Maths Paper 1. June 2017.
MEMO

Question 1.

(a)(i) $x(6x-10)-4=0$

$6x^2-10x-4=0$

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

$(3x+1)(x-2)=0$ Should show this. maybe −1 if done.

$x=-\frac{1}{3}$ or $x=2$. (3)

(ii) $2x-3=\frac{2}{x}$ $\quad x\neq 0$.

$2x^2-3x-2=0$

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

$x=-\frac{1}{2}$ or 2 (4)

(iii) $(9)^{2x-1}=(3^3)^{4-x}$.

$(3^2)^{2x-1}=(3^3)^{4-x}$

$(3)^{4x-2}=(3)^{12-3x}$

$4x-2=12-3x$

$7x=14$

$x=2$ (4)

(iv) $4.3^x-3^{x+1}=81$

$3^x(4-3)=81$

$3^x=3^4$

$x=4$ (4)

(v) $x^2-ax+(a-1)=0$.

$x=\frac{a\pm\sqrt{a^2-4(a-1)}}{2}$

$=\frac{a\pm\sqrt{a^2-4a+4}}{2}=\frac{a\pm\sqrt{(a-2)^2}}{2}$ (5)

a−1 or 1

$=\frac{a+a-2}{2}$ or $\frac{a-a+2}{2}=\frac{2a-2}{2}$ or $\frac{2}{2}=a-1$ or 1

(b)(i) $\sqrt{x} + 3x = 2$

$(\sqrt{x})^2 = (2-3x)^2$ ✓ ✓

$x = 4 - 12x + 9x^2$

$9x^2 - 13x + 4 = 0$ ✓

$(9x-4)(x-1) = 0$ (3)

(ii) $x = \frac{4}{9}$ or $x = 1$ ✓ (1)

check & what each into original:

(iii) $x = \frac{4}{9}$ $\sqrt{\frac{4}{9}} + 3.\frac{4}{9} = \frac{2}{3} + \frac{4}{3} = \frac{6}{3} = 2$ ✓

$x = 1$ $\sqrt{1} + 3 = 1 + 3 = 4 \neq 2$ not valid.

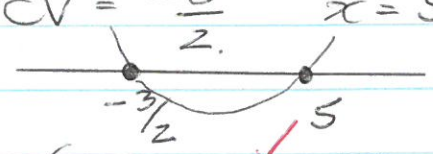
~~$x=1$~~ invalid. only solution ✓ (2)

$x = \frac{4}{9}$

(c)(i) $2x^2 - 7x - 15 \geq 0$.

$(2x+3)(x-5) \geq 0$ ✓

CV $= \frac{-3}{2}$ $x = 5$.



✓ ✓ ✓

$x \in (-\infty; -\frac{3}{2}]$ or $x \in [5; \infty)$ (4)

(ii) Real if $2x^2 - 7x - 15 \geq 0$. (2)

Positive values $x \in [5; \infty)$ but $x \neq 8$ ✓ ✓

(d) $M = \sqrt{(x+1)^2 - 4}$ M real.

(i) $(4)^2 = (\sqrt{(x+1)^2-4})^2$ ✓

$16 = (x+1)^2 - 4$.

$20 = (x+1)^2$ ✓

$x + 1 = \pm\sqrt{20}$

$x = -1 \pm 2\sqrt{5}$ ✓✓ (4)

(ii) $(x+1)^2 - 4$ TP $(-1; -4)$ min value -4.

min value is 0. ✓ (1)

(a)(i) $\frac{3}{x+2} + 1 = \frac{1}{x-3}$

CD $= (x+2)(x-3)$

$3(x-3) + (x+2)(x-3) = x+2$ ✓ Restrictions

$3x - 9 + x^2 - x - 6 - x - 2 = 0$ $x = -2$ or $x = 3$ ✓

$x^2 + x - 17 = 0$ ✓

(3)

(ii) $\left(x + \frac{1}{2}\right)^2 = 17 + \frac{1}{4} = \frac{69}{4}$

$\left(x + \frac{1}{2}\right)^2 = \frac{69}{4}$

$x = -\frac{1}{2} \pm \frac{\sqrt{69}}{2}$ ✓ $= \frac{-1 \pm \sqrt{69}}{2}$

(4)

(b) $6 - 4x - y = 0$ $\qquad 12 - 2x^2 - y = 0$ ②

$y = 6 - 4x$ ①

Sub ① into ②

$12 - 2x^2 - 6 + 4x = 0$

$2x^2 - 4x - 6 = 0$

$x^2 - 2x - 3 = 0$

$(x-3)(x+1) = 0$

$x = 3$ or -1.

$\therefore y = 6 - 12$ $\qquad y = 6 + 4$

$= -6$ or $= 10$

coord form not specified.

$(3; -6)$ $\qquad (-1; 10)$

(6)

Question 2.

(a) (i) $\frac{\left(5^{2x}\right)^{-2} \cdot 20^{x+1} \cdot 125^{x-1}}{2^{1+2x}}$

$= \frac{5^{-4x} \cdot 2^{2x+2} \cdot 5^{x+1} \cdot 5^{3x-3}}{2^{2x+1}}$

$= 2^{2x+2-(2x+1)} \cdot 5^{-4x+x+1+3x-3}$

$= 2 \cdot 5^{-2}$

$= \frac{2}{25}$

(5)

(11) $\dfrac{x^2}{1+x} = \dfrac{(1+\sqrt{3})(1+\sqrt{3})}{1+1+\sqrt{3}}$ ✓

$= \dfrac{1+2\sqrt{3}+3}{2+\sqrt{3}} = \dfrac{4+2\sqrt{3}}{2+\sqrt{3}}$ ✓

$= \dfrac{2(2+\sqrt{3})}{2+\sqrt{3}}$ ✓

$= 2$ ✓ (4)

(12) $\left(1-\frac{2}{\sqrt{x}}\right)\left(1+\frac{2}{\sqrt{x}}\right) = 3$

$1 - \frac{4}{x} = 3$ ✓

$x - 4 = 3x$ ✓

$-4 = 2x$

$x = -2$ ✓ but can't find $\sqrt{\text{neg.}}$ ✓

so no solution

(4)

[13]

Question 3

(a)

	1	5	11	19
d_1		4	6	8
d_2		2	2	

✓

$2a = 2$ ✓ $\quad a = 1$

$3(1) + b = 4$ ✓ $\quad b = 1$

$1 + 1 + c = 1$ ✓ $\quad c = -1$

$T_n = n^2 + n - 1$

(4)

(b) $n^2 + n - 1 > 505$ ✓

$n^2 + n - 506 > 0$ ✓

$n = 22$ or -23 ✓

to have more than 505 squares

need $n = 23$ ✓

(4)

Question 4

$f(x) = \frac{-4}{x-2} + 3$ $\quad g(x) = -x + 2$.

(a) $x = 2$ ✓ and $y = 3$ ✓ (2)

(b) Domain of f $x \in R$ ✓ but $x \neq 2$ ✓ (2)

(c) $y = \frac{-4}{x-2} + 3$ ① $\quad y = -x + 2$ ②

Sub ② into ① $\quad x \neq 2$

$-x + 2 = \frac{-4}{x-2} + 3$ ✓ ✓

$-x(x-2) + 2(x-2) = -4 + 3x - 6$ ✓

$-x^2 + 2x + 2x - 4 + 4 - 3x + 6 = 0$

$-x^2 + x + 6 = 0 \Rightarrow x^2 - x - 6 = 0$ ✓

$(x-3)(x+2) = 0$ ✓

$x = 3$ ✓ or -2 ✓

(7) [11]

Question 5

$f(x) = ax^2 + bx + c$ $\quad g(x) = p^x + q$. $\quad y = -1$.

(a) $x = 2$ ✓ (1)

(b) $B(4; 0)$ ✓ (1)

(c) $x \in (2; \infty)$ ✓ (1)

(d) $f(x) > 0$ $\quad x \in (0; 4)$ ✓ ✓ (2)

(e) $y = a(x-2)^2 + 3$ ✓

sub. $(0;0)$ $\quad 0 = 4a + 3$ ✓

$-\frac{3}{4} = a$

$y = -\frac{3}{4}(x-2)^2 + 3$ ✓

OR $= -\frac{3}{4}x^2 + 3x$ (3)

(f) $y = p^x - 1$ ✓

sub. $(2; 3)$ $\quad 3 = p^2 - 1$ ✓

$4 = p^2$

$p = 2$ $\quad y = 2^x - 1$ ✓

(g) $y \in (0; \infty)$ (1)

(h) $f(x+4)+5$ left by 4 up by 5 (2)

TP $(-2; 8)$.

(i) $h(x) = \frac{3}{4}(x-2)^2 - 3$ (2)

OR $= \frac{3}{4}x^2 - 3x$

(j) roots real and unequal. (1)

(k) transformation vertical shift down by 3. (1)

(l) roots $x = 2$. (1)

(m) $ax^2 + bx + c = k$.

$k > 3$ for no real roots. (1)

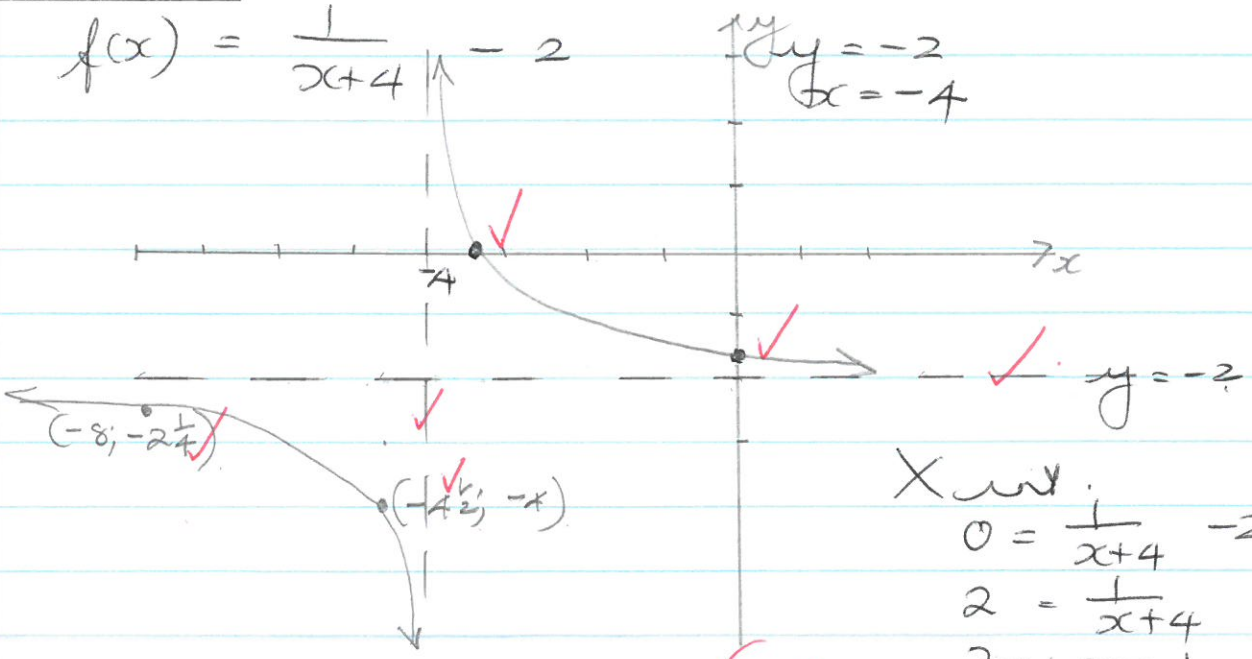
(n) $g(x) \leq f(x)$

$x \in [0; 2]$ (2)

[22]

Question 6

$f(x) = \frac{1}{x+4} - 2$



(6)

X int.

$0 = \frac{1}{x+4} - 2$

$2 = \frac{1}{x+4}$

$2x + 8 = 1$

$2x = -7$

$x = -\frac{7}{2}$

Y int $x = 0$.

$y = \frac{1}{4} - 2$

$= -1\frac{3}{4}$

Question 7

(a) eqn of parabola:

$y = a(x-4)(x+4)$ ✓

$y = a(x^2-16)$

Sub $(0; 8)$ $\quad 8 = a(-16)$ ✓

$-\frac{1}{2} = a$

$y = -\frac{1}{2}(x^2-16)$ ✓

$y = -\frac{1}{2}x^2 + 8$

$y = ax^2 + 8$

Sub $(\ )$

$0 = a(4)^2 + 8$

$-8 = 16a$

(3)

(b) Sub $x = 3$. ✓

$y = -\frac{1}{2} \cdot 9 + 8$

$= 8 - 4\frac{1}{2}$

$= 3\frac{1}{2}$ ✓

bus height is $3\frac{1}{2}$ m.

(2) [5]

Question 8

(a) $2x^2 - 4x + 6$

$= 2\{x^2 - 2x + 3\}$ ✓

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

$= 2(x-1)^2 + 4$ ✓

min value ✓ of 4 ✓

(3)

(a) $y = \frac{1}{\sqrt{2x^2-4x+6}} = \frac{1}{\sqrt{4}}$ ✓ $= \frac{1}{2}$ ✓

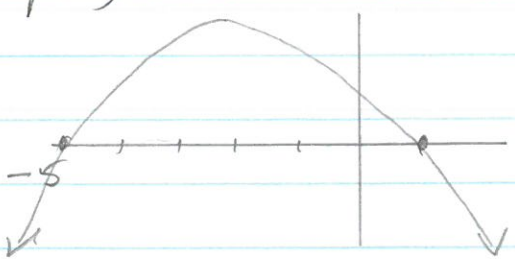
min value of $\sqrt{4}$ is 2 ∴ max value of y is $\frac{1}{2}$

(2) [5]

Question 9.

(a) $f(x) = ax^2 + bx + c$. $f(x) \geq 0$ for $x \in [-5; 1]$

$a < 0$ ∩

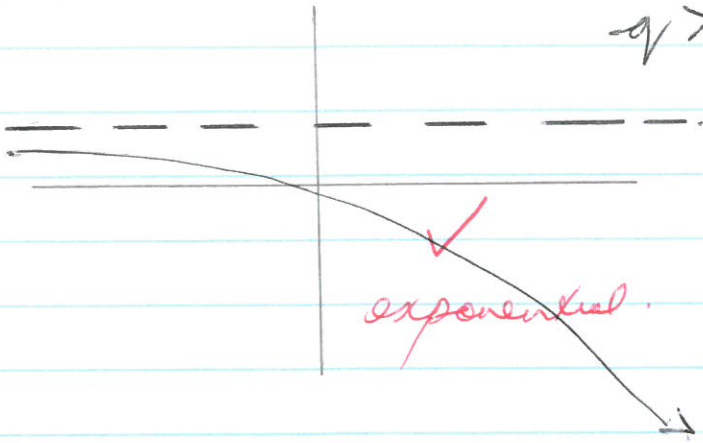


∩ ✓

2 x intercepts ✓

(2)

(b) $g(x) = a \cdot 2^x + q$ $a < 0$. $q > 0$.



means pos. asymptote

$a < 0$ means reversed the asymptote.

(3) [5]