
MEMORANDUM

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MATHEMATICS – FIRST PAPER

This memorandum consists of 12 pages.

QUESTION 1

1.1 1.1.1 $2x(x-3) = 20$
 $2x^2 - 6x - 20 = 0$ ✓
 $x^2 - 3x - 10 = 0$
 $(x-5)(x+2) = 0$ ✓
 $\therefore x = 5$ ✓ or $x = -2$ ✓

std form
factors
answers (4)

1.1.2 $x+2 = \frac{3x}{x-2}; x \neq 2$
 $x^2 - 4 = 3x$ ✓
 $x^2 - 3x - 4 = 0$ ✓
 $(x-4)(x+1) = 0$ ✓
 $\therefore x = 4$ or $x = -1$ ✓

multiply by denominator
std form
factors
both answers (4)

1.1.3 $3x^2 - 12x + 4 = 0$

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

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

$$= \frac{12 \pm \sqrt{144 - 48}}{6}$$

$$= \frac{12 \pm \sqrt{96}}{6}$$

substitution
simplification
solutions
(-1 for incorrect rounding off) (4)

$x = 3,63$ ✓ or $x = 0,37$ ✓

1.2 $x^2 - x < 20$
 $x^2 - x - 20 < 0$ ✓
 $(x-5)(x+4) < 0$ ✓

$\begin{array}{c} \longleftarrow -4 \qquad \qquad \qquad 5 \longrightarrow \\ + \qquad \qquad \qquad - \qquad \qquad \qquad + \end{array}$

$-4 < x < 5$ ✓✓✓

$\therefore -3 - 2 - 1 + 0 + 1 + 2 + 3 + 4 = 4$ ✓✓

std form
factors
solutions / notation
sum / answer (7)

1.3 OPTION 1

$x - 3y = 5 \dots\dots(1)$ $x^2 + xy + 2y^2 = 4 \dots\dots\dots(2)$

$\therefore x = 5 + 3y \dots\dots\dots(3)$ \checkmark the subject of the formula

Subst (3) into (2):

$(3y + 5)^2 + y(3y + 5) + 2y^2 = 4$	\checkmark	substitution
$9y^2 + 30y + 25 + 3y^2 + 5y + 2y^2 = 4$	\checkmark	multiplication
$14y^2 + 35y + 21 = 0$		
$2y^2 + 5y + 3 = 0$	\checkmark	std form
$(2y + 3)(y + 1) = 0$	\checkmark	factors
$y = \frac{-3}{2}$ or $y = -1$	\checkmark	both answers

Substit. into (3):

$x = 3\left(\frac{-3}{2}\right) + 5$	or	$x = 3(-1) + 5$	
$= \frac{1}{2}$	\checkmark	$= 2$	\checkmark each x-value

OPTION 2

$\frac{x}{3} - \frac{5}{3} = y \dots\dots(3)$ \checkmark

Subst into (2): $x^2 + x\left(\frac{x-5}{3}\right) + 2\left(\frac{x-5}{3}\right)^2 = 4$ \checkmark

$x^2 + \frac{x^2 - 5x}{3} + \frac{2x^2 - 20x + 50}{9} = 4$

$9x^2 + 3x^2 - 15x + 2x^2 - 20x + 50 - 36 = 0$ \checkmark

$14x^2 - 35x + 14 = 0$

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

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

$x = \frac{1}{2}$ or $x = 2$ \checkmark

Subst into (3)

$y = \frac{\frac{1}{2} - 5}{3} = -\frac{3}{2}$	\checkmark	or	$y = \frac{2 - 5}{3} = -1$	\checkmark	(8)
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QUESTION 2

2.1 $\sqrt[5]{\frac{-243}{32}} = \sqrt{\frac{-3}{2}}$ ✓
 Non real ✓
 Square root of a negative number ✓

simplification
 answer
 reason (3)

(if reason correct, full marks)

2.2 2.2.1 $\frac{2^{3+x} - 3 \cdot 2^x}{3 \cdot 2^{x-1} + 2^x}$
 $= \frac{2^x(2^3 - 3)}{2^x(3 \cdot \frac{1}{2} + 1)}$ ✓ ✓
 $= \frac{5}{\frac{5}{2}}$ ✓
 $= \frac{10}{5} = 2$ ✓

common factor
 numerator / denominator
 simplification
 answer (5)

2.2.2 $\sqrt[3]{(\sqrt{13} - \sqrt{5})^6} \cdot \sqrt[3]{(\sqrt{13} + \sqrt{5})^6}$
 $= (\sqrt{13} - \sqrt{5})^2 \cdot (\sqrt{13} + \sqrt{5})^2$ ✓
 $= [(\sqrt{13} - \sqrt{5})(\sqrt{13} + \sqrt{5})]^2$ ✓
 $= (13 - 5)^2$ ✓
 $= 64$ ✓

simplification
 law of exponents
 simplification
 answer (4)

2.3 True Area = $l \cdot b$ ✓
 $= 26,9 \times 13,1$
 $= 352,39 \text{ m}^2$ ✓

Difference = $352,39 - 351$
 $= 1,39 \text{ m}^2$ ✓

formula
 answer
 answer (3)
[15]

QUESTION 3

$$3.1 \quad T_n = 23 - 4(n-1)$$

$$3.1.1 \quad \begin{array}{c} \sqrt{\quad} \quad \sqrt{\quad} \quad \sqrt{\quad} \\ 23; 19; 15; \dots \end{array}$$

answers (3)

$$3.1.2 \quad \begin{array}{c} T_{10} = 23 - 4(9) \\ = -13 \end{array} \quad \checkmark$$

answer (1)

$$3.1.3 \quad \begin{array}{c} T_n = 23 - 4(n-1) \\ -37 = 23 - 4n + 4 \quad \checkmark \\ 4n = 27 + 37 \\ 4n = 64 \quad \checkmark \\ n = 16 \quad \checkmark \end{array}$$

substitution

simplification

answer (3)

$$3.2 \quad \frac{8}{3}; \frac{4}{3}; \frac{2}{3}$$

$$3.2.1 \quad \frac{1}{3}; \frac{1}{6}; \dots \quad \checkmark$$

answer [both values] (1)

$$3.2.2 \quad \text{Multiply by a common ratio, } \frac{1}{2} \quad \checkmark$$

explanation (1)

$$3.2.3 \quad T_n = \frac{8}{3} \left(\frac{1}{2} \right)^{n-1} \quad \checkmark \checkmark$$

answer (2)

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QUESTION 4

4.1 21 pieces of wood \checkmark answer (1)

4.2 quadratic \checkmark answer (1)

4.3 $3 ; 7 ; 13$
 First difference $4 \quad 6 \quad \checkmark$ 1^{st} difference
 Second difference $2 \quad \checkmark$ 2^{nd} difference

$$T_n = an^2 + bn + c$$

OPTION 1

$$T_n = an^2 + bn + c$$

subst $n=1 ; n=2 ; n=3$

$$T_1 = a + b + c = 3 \dots\dots\dots (1)$$

$$T_2 = a(2)^2 + b(2) + c = 7$$

$$= 4a + 2b + c = 7 \dots\dots\dots (2)$$

$$T_3 = a(3)^2 + 3b(3) + c = 13$$

$$= 9a + 3b + c = 13 \dots\dots\dots (3)$$

$$T_2 - T_1 = 3a + b = 4 \quad \text{and} \quad T_3 - T_2 = 5a + b = 6$$

$$3a + b = 4 \dots\dots\dots (4)$$

$$5a + b = 6 \dots\dots\dots (5)$$

$$(5) - (4) : \quad 2a = 2$$

$$a = 1 \quad \checkmark$$

value of a

$$\text{Subst into (4):} \quad 3(1) + b = 4$$

$$b = 1 \quad \checkmark$$

value of b

$$\text{Subst into (1):} \quad (1) + (1) + c = 3$$

$$c = 1 \quad \checkmark$$

value of c

$$T_n = n^2 + n + 1 \quad \checkmark$$

answer

OPTION 2

$$2a = 2$$

$$a = 1 \quad \checkmark$$

$$3a + b = 4$$

$$3(1) + b = 4$$

$$b = 1 \quad \checkmark$$

$$a + b + c = 3$$

$$(1) + (1) + c = 3$$

$$c = 1 \quad \checkmark$$

(6)

$$T_n = n^2 + n + 1 \quad \checkmark$$

Answer only: Full marks **[8]**

QUESTION 5

5.1 $A = P(1 + \frac{r}{100})^n$

$r = 18 \div 12 = 1,5$ \checkmark $n = 2 \times 12 = 24$ \checkmark value for r and n

$7862,27 = P(1 + \frac{1,5}{100})^{24}$ \checkmark substitution

$\frac{7862,27}{(1 + \frac{1,5}{100})^{24}} = P$ \checkmark P the subject

R 5 500 = P \checkmark answer

(5)

5.2 5.2.1 $A = P(1 - in)$ \checkmark formula

$= 6500 (1 - 0,15 \cdot 4)$ \checkmark substitution

$= 6500 (0,4)$

$= R 2 600$ \checkmark answer

(3)

5.2.2 $A = P(1 - i)^n$ \checkmark formula

$2600 = 6500(1 - i)^4$ \checkmark substitution

$1 - (0,4)^{0,25} = i$ \checkmark i the subject

$0,2047\dots = i$ \checkmark value of i

$r = 20,47\%$ \checkmark answer

(5)

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QUESTION 6

6.1 $A_3 = P (1 + i)^n$

$= 4300 (1 + 0,075)^3$ \checkmark substitution

$= R 5 341,88$ \checkmark answer

$A_6 = P (1 + i)^n$

$= 5341,88(1 + \frac{0,07}{12})^{36}$ $\checkmark \checkmark \checkmark$ new P / n / r per month

$= R 6 586,14$ \checkmark answer

(6)

6.2 $i_{eff} = (1 + \frac{i_m}{m})^m - 1$ \checkmark formula

$= (1 + \frac{0,07}{12})^{12} - 1$ \checkmark substitution

$= 0,07229$ \checkmark value of i

$r = 7,23\% \text{ p.a.}$ \checkmark answer

(4)

[10]

QUESTION 7

- 7.1 $f(x) = x^2 + 4x - 12$
 let $f(x) = 0$
 $x^2 + 4x - 12 = 0$ ✓
 $(x + 6)(x - 2) = 0$ ✓
 $x = -6$ or $x = 2$ ✓
 A (-6 ; 0) and B (2 ; 0) ✓
 equating to 0
 factors
 both solutions
 identifying which is A and B
 (4)
- 7.2 $y = x^2 + 4x - 12$
 $y = x^2 + 4x + 4 - 4 - 12$ ✓
 $y = (x + 2)^2 - 16$ ✓ ✓
 adding / subtracting 4
 factorising / simplification
 (3)
- 7.2.1 minimum value = - 16 ✓
 answer (1)
- 7.2.2 D (- 2 ; - 16) ✓ ✓
 co-ordinates (2)
- 7.3 $2x + 12 = x^2 + 4x - 12$ ✓
 $x^2 + 4x - 2x - 12 - 12 = 0$
 $x^2 + 2x - 24 = 0$ ✓
 $(x + 6)(x - 4) = 0$ ✓
 $x = - 6$ or $x = 4$
 $\therefore x = 4$ ✓
 substit. $x = 4$ into $g(x)$
 $g(4) = 2(4) + 12$
 $= 20$
 F (4 ; 20) ✓
 equating f and g
 std form
 factors
 positive value of x
 y co-ordinate of F
 (5)
- 7.4 D (- 2 ; - 16) and F (4 ; 20)
 Average gradient = $\frac{f(x_2) - f(x_1)}{x_2 - x_1}$ ✓
 $\frac{20 - (-16)}{4 - (-2)}$ ✓
 $= \frac{20 + 16}{4 + 2}$
 $= 6$ ✓
 formula
 substitution
 answer
 (3)
- 7.5 $h(x) = 2x + 14$
 answer (1)
- 7.6 T. P (- 3 ; - 16) ✓ ✓
 x and y co-ordinates (2)

[21]

QUESTION 8

8.1 $x \in \mathbb{R} ; x \neq 1$ $\checkmark \checkmark$

answer (2)

8.2 $x = 1$ and $y = -1$ $\checkmark \checkmark$

answer (2)

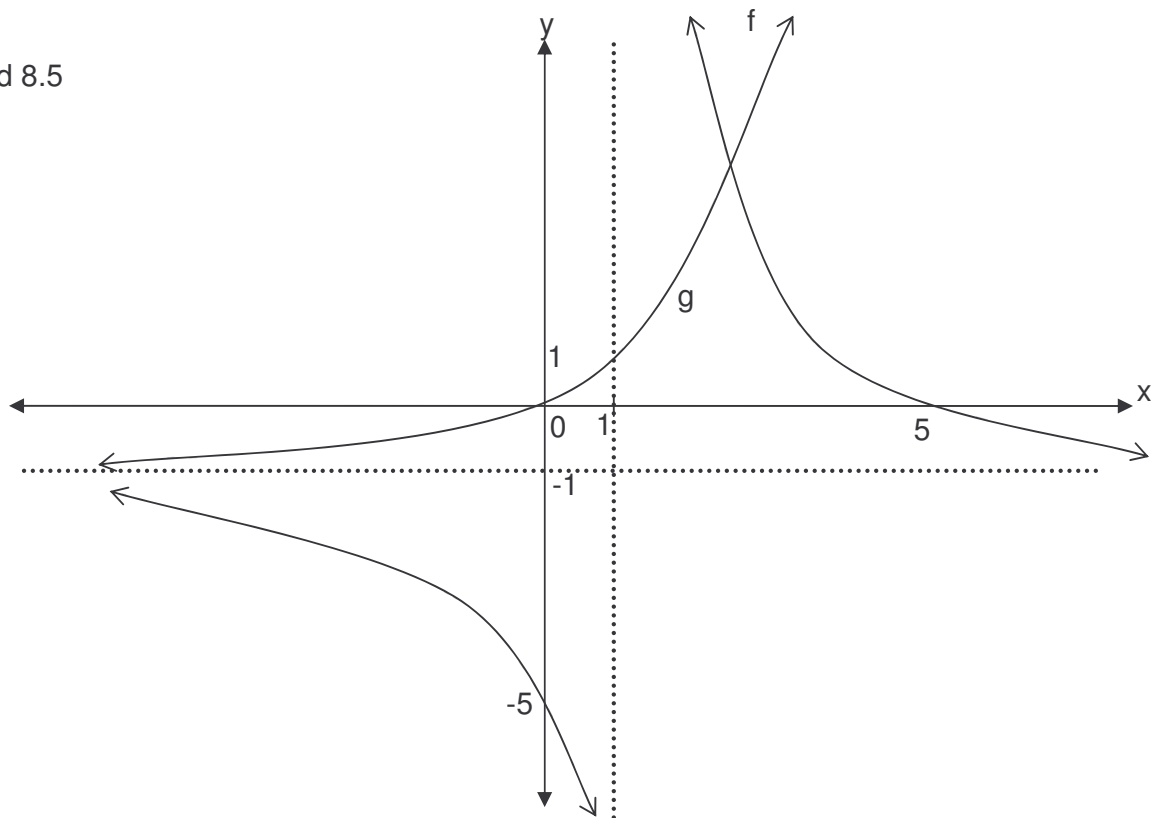
8.3 $y = -5$ \checkmark
Let $f(x) = 0$ \checkmark

y-intercept
 $y = 0$

then $\frac{4}{x-1} - 1 = 0$
 $1(x-1) = 4$ \checkmark
 $x = 5$

answer (3)

8.4 and 8.5



Exponential graph

- \checkmark asymptote
- \checkmark y-intercept
- \checkmark shape

(3)

Hyperbola

- \checkmark asymptotes
- \checkmark x-intercept
- \checkmark y-intercept
- \checkmark shape

(4)

8.6 $h(x)$ has been moved vertically downwards by 1 unit. $\checkmark \checkmark$ (2)

8.7 $g\left(\frac{3}{4}\right) = 0,682$ $\checkmark \checkmark$ answer/correct rounding off. (2)

8.8 $g(x) = 2^x - 1$
 $7 = 2^x - 1$ \checkmark substitution
 $8 = 2^x$
 $2^3 = 2^x$
 $3 = x$ \checkmark answer (2)
[20]

QUESTION 9

9.1 $g(x) = -2 \sin x$ \checkmark answer (1)

9.2 $h(x) = 2 \sin (x - 30^\circ)$ \checkmark answer (1)

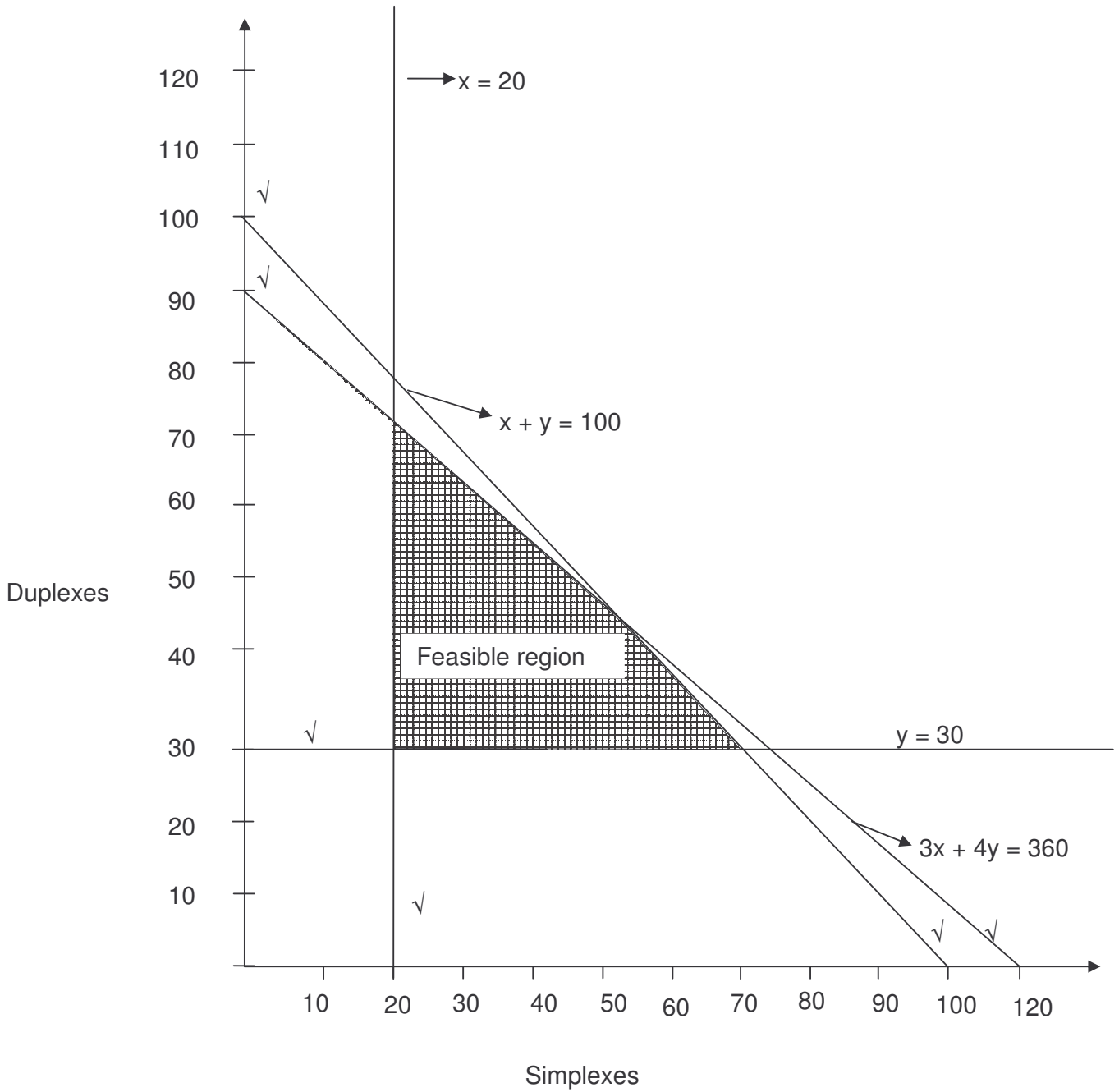
9.3 $-1 \leq y \leq 3$ $\checkmark \checkmark$ answers (2)

9.4 $360^\circ \div 3 = 120^\circ$ $\checkmark \checkmark$ answer (2)
[6]

QUESTION 10

- | | | | |
|------|--|----|------------|
| 10.1 | $x + y \leq 100$ | ✓✓ | constraint |
| | $30\,000x + 40\,000y \leq 3\,600\,000$ | ✓✓ | constraint |
| | $x \geq 20$ | ✓ | constraint |
| | $y \geq 30$ | ✓ | constraint |
- (6)

10.2



(8)

10.3 $P = 4\,000x + 8\,000y$ \checkmark answer (1)

10.4 $(20; 75) \rightarrow P = R\,680\,000$
 $(40; 60) \rightarrow P = R\,640\,000$ \checkmark method
 $(70; 30) \rightarrow P = R\,520\,000$

 $x = 20$ \checkmark and $y = 75$ \checkmark answers (3)

Answer only: Full Marks

10.5 $P = R\,680\,000$ \checkmark answer (1)
[19]

TOTAL: 150