

RBHS Mathematics Department

Gr 11 June 2016

Paper 1

PG (DG)

MEMORANDUM

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**Question 1**

1.1.1  $(2x - 1)(x + 2) = 1 - 2x$

$$2x^2 + 5x - 3 = 0 \checkmark$$

$$(2x - 1)(x + 3) = 0 \checkmark \text{ (or formula)}$$

$$x = \frac{1}{2} \checkmark \text{ or } x = -3 \checkmark$$

(4) R

1.1.2  $2x^2 - 6x - 7 = 0$

$$x = \frac{-(-6) \pm \sqrt{(-6)^2 - 4(2)(-7)}}{2(2)} \checkmark$$

$$x = 3,90 \checkmark \text{ or } -0,90 \checkmark$$

(3) R

1.1.3  $\sqrt{4x - 3} = x - 2$

$$4x - 3 = x^2 - 4x + 4 \checkmark$$

$$x^2 - 8x + 7 = 0 \checkmark$$

$$(x - 7)(x - 1) = 0 \checkmark$$

$$x = 7; x \neq 1 \checkmark \text{ (both)} \checkmark \text{ (check)}$$

(5) R

1.1.4  $2^{2x} + 7 \cdot 2^x = 8$

$$2^{2x} + 7 \cdot 2^x - 8 = 0 \checkmark$$

$$(2^x + 8)(2^x - 1) = 0 \checkmark$$

$$2^x = -8 \checkmark \text{ or } 2^x = 1 \checkmark$$

$$\text{(no value)} \quad x = 0 \checkmark$$

(5) C

1.2  $2y - 6x = 4 \dots (1)$

$$y = 3x^2 + 6x - 4 \dots (2)$$

*sub (2) into (1):*

$$2(3x^2 + 6x - 4) - 6x = 4 \checkmark$$

$$6x^2 + 6x - 12 = 0 \checkmark$$

$$x^2 + x - 2 = 0$$

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

$$x = -2 ; 1 \checkmark \text{ (both)}$$

$$y = -4 \checkmark ; 5 \checkmark$$

(6) R

[23]

## Question 2

$$2.1.1 \quad y - \frac{1}{4y} - \frac{4}{3} = 0$$

$$12y^2 - 3 - 16y = 0 \checkmark$$

$$12y^2 - 16y - 3 = 0 \checkmark$$

$$(2y - 3)(6y + 1) = 0$$

$$y = \frac{3}{2} \checkmark \text{ or } y = -\frac{1}{6} \checkmark$$

(4) R

$$2.1.2 \quad \frac{2x-1}{2x} - \frac{x}{2(2x-1)} - \frac{4}{3} = 0$$

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

$$\therefore \frac{2x-1}{2x} = \frac{3}{2} \checkmark \text{ CA or } \frac{2x-1}{2x} = -\frac{1}{6} \checkmark \text{ CA}$$

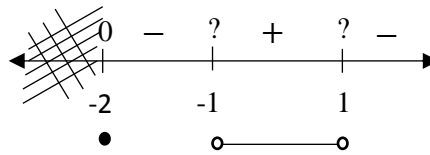
$$x = -1 \checkmark \quad \text{or} \quad x = \frac{3}{7} \checkmark$$

(4) C

$$2.2 \quad \frac{\sqrt{x+2}}{3-3x^2} \geq 0$$

$$\frac{\sqrt{x+2}}{3(1-x)(1+x)} \checkmark \geq 0$$

$$-1 < x < 1 \checkmark \checkmark \text{ and } x = -2 \checkmark$$



(4) P

$$2.3 \quad y = (x + n)^2 - nx$$

$$y = x^2 + 2xn + n^2 - nx$$

$$y = x^2 + xn + n^2 \checkmark$$

$$\Delta = n^2 - 4(1)(n^2) \checkmark$$

$$\Delta = -3n^2$$

$\therefore \Delta < 0$  for all values of  $n \checkmark \therefore$  no real roots.

(3) C

[15]

### **Question 3**

$$\begin{aligned} 3.1 \quad & \frac{2 \cdot 3^x - 3^{x-2}}{2 \cdot 3^{x-2}} \\ &= \frac{3^x(2 - 3^{-2})}{3^x(2 \cdot 3^{-2})} \checkmark \\ &= \frac{2 - \frac{1}{9}}{\frac{2}{9}} \checkmark \\ &= \frac{17}{2} \checkmark \end{aligned}$$

(3) R

$$\begin{aligned} 3.2 \quad & \frac{a^{-2} - b^{-2}}{b^2 - a^2} \\ &= \frac{\frac{1}{a^2} - \frac{1}{b^2}}{b^2 - a^2} \checkmark \\ &= \frac{b^2 - a^2}{a^2 b^2} \checkmark \times \frac{1}{b^2 - a^2} \\ &= \frac{1}{a^2 b^2} \checkmark \end{aligned}$$

(3) R

[6]

#### Question 4

4.1 3 ; p ; 10 ; q ; 21 ; ...

4.1.1  $p - 3$      $10 - p$      $q - 10$      $21 - q$  ✓

$$13 - 2p \quad q + p - 20 \quad 31 - 2q \quad \checkmark$$

$$13 - 2p = 1 \quad \checkmark$$

$$31 - 2q = 1 \quad \checkmark$$

$$p = 6$$

$$q = 15 \quad (-1 \text{ if not finished}) \quad (4) \text{ C}$$

4.1.2 3 ; 6 ; 10 ; 15 ; 21

$$3 \quad 4 \quad 5 \quad 6$$

$$1 \quad 1 \quad 1$$

$$2a = 1$$

$$3a + b = 3$$

$$a + b + c = 3$$

$$a = \frac{1}{2} \quad \checkmark$$

$$b = \frac{3}{2} \quad \checkmark$$

$$c = 1 \quad \checkmark$$

$$T_n = \frac{1}{2}n^2 + \frac{3}{2}n + 1 \quad \checkmark$$

(ans only full marks)

(4) R

4.1.3  $\frac{1}{2}n^2 + \frac{3}{2}n + 1 = 210$  ✓

$$n^2 + 3n + 2 = 420$$

$$n^2 + 3n - 418 = 0 \quad \checkmark$$

$$(n - 19)(n + 22) = 0$$

$$n = 19 ; n \neq -22 \quad \therefore \text{yes} \quad \checkmark$$

(3) R

4.1.4  $T_n + T_{n+1} = \frac{1}{2}n^2 + \frac{3}{2}n + 1 + \frac{1}{2}(n+1)^2 + \frac{3}{2}(n+1) + 1$  ✓

$$= \frac{1}{2}n^2 + \frac{3}{2}n + 1 + \frac{1}{2}(n^2 + 2n + 1) + \frac{3}{2}n + \frac{3}{2} + 1$$

$$= n^2 + 4n + 4 \quad \checkmark$$

$$= (n + 2)^2 \quad \checkmark \quad \therefore T_n + T_{n+1} = \text{square number for all } n \in R \quad (3) \text{ P}$$

4.2 -58 ; -55 ; -52 ✓✓✓ OR -59 ; -56 ; -53 OR -60 ; -57 ; -54

(3) P

[18]

### Question 5

$$f(x) = -x^2 + 4x \text{ and } g(x) = 2^{x+1} - 4.$$

5.1 OA:  $-x(x - 4) = 0$  ✓

$$x = 0; 4$$

$$OA = 4 \text{ units} \checkmark$$

5.2 OB:  $2^{x+1} - 4 = 0$  ✓

$$2^{x+1} = 2^2$$

$$x + 1 = 2 \checkmark$$

$$x = 1$$

$$OB = 1 \text{ unit} \checkmark$$

5.3 EB:  $f(1) - g(1)$  (CA from 5.2)

$$EB = 3 \text{ units} \checkmark \checkmark$$

5.4 FG:  $y = -4$

$$-x^2 + 4x = -4 \checkmark$$

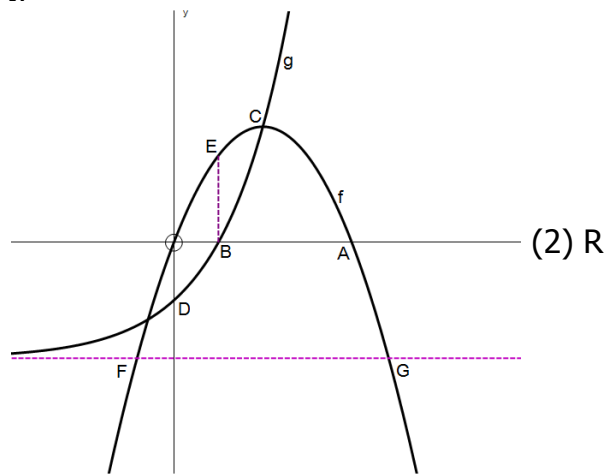
$$x^2 - 4x - 4 = 0$$

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

$$x = 2 \pm 2\sqrt{2} \checkmark$$

$$FG = 2 + 2\sqrt{2} - (2 - 2\sqrt{2})$$

$$= 4\sqrt{2} \text{ units} \checkmark$$



(2) R

(3) R

(2) C

(3) C

[10]

### Question 6

Given  $h(x) = \frac{5}{x+2} - 3$

6.1  $x = -2$  ✓;  $y = -3$  ✓ (2) R

6.2  $x \text{ int: } \frac{5}{x+2} = 3$  ✓

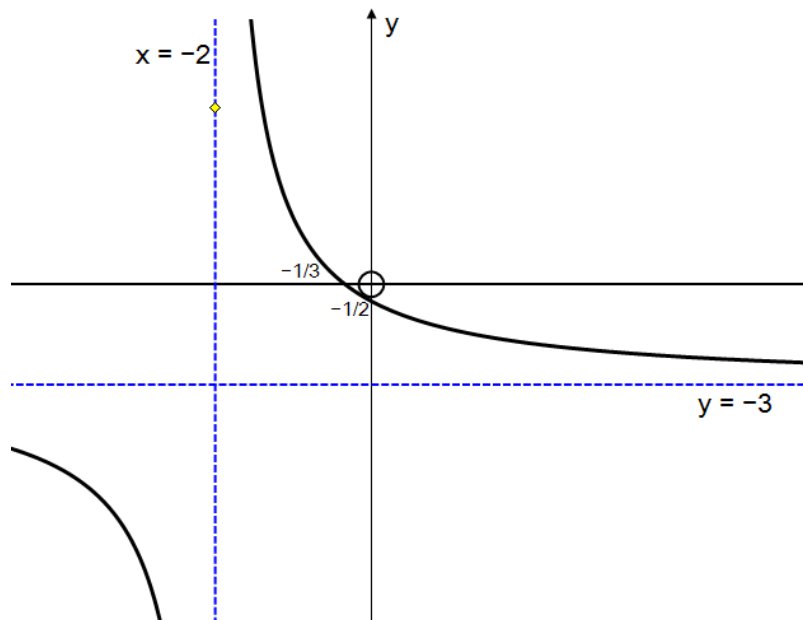
$$x = -\frac{1}{3} \text{ ✓}$$

$y \text{ int: } y = \frac{5}{2} - 3$  ✓

$$y = -\frac{1}{2} \text{ ✓}$$

(4) R

6.3



✓  $x = -2$  ✓  $y = -3$  ✓  $x \text{ int}$  ✓  $y \text{ int}$  (4) R

6.4  $y \in R; y \neq -2$  ✓ (1) C

6.5  $y = \frac{-5}{x+3} + 2$  ✓ (3) C

[14]

**Question 7**  $g(x) = ax^2 + bx + c$  and  $p(x) = \frac{1}{2}x + 6$

7.1  $y = a(x - 1)^2 - 4$  ✓

sub (3; 0)

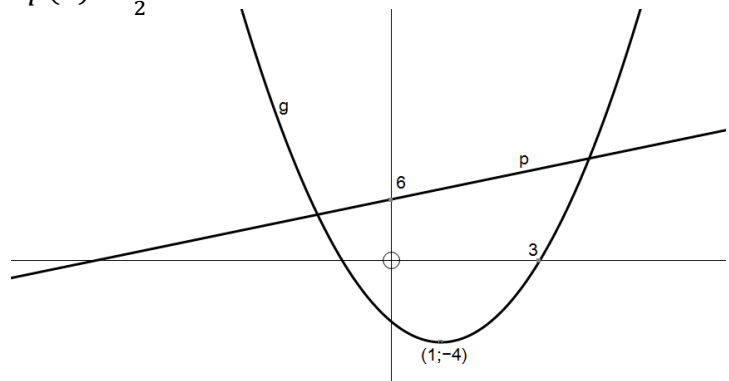
$0 = a(3 - 1)^2 - 4$  ✓

$a = 1$  ✓

$y = 1(x - 1)^2 - 4$

$y = x^2 - 2x + 1 - 4$

$g(x) = x^2 - 2x - 3$  no penalty for notation. (-1 for not finishing)



OR  $x - \text{int} = -1$   $y = a(x + 1)(x - 3)$  ✓

$-4 = a(1 + 1)(1 - 3)$  ✓

$a = 1$  ✓

$y = 1(x + 1)(x - 3) = x^2 - 2x - 3$  (3) R

7.2  $x^2 - 2x - 3 = \frac{1}{2}x + 6$  ✓

$\therefore x^2 - 2\frac{1}{2}x - 9 = 0$  ✓

$2x^2 - 5x - 18 = 0$   $(x + 2)(2x - 9) = 0$

$x = -2$  or  $x = \frac{9}{2}$  ✓ (both)

$y = 5$  ✓ or  $y = 8\frac{1}{4}$   $(\frac{33}{4})$  ✓  $(-2; 5)$   $(\frac{9}{2}; 8\frac{1}{4})$  (5) R

7.3.1  $g(x) - p(x) \leq 0$   $\therefore g(x) \leq p(x)$

$-2 \leq x \leq \frac{9}{2}$  ✓✓ (2) R

7.3.2  $-g(x) \cdot x \geq 0$

$x \leq -1$  ✓ and  $0 \leq x \leq 3$  ✓✓ (3) P

7.4  $x^2 - 2x - 5 = k$   $\therefore 3 < -2 - k < 4$

$-6 < k < -5$  ✓✓ (2) C  
[15]