	
		$0 > (3x-4)(2x+3) \checkmark$			$= 21$ $= -1$ ^{both}	
		$\begin{array}{c} + \quad 0 \quad - \quad 0 \quad + \\ \quad \quad \quad \\ -3/2 \quad 4/3 \end{array}$			$\therefore x = 21$ and $y = 13$	
		$-3/2 < x < 4/3 \checkmark$	4		or	
					$x = -1$ and $y = 2 \checkmark$	7
1.1.	7.	$x \geq 2 \checkmark$	1			

1.3.	$49x^2 - 42x + 9 = 0$ $\Delta = (-42)^2 - 4(49)(9) \checkmark$ $= 0 \checkmark$ \therefore roots are • real • rational • equal	\checkmark ans only (no Δ) $\frac{0}{2}$	$(y-2)(y+2) \geq 0 \checkmark$ $\oplus \frac{0}{-2} - \frac{0}{2} \oplus$ $y \leq -2$ or $2 \leq y$ \checkmark \checkmark -1 no "or"	4
1.4. 1.	$y = x + \frac{1}{x}$ LCD = x ($\because x \neq 0$) x thru $yx = x^2 + 1$ $\checkmark 0 = x^2 - yx + 1$	3	1.5. $\frac{(2-3\sqrt{5})^2}{\sqrt{5}}$ num = $(2-3\sqrt{5})(2-3\sqrt{5})$ $= 4 - 12\sqrt{5} + 9 \cdot 5$ $= 49 - 12\sqrt{5} \checkmark$ $\frac{49-12\sqrt{5}}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \checkmark$ $= \frac{49\sqrt{5} - 12 \cdot 5}{5}$ $= \frac{49\sqrt{5}}{5} - 12$ $= -12 + \frac{49}{5} \cdot \sqrt{5}$	4
1.4. 2.	$\Delta = (-y)^2 - 4(1)(1)$ $= y^2 - 4 \checkmark$	2	2. A(-2; -4) $\frac{5 \uparrow}{3 \leftarrow} \rightarrow (-5; 1)$	2
1.4. 3.	For a real graph $\Delta \geq 0$ $y^2 - 4 \geq 0 \checkmark$			

$$3. \quad f(x) = -2 \cdot 3^{x-1} + 5$$

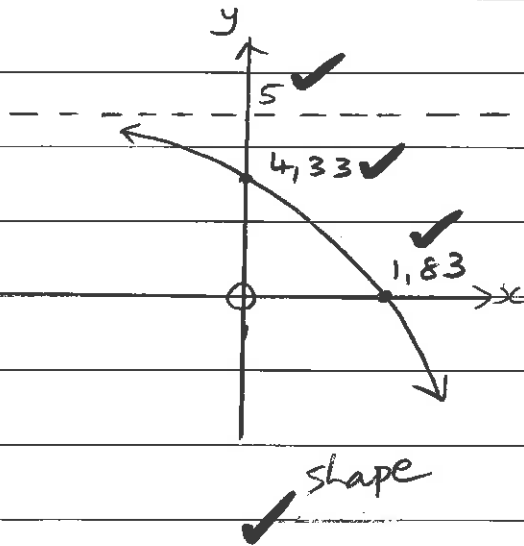
$$y = -2 \cdot 3^{x-1} + 5$$

3.1. • exponential

• y int: $y = -2 \cdot 3^{0-1} + 5$
 $= \frac{12}{3} \quad 4,33$

• x int: $0 = -2 \cdot 3^{x-1} + 5$
 $2 \cdot 3^{x-1} = 5$
 $3^{x-1} = \frac{5}{2}$
 $x - 1 = \frac{\log 5/2}{\log 3} \checkmark \log 3$
 $x = 1,83$

• ha: $y = 5$



$$3.2 \quad x = -1 \quad y = -2 \cdot 3^{-1-1} + 5$$

$$= \frac{4^3}{9} \checkmark$$

$$\therefore (-1; \frac{4^3}{9})$$

$$x = 1 \quad y = -2 \cdot 3^{1-1} + 5$$

$$= 3 \checkmark$$

$$\therefore (1; 3)$$

av grad

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

$$= \frac{3 - 4^3/9}{1 - (-1)}$$

$$= -\frac{8}{9} \checkmark$$

$$-0,89 \quad \mathbf{3}$$

4.	$f(x) = \frac{3x-8}{x-2}$		4.2. 2.	$y_{int}: y = \frac{3(0)-8}{0-2}$ $= 4$ $\therefore B(0;4) \checkmark$	1
	$y = \frac{3x-8}{x-2}$				
4.1.	$\begin{array}{r} 3 \\ x-2 \overline{) 3x-8} \\ \underline{\ominus 3x \oplus 6} \\ -2 \end{array}$	\checkmark method	4.2. 3.	$x_{int}: 0 = -\frac{2}{x-2} + 3$ $\frac{2}{x-2} = 3$ LUD = $(x-3)$ ($\because x \neq 3$) x thru $2 = 3(x-2)$ $\frac{8}{3} = x$ 2,67 $\therefore C(\frac{8}{3}; 0) \checkmark \checkmark$	2
	$\therefore \frac{3x-8}{x-2} = 3 + \frac{-2}{x-2}$	1			
	<u>NO MARKS FOR :</u>				
	$-\frac{2}{x-2} + 3 = \frac{-2 + 3(x-2)}{x-2}$ $= \frac{-2 + 3x - 6}{x-2}$ $= \frac{3x-8}{x-2}$		4.3. 1.	$y = -(x-2) + 3$ $= -x + 2 + 3$ $= -x + 5$ $\checkmark \checkmark$ -1 if no $y = \dots$	2
4.2. 1.	ha: $y = 3$ va: $x = 2$				
	$\therefore A(2;3) \checkmark \checkmark$	2	4.3. 2.	$(-\sqrt{2}; \sqrt{2})$ $\therefore P(-\sqrt{2}+2; \sqrt{2}+3)$ (OK) $= P(0,59; 4,41) \checkmark \checkmark$	2

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

Reflect x axis

• $x \rightarrow x$

• $y \rightarrow -y$

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

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

(OR)

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

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

2

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

$x \cdot y_f \geq 0$

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

\checkmark
val
+
notⁿ

\checkmark
val
+
notⁿ

2

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

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

ie $y = 2x + 10$

5.1. 1. yint: $y = 10$

$\therefore C(0; 10) \checkmark$

1

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

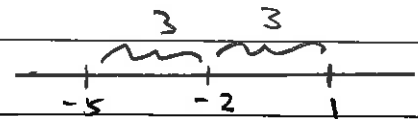
$-5 = x$

$\therefore A(-5; 0) \checkmark$

1

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

$\therefore x_B = 1$



$\therefore B(1; 0) \checkmark$

1

5.2 $y = a(x+5)(x-1) \checkmark$

sub $C(0; 10)$

$10 = a(5)(-1) \checkmark$

$-2 = a \checkmark$

	$\therefore y = -2(x+5)(x-1)$ $= -2(x^2 + 4x - 5)$ $= -2x^2 - 8x + 10$	4	s.s. 2. $x = -\frac{(-10)}{2(-2)}$ $= -\frac{5}{2}$	1
s.3.	$x = -2$ $y = -2(-2)^2 - 8(-2) + 10$ $= 18$ $\therefore M(-2; 18)$	1	s.s. 3. HL _{max} $= -2\left(-\frac{5}{2}\right)^2 - 10\left(-\frac{5}{2}\right)$ $= \frac{25}{2}$	1
s.4.	$f(x) \cdot g(x) \leq 0$ $y_f \cdot y_g = 0$ $x = -5$ or $x \in [1; \infty)$	2	s.6. $2k - 5 = 2x^2 + 8x$ $-2x^2 - 8x + 2k - 5 = 0$ $-2x^2 - 8x + 2k - 5 = y$ \checkmark y_{int}	
s.s. 1.	HL $method = y_H - y_L$ $= -2x^2 - 8x + 10 - (2x + 10)$ $= -2x^2 - 8x + 10 - 2x - 10$ $= -2x^2 - 10x$	2	$10 - 18 < y_{int} < 0$ $-8 < 2k - 5 < 0$ $-3 < 2k < 5$ $-\frac{3}{2} < k < \frac{5}{2}$	3

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

$\checkmark \quad \checkmark$

$-8 \quad -8$

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

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

$$= -7 - 8n + 8$$

$$= \underline{-8n + 1}$$

2

$\therefore c = 10 \checkmark$

$\therefore T_n = \underline{-4n^2 + 5n + 10}$ 5

6.2. $D_n = -8n + 1$

$-1199 = -8n + 1 \checkmark$

$8n = 1200$

$n = 150 \checkmark$

$\therefore T_{150}$ and T_{151}

3

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

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

$-4 = a \checkmark \quad 5 = b \checkmark$

$T_{38} = -5576$

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

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