	Class	Index No	Name
O			

Jurongville Secondary School
Mid Year Examination 2015
Secondary 2 Express

Mathematics
Paper 1

Marking Scheme

4048/01
13 May 2015 (Wed)
1 hour 15 minutes

Candidates answer on the Question Paper.

Observe our school values of **Integrity and **Excellence** by not cheating and doing your best in this paper*

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces on all the work you hand in.
Write in dark blue or black pen.
You may use pencil for drawing diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **ALL** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
All working must be written step-wise and shown clearly in **INK**.
CAUTION: Any working or answer not written in ink will NOT be marked.

The total marks for this paper is 50.
The number of marks is given in brackets [ ] at the end of each question or part question
You are expected to use a scientific calculator to evaluate explicit numerical expressions.
If the degree of accuracy is not specified in the question and if the answer is not exact, give the answer to 3 significant figures. Give answers in degrees to 1 decimal place.
For π, use either your calculator value or 3.142.

INSTRUCTIONS FOR SUBMISSION:
At the end of the examination, fasten all your work securely together.

DO NOT OPEN THE BOOKLET UNTIL YOU ARE TOLD TO DO SO

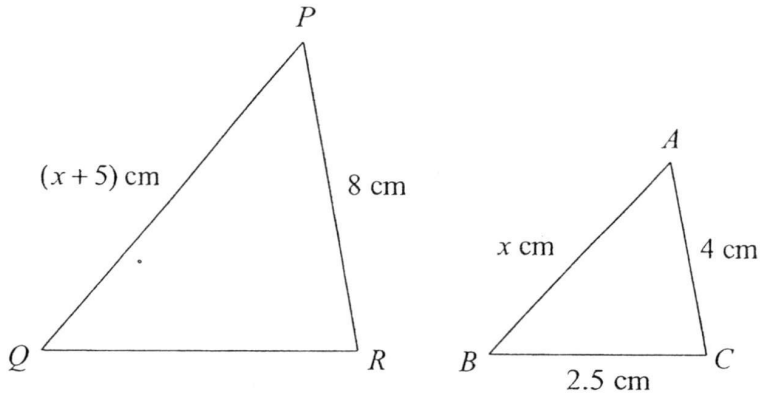
Parent's Signature	For Examiner's Use
	50

Setter: Mr Justin Ho

59

Answer ALL Questions

1 ΔABC is similar to ΔPQR, $BC = 2.5$ cm, $PQ = (x+5)$ cm, $AC = 4$ cm, $AB = x$ cm and $PR = 8$ cm.



Find

(a) QR,

(a) QR $= 2.5 \times 2$

$= 5$ cm [B1]

Answer (a) 5 cm [1]

(b) PQ.

(b) $\dfrac{x+5}{x} = 2$

$x + 5 = 2x$ [M1]

$x = 5$

$\therefore$ PQ $= 5 + 5$

$= 10$ [A1]

Answer (b) 10 cm [2]

2 An actual area of a plot of land is 125 m^2 is represented by 5 cm^2 on a map.
Calculate

(a) the scale of the map in the form 1 : n,

(a) $5\ cm^2 : 125\ m^2$

$1\ cm^2 : 25\ m^2$

$1\ cm : \sqrt{25}\ m$

$1\ cm : 5\ m$ [M1]

$1 : 500$ [A1]

Answer *(a)* 1 : 500 [2]

(b) the length of a line on the map, in cm, which represents a path 13 m long.

$\text{Length of line} = \frac{13}{5}$ [M1]

$= 2.6\ cm$ [A1]

Answer *(b)* 2.6 cm [1]

3 **(a)** Simplify $(4s - 2s^2) + (8 - 9s^2)$.

$(4s - 2s^2) + (8 - 9s^2)$

$= -11s^2 + 4s + 8$ [B1]

Answer *(a)* $-11s^2 + 4s + 8$ [1]

(b) Simplify $-2(-x^2 + 3) - 3x^2$.

$-2(-x^2 + 3) - 3x^2$

$= -2x^2 - 6 - 3x^2$ [M1]

$= -x^2 - 6$ [A1]

Answer *(b)* $-x^2 - 6$ [2]

60

4 **(a)** Given that $v = ax - 4ay - 4by + bx$, factorise the expression, $ax - 4ay - 4by + bx$.

$ax - 4ay - 4by + bx$
$= ax + bx - 4ay - 4by$
$= x(a+b) - 4y(a+b)$ [M1]
$= (a+b)(x-4y)$ [A1]

Answer (a) $(a+b)(x-4y)$ [2]

(b) **Hence**, find the value of v when $a = 2, b = 1, x = -1$, and $y = 0$.

$v = (a+b)(x-4y)$
$= (2+1)(-1-0)$
$= -3$ [B1]

Answer (b) $v = -3$ [1]

5 **(a)** Simplify $\frac{63s^3t}{49x} \times \frac{xy}{9s^3t}$.

$\frac{63s^3t}{49x} \times \frac{xy}{9s^3t}$
$= \frac{63xy}{441x}$ [M1]
$= \frac{1}{7}y$ [A1]

Answer (a) $\frac{1}{7}y$ [2]

(b) Simplify $\frac{a^4b^5}{c-1} \div \frac{ab^5}{-(1-c)}$.

$\frac{a^4b^5}{c-1} \div \frac{ab^5}{-(1-c)}$

$= \frac{a^4b^5}{c-1} \times \frac{c-1}{ab^5}$ [M1]
$= a^3$ [A1]

Answer (b) a^3 [2]

6 Express each of the following as a single fraction in its simplest form.

(a) $1+\dfrac{1}{p+q}$

$1+\dfrac{1}{p+q}$

$=\dfrac{p+q+1}{p+q}$ [B1]

Answer (a) $\dfrac{p+q+1}{p+q}$ [1]

(b) $\dfrac{-a}{a-b}-\dfrac{b+a}{b-a}$

$\dfrac{-a}{a-b}-\dfrac{b+a}{b-a}$

$=\dfrac{-a}{a-b}-\dfrac{b+a}{-(a-b)}$ [M1]

$=\dfrac{-a}{a-b}+\dfrac{b+a}{a-b}$

$=\dfrac{-a+b+a}{a-b}$ [M1]

$=\dfrac{b}{a-b}$ [A1]

Answer (b) $\dfrac{b}{a-b}$ [3]

7 **(a)** Factorise fully $x^2y-9xy+20y$.

$x^2y-9xy+20y$

$=y(x^2-9x+20)$ [M1]

$=y(x-5)(x-4)$ [A1]

M1 for cross method working

Answer (a) $y(x-5)(x-4)$ [3]

(b) Factorise fully $81r^2-49t^2$.

$81r^2-49t^2$

$=(9r^2)-(7t)^2$ [M1]

$=(9r+7t)(9r-7t)$ [A1]

61

Answer (b) $(9r+7t)(9r-7t)$ [2]

8 x is directly proportional to $(y-3)^2$ and y is positive.
The table below shows some corresponding values of x and y.

x	a	2	72
y	1.2	5	b

Find

(a) the equation connecting x and y,

(a) $x = k(y-3)^2$

$2 = k(5-3)^2$

$k = 0.5$ [M1]

$\therefore x = \frac{1}{2}(y-3)^2$ [A1]

Answer (a) $x = \frac{1}{2}(y-3)^2$ [2]

(b) the value of a,

(b) $a = 0.5(1.2-3)^2$

$= 1.62$ [B1]

Answer (b) $a = 1.62$ [1]

(c) the value of b.

(c) $72 = 0.5(b-3)^2$

$144 = (b-3)^2$

$\pm\sqrt{144} = b-3$ [M1]

$\pm 12 = b-3$

$b = 15$ [A1] or $b = -9$ (rejected as q is + ve)

Answer (c) $b = 15$ [2]

9 Josh and Amir are bringing their families to the Esplanade for a concert.
One adult ticket cost $\$y$ and one child ticket cost $\$x$.

(a) Josh bought 2 adult tickets and 3 child tickets and paid \$135 in total.
Form an equation in terms of x and y.

$3x + 2y = 135$ [B1]

Answer (a) $3x + 2y = 135$ [1]

(b) Amir bought 1 adult tickets and 2 child ticket for \$79.
Form an equation in terms of x and y.

$2x + y = 79$ [B1]

Answer (b) $2x + y = 79$ [1]

(c) Find the cost of 1 adult ticket and 1 child ticket.

$3x + 2y = 135$ -----(1)

$2x + y = 79$ -----(2)

$(2) \times 2$,

$4x + 2y = 158$ -----(3)

$(3) - 1$,

$(4x + 2y) - (3x + 2y) = 158 - 135$ [M1]

$x = 23$ [A1]

Sub $x = 23$ into (2)

$2(23) + y = 79$

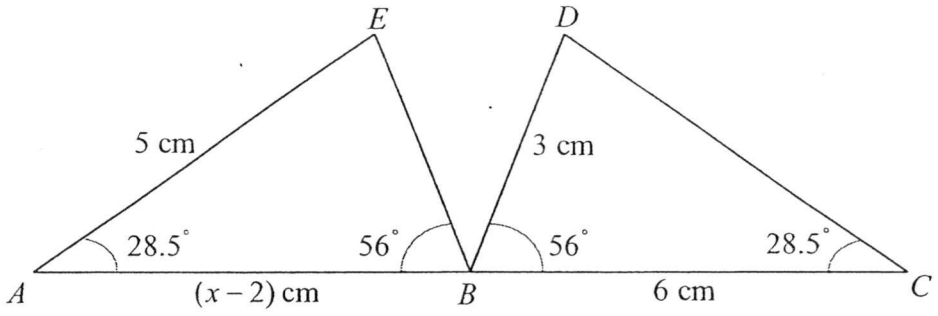
$y = 33$ [A1]

Answer (c) Adult ticket = \$ 33

Child ticket = \$ 23 [3]

62

10 Given that ΔABE and ΔCBD are congruent.



Find

(a) the length of CD,

CD = 5cm [B1]

Answer (a) 5 cm [1]

(b) the value of x,

$x - 2 = 6$ [M1]

$x = 8$ [A1]

Answer (b) $x = 8$ [2]

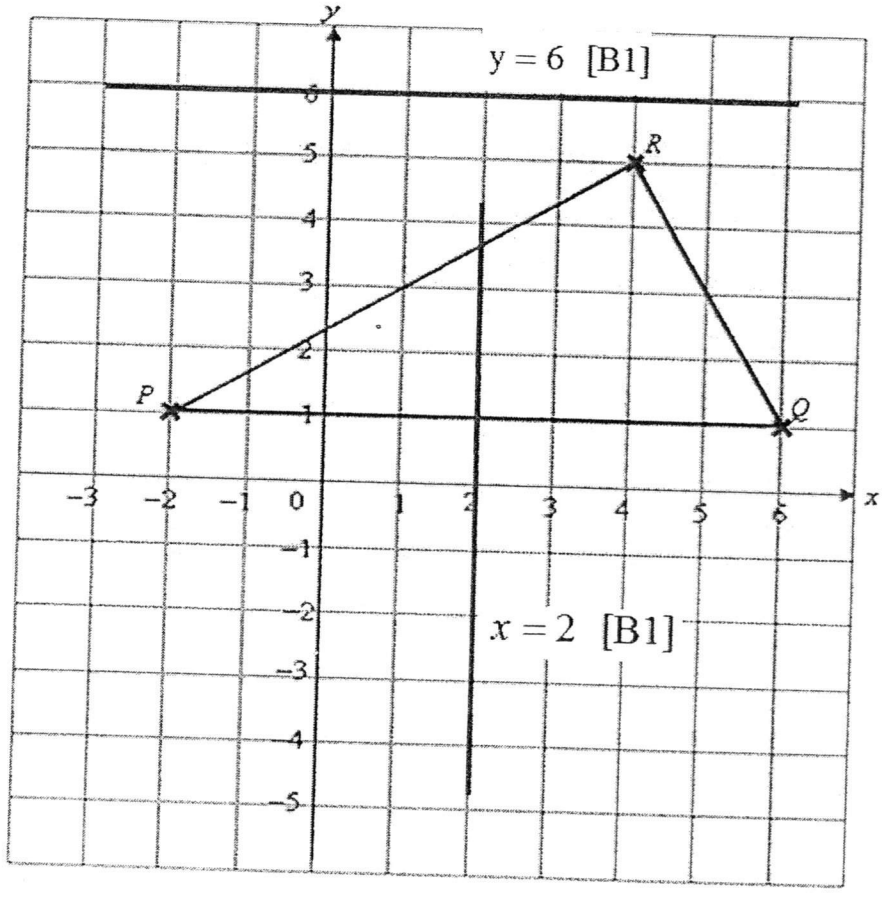
(c) $\angle DBE$.

$\angle DBE = 180^\circ - 2(56^\circ)$ [M1]

$= 68^\circ$ [A1]

Answer (c) $\angle DBE = 68^\circ$ [2]

11 The grid below shows triangle PQR.



(a) On the grid, draw and label the graphs $x = 2$ and $y = 6$. [2]

(b) Find the gradient of PQ.

Answer (a) 0 [B1] [1]

(c) Find the gradient of RQ.

Gradient of $RQ = \dfrac{5-1}{4-6}$ [M1]

$= \dfrac{4}{-2}$

$= -2$ [A1]

63

Answer (b) -2 [2]

12 For the following number sequence:
5, 8, 11, 14, 17, ...
find

(a) the next two terms,

(a) 20 [B1] and 23 [B1]

Answer *(a)* 20 and 23 [2]

(b) the n^{th} term,

$(b) T_1 = 5 = 3(1) + 2$
$T_2 = 8 = 3(2) + 2$
$T_3 = 11 = 3(3) + 2$ [M1] for showing the pattern
.
;
$T_n = 3n + 2$ [A1]

Answer *(b)* $T_n = 3n + 2$ [2]

(c) the 91^{st} term.

$(c) T_{91} = 3(91) + 2$
$= 275$ [B1]

Answer *(c)* 275 [1]

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			Marking Scheme

Jurongville Secondary School
Mid Year Examination 2015
Secondary 2 Express

Mathematics
Paper 2

4048/02

Additional Materials: Writing Paper
Graph Paper (1 sheet)

11 May 2015
1 h 15 min

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Setter: Mr Jayce Lim

Answer ALL the questions.

1 (a) Two quantities, $(x + 1)$ and $(y - 2)$ are in inverse proportion. Values of x and y are shown in the table below.

x	1	3	b
y	10	a	30

(i) Find the equation connecting $(x + 1)$ and $(y - 2)$. [3]

(ii) Hence, find the values of a and b. [4]

Solution:

(i)

Since $(x + 1)$ and $(y - 2)$ are in inverse proportion, $(x + 1)(y - 2) = k$, ...M1
where k is a constant.

From the table, when $x = 1$, $y = 10$.

$(1 + 1)(10 - 2) = k$.....M1

$\therefore k = 2 \times 8$

$= 16$

$\therefore (x + 1)(y - 2) = 16$ or

$y - 2 = \dfrac{16}{x+1}$ A1

(ii)

When $x = 3$,

$y - 2 = \dfrac{16}{3+1}$ M1

$y = 4 + 2$

$= 6$

$\therefore a = 6$.....A1

When $y = 30$,

$30 - 2 = \dfrac{16}{x+1}$ M1

$28(x + 1) = 16$

$28x + 28 = 16$

$28x = -12$

$x = -\dfrac{12}{28}$

$= -\dfrac{3}{7}$

$\therefore b = -\dfrac{3}{7}$ A1

(b) The kinetic energy of a moving object, E joules, is directly proportional to the square of its speed, v m/s. If the speed of the moving object is halved, calculate the new kinetic energy of the object as a ratio of its original kinetic energy. [3]

Solution:

Since E is directly proportional to the square of v, $E = kv^2$, where k is a constant.

If v is halved,

$$E = k\left(\frac{v}{2}\right)^2 \quad \text{..... M1}$$

$$= \frac{1}{4}kv^2$$

$$\therefore \text{required ratio} = \frac{1}{4}kv^2 : kv^2 \quad \text{.....M1}$$

$$= \frac{1}{4} : 1$$

$$= 1 : 4 \quad \text{.....A1}$$

2 (a) There are chickens and cows in a farm. If there is a total of 30 heads and 94 legs, find the number of the chickens and cows in the farm. [5]

Solution:

Let x be the number of chicken and y be the number of cows.

$x + y = 30$

$x = 30 - y$ ----------(1)

$2x + 4y = 94$

$x + 2y = 47$ ----------(2).....B1 (correct equations)

Substitute (1) into (2),

$30 - y + 2y = 47$.....M1

$y = 47 - 30$

$y = 17$.....A1

Substitute $y = 17$ into (1),

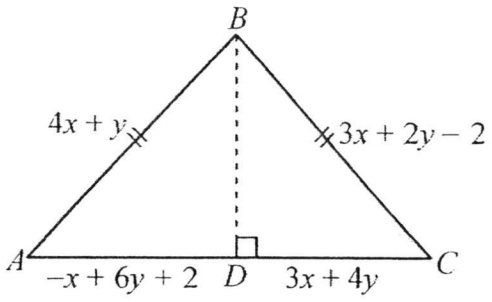
$x = 30 - 17$.....M1

$x = 13$.....A1

There are 13 chicken and 17 cows in the farm.

(b) The diagram shows an isosceles triangle ABC with BD perpendicular to AC. The dimensions given are in cm. [5]

65



(i) Find the values of x and y. [3]

(ii) Find the perimeter of ΔABC. [2]

Solution:

(i) Since $AB = BC$ (sides of isos. Δ)

$4x + y = 3x + 2y - 2$

$x - y = -2$ ------- (1) B1

$AD = DC$ ($\perp$ bisector)

$-x + 6y + 2 = 3x + 4y$

$2y - 4x = -2$

$y - 2x = -1$ -------- (2) B1

(1) + (2): $-x = -3$

$x = 3$

Substituting $x = 3$ into (2),

$y - 2(3) = -1$

$y = 5$ .....A1 (correct x and y values)

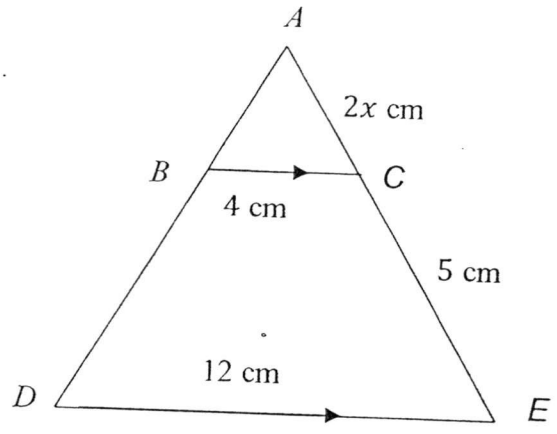
(ii) Perimeter of $\Delta ABC = 4x + y + 3x + 2y - 2 + 3x + 4y + 6y + 2 - x$

$= 9x + 13y$ M1

$= 9(3) + 13(5)$

$= 92$ cm A1

3 **(a)** ΔABC is similar to ΔADE. Given that $BC = (x + 4)$ cm, $DE = (4x - 5)$ cm, $AC = 2x$ cm and $CE = (2x - 5)$ cm. Find the value of x. [4]



Solution:

$$\frac{BC}{DE} = \frac{AC}{AE}$$

$\frac{4}{12} = \frac{2x}{2x+5}$ .....M1 (correct ratio)

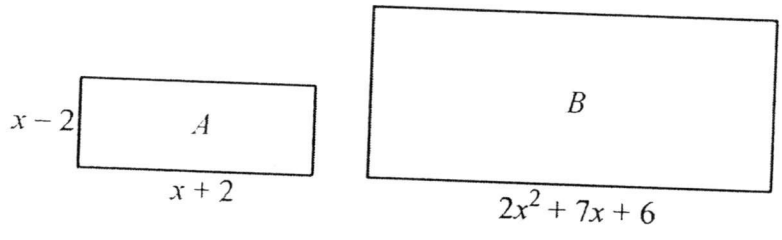
$2x(12) = 4(2x + 5)$ .....M1 (correct cross-multiply)

$24x = 8x + 20$

$16x = 20$

$x = \frac{20}{16} = \frac{5}{4} = 1.25\ cm$ A1

(b) In the diagram, rectangle B is an enlargement of rectangle A. The dimensions given are in cm.



(i) Find the scale factor of the enlargement in terms of x. [2]

(ii) Hence, calculate the length of the unknown side of rectangle B in terms of x. [1]

(iii) Express $\frac{\text{area of rectangle } B}{\text{area of rectangle } A}$ in terms of x. [3]

(iv) Hence, find area of rectangle B : area of rectangle A if $x = 3$. [1]

66

Solution:

(i) Scale factor $= \dfrac{2x^2+7x+6}{x+2}$ M1

$= \dfrac{(2x+3)(x+2)}{x+2}$

$= 2x+3$ A1

(ii) Length of unknown side of rectangle $B = (2x+3)(x-2)$

$= (2x^2-x-6)$ cm B1

(iii) $\dfrac{\text{area of rectangle } B}{\text{area of rectangle } A} = \dfrac{(2x^2+7x+6)(2x^2-x-6)}{(x-2)(x+2)}$ M1

$= \dfrac{(2x+3)(x+2)(2x+3)(x-2)}{(x-2)(x+2)}$ .....M1 (factorize)

$= (2x+3)^2$ A1

(iv) If $x = 3$, area of rectangle B : area of rectangle $A = [2(3)+3]^2 : 1$

$= (9)^2 : 1$

$= 81 : 1$ B1

4 It is given that $x = \dfrac{1+t}{1-t}$ and $y = \dfrac{1-t}{1+t}$.

(a) Find, in terms of t, (giving each answer as fraction in its simplest form) an expression for

(i) $x - y$, [2]

(ii) $x + y$, [2]

(iii) Hence, or otherwise, find $x^2 - y^2$. [3]

(b) Express x in terms of y only. [3]

Solution:

(a) (i) $x - y = \dfrac{1+t}{1-t} - \dfrac{1-t}{1+t}$

$= \dfrac{(1+t)^2-(1-t)^2}{(1-t)(1+t)}$ .....M1 (manipulation of fraction)

$= \dfrac{(1+t+1-t)(1+t-1+t)}{1-t^2}$

$= \dfrac{2(2t)}{1-t^2}$

$= \dfrac{4t}{1-t^2}$ A1

(ii) $x+y=\dfrac{1+t}{1-t}+\dfrac{1-t}{1+t}$

$x+y=\dfrac{(1+t)^2+(1-t)^2}{(1+t)(1-t)}$ .....M1 (manipulation of fraction)

$=\dfrac{1+2t+t^2+1-2t+t^2}{1-t^2}$

$=\dfrac{2+2t^2}{1-t^2}$ A1

$\therefore x^2-y^2=(x+y)(x-y)$.....M1

$=\left(\dfrac{2+2t^2}{1-t^2}\right)\left(\dfrac{4t}{1-t^2}\right)$.....M1 (correct manipulation)

$=\dfrac{8t(1+t^2)}{(1-t^2)^2}$ *or* $\dfrac{8t+8t^3}{1-2t^2+t^4}$ A1

Method 1:

(b) $y=\dfrac{1-t}{1+t}$

$y+yt=1-t$

$yt+t=1-y$

$t=\dfrac{1-y}{1+y}$

$x=\dfrac{1+\dfrac{1-y}{1+y}}{1-\dfrac{1-y}{1+y}}$

$=\dfrac{1+y+1-y}{1+y}\times\dfrac{1+y}{1+y-1+y}$

$=\dfrac{2}{2y}$

$\therefore x=\dfrac{1}{y}$

Method 2:

(b) $y=\dfrac{1-t}{1+t}$

$=\dfrac{1}{\left(\dfrac{1+t}{1-t}\right)}$ M1

67

$= \frac{1}{x}$ M1

$\therefore x = \frac{1}{y}$ A1

5 (a) The points $(4, a)$, $(b, -2)$ are some points on the graph of $y = 2x + 7$. Find without plotting the graph,

(i) the value of a, [2]

(ii) the value of b. [2]

Solution:

(a)

(i) Since the point $(4, a)$ lies on the graph, the coordinates of the point satisfy the equation $y = 2x + 7$.

$\therefore$ we substitute $x = 4$ into $y = 2x + 7$.

When $x = 4$,

$y = 2(4) + 7$.....M1

$= 15$

$\therefore a = 15$.....A1

(ii) When $y = -2$,

$-2 = 2x + 7$.....M1

$2x = -9$

$x = -\frac{9}{2}$

$\therefore b = -\frac{9}{2} \text{ or } \quad b = -4\frac{1}{2}$ A1

(b) Answer this part on the graph paper. Given the following table

x	0	1	2	3	4	5	6
$y = x - 4$	–4	–3	–2	–1	0	1	2

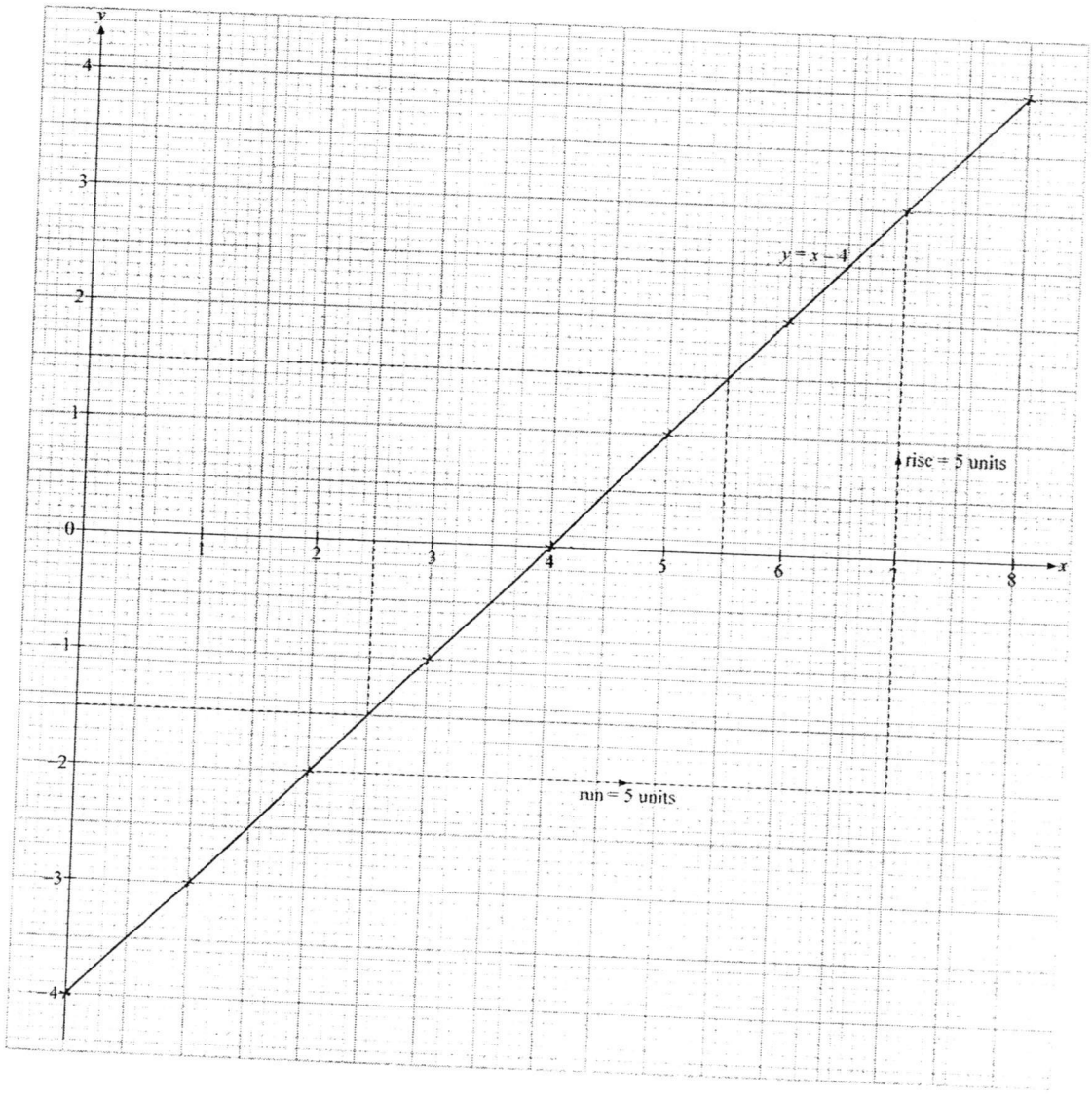
(i) Using a scale of 2 cm to 1 unit on both axes, draw the graph of $y = x - 4$ for values of x from 0 to 6. [3]

(ii) Find the gradient of the graph. [2]

(iii) From the graph, find the value of y when $x = 2.5$. [1]

Solution:

(b)(i)



Correct Plotted points -------P1

Smooth Straight line ……..C1

Correct scale, with axis label, equation of line label, scale markings ……B1

b)(ii)

Gradient of the graph $= \frac{\text{rise}}{\text{run}}$

$= \frac{5}{5}$ ……..M1

$= 1$……A1 (range ± 0.1)

(iii) From the graph,

when $x = 2.5$, $y = -1.5$…… B1 (range ± 0.1)

68

END OF PAPER