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中正中學

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**CHUNG CHENG HIGH SCHOOL (MAIN)**

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Signature

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**END-OF-YEAR EXAMINATION 2008  
SECONDARY 2**

**Mathematics**

**Monday, 6 Oct 2008  
2 hours**

**INSTRUCTIONS TO CANDIDATES:**

1. Write your name, class and class register number in the spaces provided on the answer paper.
2. Answer **ALL** the questions.
3. Write in **dark blue** or **black** pen. You may use a pencil for any diagrams or graphs.
4. Do not use paper clips, highlighters, glue or correction fluid/tape.
5. When your final answer is non-exact, correct your final answer to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.

**ADDITIONAL MATERIALS:**

1 Graph paper (attached)

**INFORMATION FOR CANDIDATES:**

**ELECTRONIC CALCULATORS MAY BE USED TO EVALUATE EXPLICIT NUMERICAL EXPRESSIONS.**

The number of marks is given in brackets [ ] at the end of each question or part question. The total number of marks for this paper is 100.

You are reminded of the need for clear presentation in your answers.

**OMISSION OF ESSENTIAL WORKINGS WILL RESULT IN LOSS OF MARKS.**

This question paper consists of 16 printed pages (including this cover page)

**DO NOT TURN OVER UNTIL YOU ARE TOLD TO DO SO**

1. By writing each number correct to 1 significant figure, estimate the value of

$$\frac{5.74 \times 3.09^2}{0.387}$$

Ans : \_\_\_\_\_ [2]

2. Express

(a) 0.0624 as a percentage

Ans : \_\_\_\_\_ [1]

(b) 0.32% as a decimal.

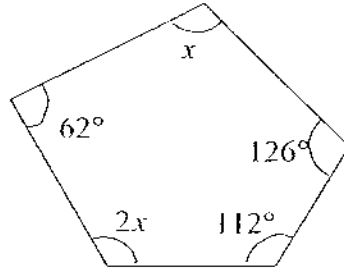
Ans : \_\_\_\_\_ [1]

3. Find the greatest integer  $x$  that satisfies the inequality below

$$7x - 6 < -27$$

Ans : \_\_\_\_\_ [2]

4. (a) Find the value of  $x$  in the figure below.



Ans :  $x =$  \_\_\_\_\_  $^\circ$  [3]

- (b) If each exterior angle of a  $n$ -sided regular polygon is  $24^\circ$ , find the value of  $n$ .

Ans :  $n =$  \_\_\_\_\_ [1]

5. Expand and simplify the following:

(a)  $3(6 - 5x) + 5(7x - 8)$

(b)  $4(2x + 1)^2 - (2x - 1)^2$

Ans : (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [3]

6. Make  $f$  the subject of the formula:  $f + a = \frac{2f + 3}{a}$

Ans : \_\_\_\_\_ [3]

7. Factorize completely the following:

(a)  $2m^2 - 11m - 21$

(b)  $125m^8n^2 - 5m^4n^2$

(c)  $m^3 + n^2 - m^2 - mn^2$

Ans : (a) \_\_\_\_\_ [1]

(b) \_\_\_\_\_ [2]

(c) \_\_\_\_\_ [4]

8. Express the following as a single fraction in its simplest form:

(a)  $\frac{2x+7}{7-2x} - 1$

(b)  $\frac{p^6 q^9}{(-4p)^4} \div \left(\frac{1}{2} p^2 q^3\right)^2$

Ans : (a) \_\_\_\_\_ [2]

(b) \_\_\_\_\_ [3]

9. (a) Given that  $y$  is directly proportional to the cube root of  $x$ , and that  $y = 16$  when  $x = 64$ .
- (i) Express  $y$  in terms of  $x$ .
- (ii) Calculate the value of  $x$  when  $y = 12$ .

Ans : (a) (i) \_\_\_\_\_ [2]

(ii) \_\_\_\_\_ [1]

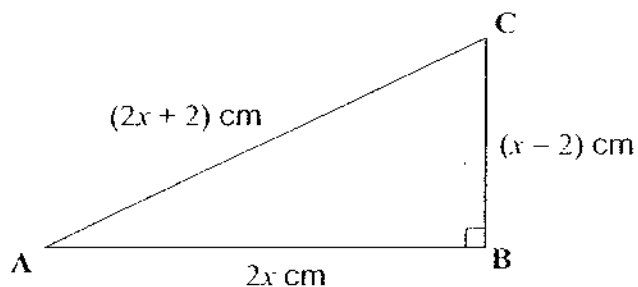
- (b) 8 workers can build a house in 30 days. How many workers are needed if the house is to be built in 10 days?

Ans : (b) \_\_\_\_\_ workers [3]

- (c) On a map, 2 m represents 5 km on actual ground. Express the area scale of the map in  $1:n$  form.

Ans : (c) \_\_\_\_\_ [2]

10. The figure below shows a right-angled triangle ABC where  $AB = 2x$  cm,  $BC = (x - 2)$  cm and  $AC = (2x + 2)$  cm.



- (a) Form an equation in  $x$  and show that it reduces to  $x^2 - 12x = 0$ . [3]  
(b) Solve the equation to find  $x$  and hence, find the area of  $\triangle ABC$ .

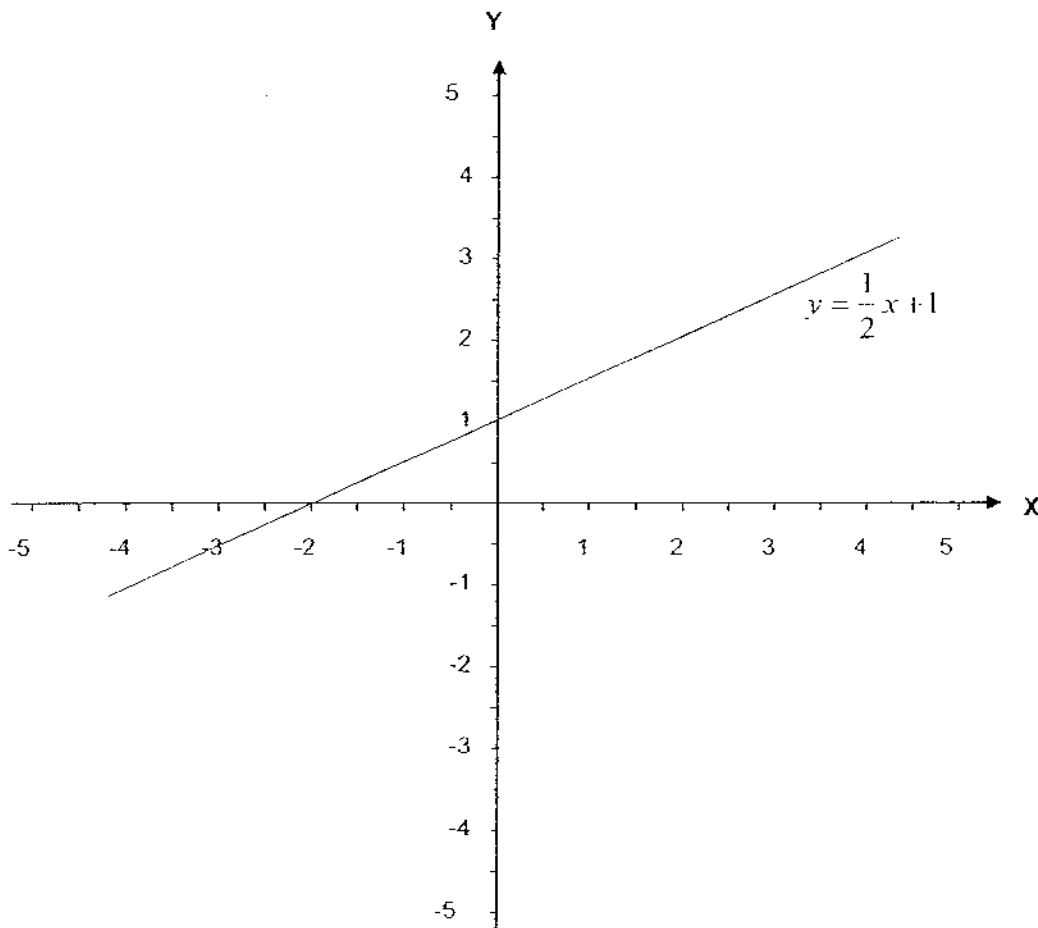
Ans : (b) Area of  $\triangle ABC = \underline{\hspace{2cm}} \text{ cm}^2$  [3]

11. (a) The grid square below shows the graph of the equation  $y = \frac{1}{2}x + 1$ . On the same grid square given, draw the graph of the equation  $2y = -3x - 2$  for  $-2 \leq x \leq 2$ . [3]

(b) Hence, solve the simultaneous equations  $2y = -3x - 2$  and  $y = \frac{1}{2}x + 1$  graphically.

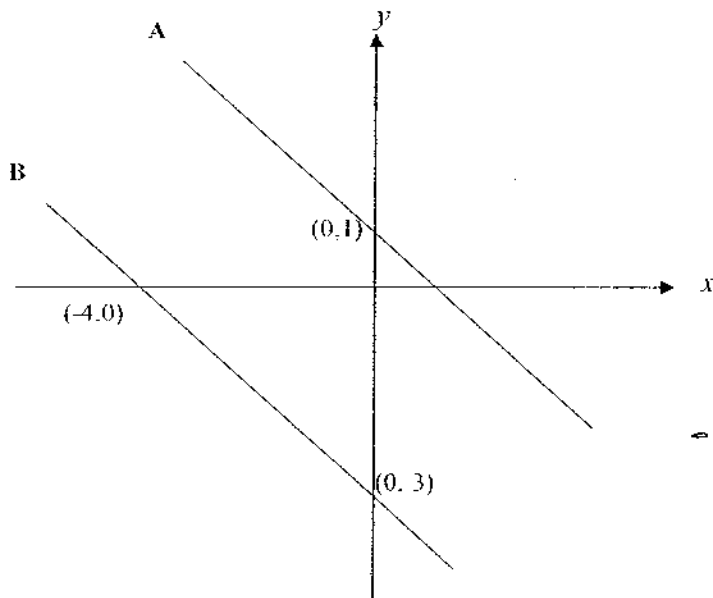
$2y = -3x - 2$

$x$			
$y$			



Ans : (b)  $x = \dots, y = \dots$  [1]

12. From the graphs below, deduce the equations of lines A and B, given that lines A and B are parallel. [3]



Ans : Equation of line A: \_\_\_\_\_

Equation of line B: \_\_\_\_\_

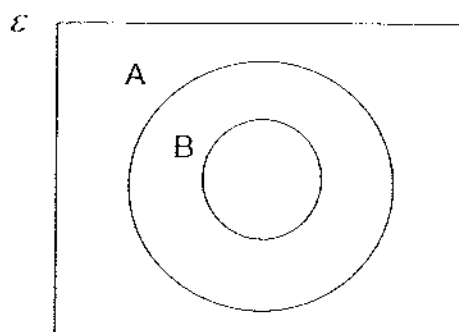
13. (a) Given that  $E = \{x : 1 < x < 30, x \text{ is a positive integer}\}$ ,  $P = \{x : x \text{ is an odd number}\}$ ,  $Q = \{x : 15 \leq x < 27 \text{ and } x \text{ is a multiple of } 3\}$  and  $R = \{x : x \text{ is a factor of } 45\}$ .
- List all the elements in set R.
  - Write down the elements that are common to both sets P and Q.
  - Find  $n(R \cap Q)$ .

Ans : (a) (i) \_\_\_\_\_ [1]

(ii) \_\_\_\_\_ [1]

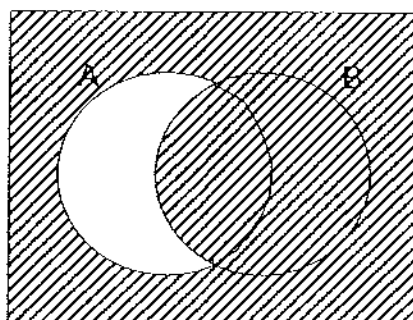
(ii) \_\_\_\_\_ [1]

13. (b) (i) On the Venn diagram below, shade the region which represents the set  $A \cap B$



[1]

- (ii) Identify the sets shaded in the Venn diagram below.



Ans : (b) (i) \_\_\_\_\_ [1]

14. The stem and leaf diagram below shows the distances in km, travelled by a postman in 30 days.

Stem	Leaf
0	2 2 7 9
1	3 3 4 5 5 8
2	4 5 6 6
3	
4	0 1 2
5	0 0 9
6	8 9
7	3 3 3 4
8	2 5 7 9

- (a) Complete the grouped frequency table below using the stem and leaf diagram given. Let the distance travelled be  $d$  km.

Class Interval	Mid-value	Frequency
$0 < d \leq 20$		
$20 < d \leq 40$		
$40 < d \leq 60$		
$60 < d \leq 80$		
$60 < d \leq 80$		

[3]

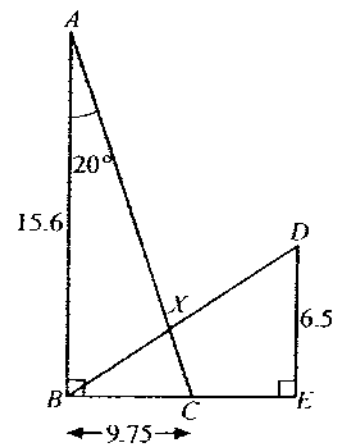
14. (b) Find the estimated mean distance travelled by the postman from the frequency table above.

Ans: \_\_\_\_\_ km [2]

15. In the diagram,  $\triangle ABC$  is similar to  $\triangle BED$ ,  $AB = 15.6$  cm,  $BC = 9.75$  cm,  $DE = 6.5$  cm,  $\angle BAC = 20^\circ$  and  $BD$  and  $AC$  intersect at  $X$ .

Find

- (a)  $\angle BDE$ ,  
 (b) length  $CE$ .



Ans : (a)  $\angle BDE =$  \_\_\_\_\_  $^\circ$  [1]

(b)  $CE =$  \_\_\_\_\_ cm [3]

16. The frequency table records the number of books borrowed by 60 students during a 1-year period.

No. of books	5	6	7	8	9
Frequency	24	$p$	13	$q$	5

- (a) Show that  $p + q = 18$ . [2]  
 (b) Given that the mean number of books borrowed is 6.3, show that  $6p + 8q = 122$ . [2]  
 (c) Hence, find the values of  $p$  and  $q$ .  
 (d) State the median number of books borrowed.

Ans : (c)  $p =$  \_\_\_\_\_

$q =$  \_\_\_\_\_ [3]

(d) \_\_\_\_\_ books [1]

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17. 300 chips are put inside a bag. The 300 chips consist of  $x$  red chips,  $y$  blue chips and 138 green chips. A chip is randomly selected from the bag.

(a) If the probability of selecting a red chip is  $\frac{6}{25}$  and the probability of selecting a blue

chip is  $\frac{3}{10}$ , find the values of  $x$  and  $y$ .

(b) How many green chips must be removed from the bag for the probability of selecting a green chip to be  $\frac{2}{5}$ ?

(c) If 12 red chips, 10 blue chips and 38 green chips are removed from the bag, find the **new** probability of selecting a blue chip from the bag.

$$\begin{aligned} \text{(a)} \quad x &= \frac{6}{25} \times 300 \\ &= 72 \end{aligned}$$

$$\begin{aligned} y &= \frac{3}{10} \times 300 \\ &= 90 \end{aligned}$$

(b) Let the number of green chips to be removed be  $g$ .

$$\frac{139 - g}{300 - g} = \frac{2}{5}$$

$$690 - 5g = 600 - 2g$$

$$90 = 3g$$

$$g = 30$$

Number of green chips to be removed = 30 green chips

(c) New total number of chips in bag

$$= 300 - 12 - 10 - 38$$

$$= 240$$

$$\begin{aligned} P(\text{blue chip}) &= \frac{90 - 10}{240} \\ &= \frac{1}{3} \end{aligned}$$

Ans : (a)  $x =$  72

$y =$  90 [2]

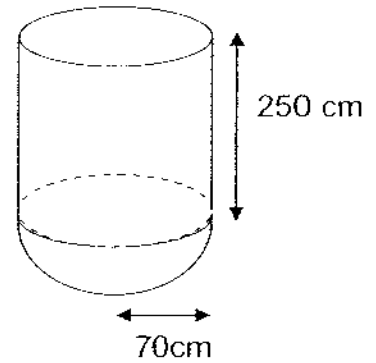
(b) 30 green chips [2]

(c)  $\frac{1}{3}$  [3]

18. The container below consists of a cylindrical drum of height 250 cm that is welded to a hollow hemispherical base of radius 70 cm. Water is poured into the container at the rate of 50 litres per minute. Leave all answers in fractions, if necessary.

Take  $\pi$  as  $\frac{22}{7}$ . (1 litre = 1000 cm<sup>3</sup>)

- (a) How much time is needed to fill the container fully. Leave your answer in minutes.
- (b) Find, in litres, the amount of water that would have spilled from the container after 1 hour and 20 minutes.
- (c) Find the total surface area of the container that is in contact with the water after 20 minutes.



Ans : (a) \_\_\_\_\_ [3]

(b) \_\_\_\_\_ [1]

(c) \_\_\_\_\_ [6]

19. Answer the whole of this question on a sheet of graph paper.

(a) The table below shows the corresponding values of  $x$  and  $y$  for the equation  $y = 5 + 3x - x^2$ . Write down the values of  $a$  &  $b$ .

$x$	-2	-1	0	1	2	3	4	5
$y$	-5	1	$a$	7	7	$b$	1	-5

[2]

(b) Using a scale of 1 cm to represent 1 unit on both axes, draw the graph of  $y = 5 + 3x - x^2$  for  $-2 \leq x \leq 5$ .

[4]

(c) Write down the equation of the line of symmetry for the graph of  $y = 5 + 3x - x^2$ . [1]

(d) From the graph, estimate

(i) the values(s) of  $y$  when  $x = -0.5$ , [1]

(ii) the values(s) of  $x$  when  $y = 6$ . [1]

(e) Using the graph, solve the equation  $5 + 3x - x^2 = 0$ . [1]

- End of Paper -

1. By writing each number correct to 1 significant figure, estimate the value of

$$\begin{aligned} & \frac{5.74 \times 3.09^2}{0.387} \\ & \approx \frac{6 \times 3^2}{0.4} \\ & = \frac{6 \times 9}{0.4} \\ & = 135 \end{aligned}$$

Ans : 135 [2]

2. Express

- (a) 0.0624 as a percentage

$$0.0624 \times 100\% = 6.24\%$$

Ans : 6.24% [1]

- (b) 0.32% as a decimal.

$$\frac{0.32}{100} = 0.0032$$

Ans : 0.0032 [1]

3. Find the greatest integer  $x$  that satisfies the inequality below

$$7x - 6 < -27$$

$$7x < -27 + 6$$

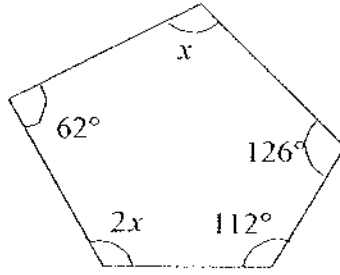
$$7x < -21$$

$$x < -3$$

Greatest integer  $x = -4$

Ans : -4 [2]

4. (a) Find the value of  $x$  in the figure below.



$$\begin{aligned} \text{Sum of interior angles} &= x + 62^\circ + (5 - 2) \times 180^\circ \\ &= 540^\circ \end{aligned}$$

$$\begin{aligned} x + 62^\circ + 2x + 112^\circ + 126^\circ &= 540^\circ \\ 3x + 300^\circ &= 540^\circ \\ 3x &= 240^\circ \\ x &= 80^\circ \end{aligned}$$

Ans :  $x = \underline{\quad 80 \quad}^\circ$  [3]

- (b) If each exterior angle of a  $n$ -sided regular polygon is  $24^\circ$ , find the value of  $n$ .

$$\text{Sum of exterior angles} = 360^\circ$$

$$\begin{aligned} n &= \frac{360^\circ}{24^\circ} \\ &= 15 \end{aligned}$$

Ans :  $n = \underline{\quad 15 \quad}$  [1]

5. Expand and simplify the following:

$$(a) \quad 3(6 - 5x) + 5(7x - 8)$$

$$= 18 - 15x + 35x - 40$$

$$= 20x - 22$$

$$= 2(10x - 11)$$

$$(b) \quad 4(2x + 1)^2 - (2x - 1)^2$$

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

$$= 16x^2 + 16x + 4 - 4x^2 + 4x - 1$$

$$= 12x^2 + 20x + 3$$

$$= (2x + 3)(6x + 1)$$

$$\text{Ans : (a) } \underline{20x - 22} \quad [2]$$

$$(b) \underline{(2x + 3)(6x + 1)} \quad [3]$$

6. Make  $f$  the subject of the formula:  $f + a = \frac{2f + 3}{a}$

$$af + a^2 = 2f + 3$$

$$af - 2f = 3 - a^2$$

$$f(a - 2) = 3 - a^2$$

$$f = \frac{3 - a^2}{a - 2}$$

$$\text{Ans : } \underline{f = \frac{3 - a^2}{a - 2}} \quad [3]$$

7. Factorize completely the following:

(a)  $2m^2 - 11m - 21$

$$= (2m + 3)(m - 7)$$

(b)  $125m^8n^2 - 5m^4n^2$

$$= 5m^4n^2(24m^4 - 1)$$

$$= 5m^4n^2(5m^2 - 1)(5m^2 + 1)$$

(c)  $m^3 + n^3 - m^2 - mn^2$

$$= m^3 - mn^2 + n^3 - m^2$$

$$= m(m^2 - n^2) + (n^3 - m^2)$$

$$= m(m^2 - n^2) - (m^2 - n^2)$$

$$= (m^2 - n^2)(m - 1)$$

$$= (m - n)(m + n)(m - 1)$$

Ans : (a)  $(2m + 3)(m - 7)$  [1]

(b)  $5m^4n^2(5m^2 - 1)(5m^2 + 1)$  [2]

(c)  $(m - n)(m + n)(m - 1)$  [4]

8. Express the following as a single fraction in its simplest form:

$$(a) \frac{2x+7}{7-2x} - 1$$

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

$$= \frac{2x+7-(7-2x)}{7-2x}$$

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

$$= \frac{4x}{7-2x}$$

$$(b) \frac{p^6 q^9}{(-4p)^4} \div \left(\frac{1}{2} p^2 q^3\right)^3$$

$$= \frac{p^6 q^9}{256 p^4} \div \left(\frac{p^6 q^9}{8}\right)$$

$$= \frac{p^6 q^9}{256 p^4} \times \frac{8}{p^6 q^9}$$

$$= \frac{1}{32 p^4}$$

$$\text{Ans : (a) } \underline{\underline{\frac{4x}{7-2x}}} \quad [2]$$

$$(b) \underline{\underline{\frac{1}{32 p^4}}} \quad [3]$$

9. (a) Given that  $y$  is directly proportional to the cube root of  $x$ , and that  $y = 16$  when  $x = 64$ .
- (i) Express  $y$  in terms of  $x$ .
- (ii) Calculate the value of  $x$  when  $y = 12$ .

(i)

$$y \propto \sqrt[3]{x}$$

$$y = k\sqrt[3]{x} \text{ where } k \text{ is a constant}$$

When  $y = 16, x = 64$

$$16 = k\sqrt[3]{64}$$

$$16 = k(4)$$

$$k = 4$$

$$\therefore y = 4\sqrt[3]{x}$$

(ii) When  $y = 12$

$$12 = 4\sqrt[3]{x}$$

$$\sqrt[3]{x} = 3$$

$$x = 3^3$$

$$= 27$$

Ans : (a) (i)                      $y = 4\sqrt[3]{x}$                      [2]

(ii)                     27                     [1]

- (b) 8 workers can build a house in 30 days. How many workers are needed if the house is to be built in 10 days?

Let the number of workers needed be  $n$  workers, and the number of days be  $d$  days.

$$n \propto \frac{1}{d}$$

$$n = \frac{k}{d} \text{ where } k \text{ is a constant}$$

When  $d = 10, n = \frac{240}{10}$

$$= 24$$

When  $n = 8, d = 30$

24 workers are needed to build the house in 10 days.

$$8 = \frac{k}{30}$$

$$k = 240$$

$$\therefore n = \frac{240}{d}$$

Ans : (b)                     24                     workers [3]

- (c) On a map, 2 m represents 5 km on actual ground. Express the area scale of the map in 1 :  $n$  form.

Linear scale =  $2m : 5km$

Area scale =  $(2^2)m^2 : (5)^2 km^2$

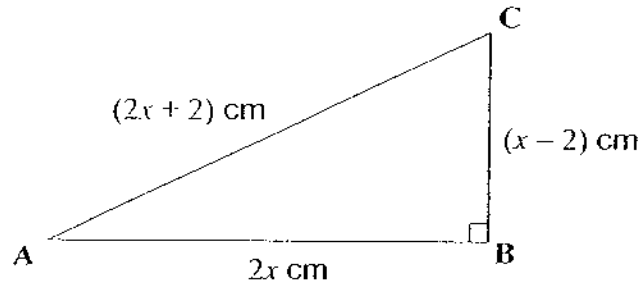
$$= 4m^2 : 25km^2$$

$$= 1m^2 : 6.25km^2$$

$$= 1 : 6250000$$

Ans : (c)                     1 : 6250000                     [2]

10. The figure below shows a right-angled triangle ABC where  $AB = 2x$  cm,  $BC = (x - 2)$  cm and  $AC = (2x + 2)$  cm.



- (a) Form an equation in  $x$  and show that it reduces to  $x^2 - 12x = 0$ . [3]  
 (b) Solve the equation to find  $x$  and hence, find the area of  $\triangle ABC$ .

(a)

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

$$4x^2 + x^2 + 4 = 4x^2 + 8x + 4$$

$$5x^2 - 4x + 4 = 4x^2 + 8x + 4$$

$$x^2 - 12x = 0$$

(b)

$$x(x - 12) = 0$$

$$x = 0 \text{ or } x - 12 = 0$$

$$\text{(rejected) or } x = 12$$

$$AB = 2(12) = 24\text{cm}$$

$$BC = 12 - 2 = 10\text{cm}$$

$$AC = 2(12) + 2 = 26\text{cm}$$

$$\begin{aligned} \text{Area of } \triangle ABC &= \frac{1}{2}(24)(10) \\ &= 120\text{cm}^2 \end{aligned}$$

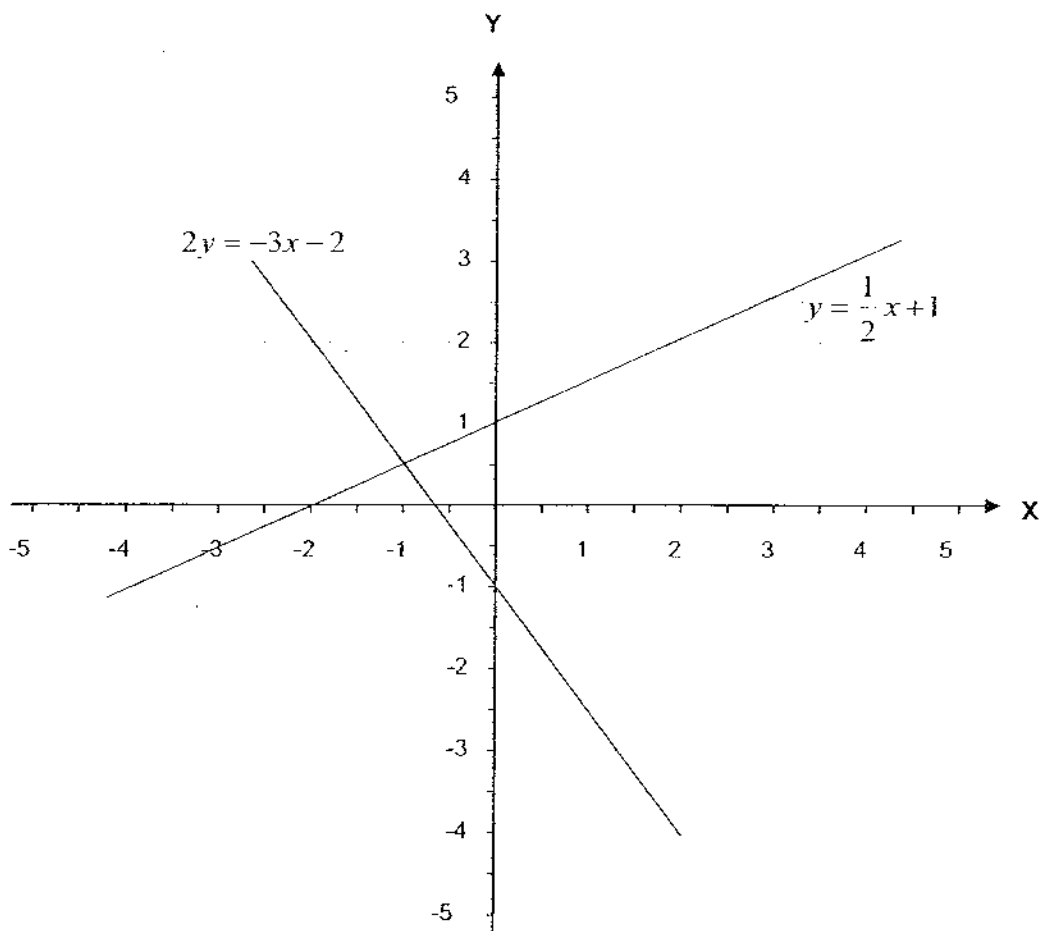
Ans : (b) Area of  $\triangle ABC = \underline{120} \text{ cm}^2$  [3]

11. (a) The grid square below shows the graph of the equation  $y = \frac{1}{2}x + 1$ . On the same grid square given, draw the graph of the equation  $2y = -3x - 2$  for  $-2 \leq x \leq 2$ . [3]

(b) Hence, solve the simultaneous equations  $2y = -3x - 2$  and  $y = \frac{1}{2}x + 1$  graphically.

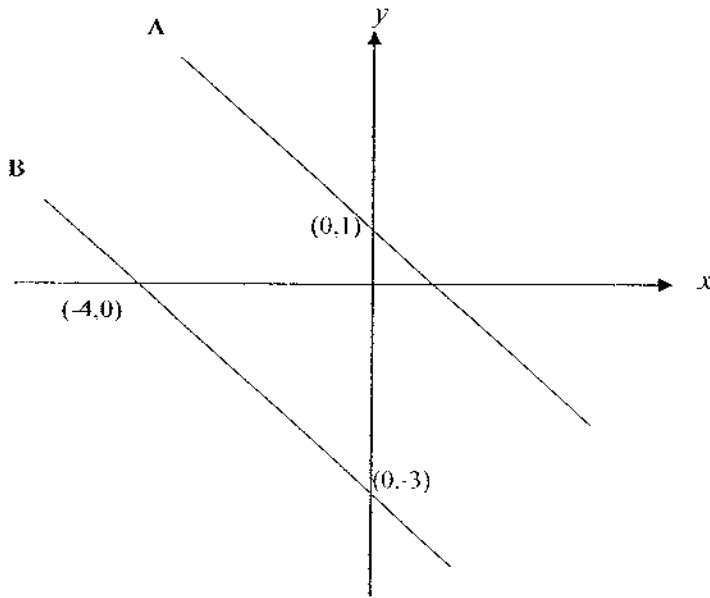
$$2y = -3x - 2$$

x	-2	0	2
y	2	-1	-4



Ans : (b)  $x = -1, y = \frac{1}{2}$  [1]

12. From the graphs below, deduce the equations of lines A and B, given that lines A and B are parallel. [3]



Line A

$$m = -\left(\frac{3}{4}\right)$$

$$c = -3$$

$$\text{Equation of Line A : } y = -\frac{3}{4}x - 3$$

Line B

$$m = -\left(\frac{3}{4}\right) \text{ [parallel to line A thus having the same gradient as line A]}$$

$$c = 1$$

$$\text{Equation of Line B : } y = -\frac{3}{4}x + 1$$

Ans : Equation of line A:  $y = -\frac{3}{4}x - 3$

Equation of line B:  $y = -\frac{3}{4}x + 1$

13. (a) Given that  $E = \{x : 1 < x < 30, x \text{ is a positive integer}\}$ ,  $P = \{x : x \text{ is an odd number}\}$ ,  $Q = \{x : 15 \leq x < 27 \text{ and } x \text{ is a multiple of } 3\}$  and  $R = \{x : x \text{ is a factor of } 45\}$ .
- List all the elements in set R.
  - Write down the elements that are common to both sets P and Q.
  - Find  $n(R \cap Q)$ .

(i)  $R = \{3, 5, 9, 15\}$

(ii)  $P = \{3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29\}$

$Q = \{15, 18, 21, 24\}$

$P \cap Q = \{15, 21\}$

(iii)  $R \cap Q = \{15\}$

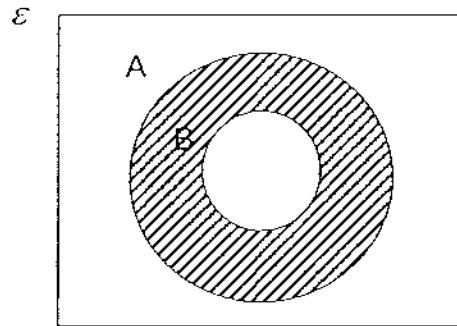
$n(R \cap Q) = 1$

Ans : (a) (i)  $R = \{3, 5, 9, 15\}$  [1]

(ii)  $P \cap Q = \{15, 21\}$  [1]

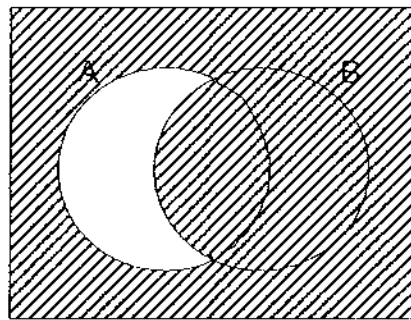
(iii)  $n(R \cap Q) = 1$  [1]

13. (b) (i) On the Venn diagram below, shade the region which represents the set  $A \cap B'$



[1]

- (ii) Identify the sets shaded in the Venn diagram below.



Ans : (b)(i)  $A \cap B'$  OR  $(A \cap B) \cup A'$  [1]

14. The stem and leaf diagram below shows the distances in km, travelled by a postman in 30 days.

Stem	Leaf
0	2 2 7 9
1	3 3 4 5 5 8
2	4 5 6 6
3	
4	0 1 2
5	0 0 9
6	8 9
7	3 3 3 4
8	2 5 7 9

- (a) Complete the grouped frequency table below using the stem and leaf diagram given. Let the distance travelled be  $d$  km.

Class Interval	Mid-value	Frequency
$0 < d \leq 20$	10	10
$20 < d \leq 40$	30	5
$40 < d \leq 60$	50	5
$60 < d \leq 80$	70	6
$80 < d \leq 100$	90	4

[3]

14. (b) Find the estimated mean distance travelled by the postman from the frequency table above.

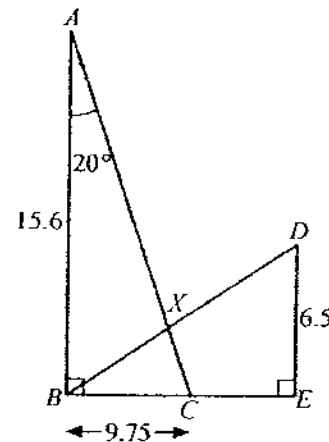
$$\begin{aligned} \text{Estimated mean} &= \frac{10 \times 10 + 30 \times 5 + 50 \times 5 + 70 \times 6 + 90 \times 4}{30} \\ &= 42 \frac{2}{3} \text{ km or } 42.7 \text{ km (3sf)} \end{aligned}$$

Ans:  $42 \frac{2}{3}$  km or 42.7 km (3sf) km [2]

15. In the diagram,  $\triangle ABC$  is similar to  $\triangle BED$ ,  $AB = 15.6$  cm,  $BC = 9.75$  cm,  $DE = 6.5$  cm,  $\angle BAC = 20^\circ$  and  $BD$  and  $AC$  intersect at  $X$ .

Find

- (a)  $\angle BDE$ ,  
 (b) length  $CE$ .



(a)  $\angle BDE = \angle ACB$   
 $= 180^\circ - 90^\circ - 20^\circ$  ( $\angle$  sum of  $\triangle$ )  
 $= 70^\circ$

(b)  $\frac{BE}{AB} = \frac{DE}{CB}$   
 $\frac{BE}{15.6} = \frac{6.5}{9.75}$   
 $BE = \frac{6.5}{9.75} \times 15.6$   
 $= 10.4 \text{ cm}$   
 $CE = 10.4 - 9.75$   
 $= 0.65 \text{ cm}$

Ans : (a)  $\angle BDE = 70^\circ$  [1]

(b)  $CE = 0.65$  cm [3]

16. The frequency table records the number of books borrowed by 60 students during a 1-year period.

No. of books	5	6	7	8	9
Frequency	24	$p$	13	$q$	5

- (a) Show that  $p + q = 18$ . [2]  
 (b) Given that the mean number of books borrowed is 6.3, show that  $6p + 8q = 122$ . [2]  
 (c) Hence, find the values of  $p$  and  $q$ .  
 (d) State the median number of books borrowed.

(a)  $24 + p + 13 + q + 5 = 60$   
 $42 + p + q = 60$   
 $p + q = 18$  (shown)

(b)  $\frac{5 \times 24 + 6p + 7 \times 13 + 8q + 9 \times 5}{60} = 6.3$

$120 + 6p + 91 + 8q + 45 = 378$

$256 + 6p + 8q = 378$

$6p + 8q = 122$  (shown)

(c)  $p + q = 18$  ----- (1)

$6p + 8q = 122$  ----- (2)

from (1),  $p = 18 - q$

Substitute (3) into (2).

$6(18 - q) + 8q = 122$

$108 - 6q + 8q = 122$

$2q = 14$

$q = 7$

Substitute  $q = 7$  into (3).

$p = 18 - 7$

$= 11$

$\therefore p = 11, q = 7$

(d) Median number of books =  $\frac{30\text{th} + 31\text{st value}}{2}$

$= \frac{6 + 6}{2}$

$= 6$  books

Ans : (c)  $p = 11$

$q = 7$  [3]

(d)  $6$  books [1]

17. 300 chips are put inside a bag. The 300 chips consist of  $x$  red chips,  $y$  blue chips and 138 green chips. A chip is randomly selected from the bag.
- (a) If the probability of selecting a red chip is  $\frac{6}{25}$  and the probability of selecting a blue chip is  $\frac{3}{10}$ , find the values of  $x$  and  $y$ .
- (b) How many green chips must be removed from the bag for the probability of selecting a green chip to be  $\frac{2}{5}$ ?
- (c) If 12 red chips, 10 blue chips and 38 green chips are removed from the bag, find the **new** probability of selecting a blue chip from the bag.

$$\begin{aligned} \text{(a)} \quad x &= \frac{6}{25} \times 300 \\ &= 72 \end{aligned}$$

$$\begin{aligned} y &= \frac{3}{10} \times 300 \\ &= 90 \end{aligned}$$

- (b) Let the number of green chips to be removed be  $g$ .

$$\frac{139 - g}{300 - g} = \frac{2}{5}$$

$$690 - 5g = 600 - 2g$$

$$90 = 3g$$

$$g = 30$$

Number of green chips to be removed = 30 green chips

- (c) New total number of chips in bag  
 $= 300 - 12 - 10 - 38$   
 $= 240$

$$\begin{aligned} P(\text{blue chip}) &= \frac{90 - 10}{240} \\ &= \frac{1}{3} \end{aligned}$$

$$\text{Ans : (a) } x = \underline{\quad 72 \quad}$$

$$y = \underline{\quad 90 \quad} [2]$$

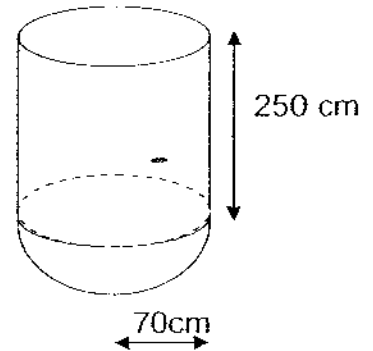
$$\text{(b) } \underline{\quad 30 \quad} \text{ green chips} [2]$$

$$\text{(c) } \underline{\quad \frac{1}{3} \quad} [3]$$

18. The container below consists of a cylindrical drum of height 250 cm that is welded to a hollow hemispherical base of radius 70 cm. Water is poured into the container at the rate of 50 litres per minute. Leave all answers in fractions, if necessary.

Take  $\pi$  as  $\frac{22}{7}$ . (1 litre = 1000 cm<sup>3</sup>)

- (a) How much time is needed to fill the container fully. Leave your answer in minutes.  
 (b) Find, in litres, the amount of water that would have spilled from the container after 1 hour and 20 minutes.  
 (c) Find the total surface area of the container that is in contact with the water after 20 minutes.



$$\begin{aligned} \text{(a) Vol. of container} &= \left[ \frac{22}{7} \times (70)^2 \times 250 \right] + \left[ \frac{2}{3} \times \frac{22}{7} \times (70)^3 \right] \\ &= 3850000 + 718666 \frac{2}{3} \\ &= 4568666 \frac{2}{3} \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Time needed} &= \frac{4568666 \frac{2}{3}}{50000} \\ &= 91 \frac{23}{75} \text{ min} \end{aligned}$$

- (b) 1h 20min = 80min  
 There would be no spillage of water from the container.

$$\begin{aligned} \text{(c) Volume of water in container after 20min} &= 20 \times 50000 \\ &= 1000000 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Volume of water in cylindrical portion of container} &= 1000000 - 718666 \frac{2}{3} \\ &= 281333 \frac{1}{3} \text{ cm}^3 \end{aligned}$$

$$\text{Height of water in cylindrical portion} = \frac{281333 \frac{1}{3}}{\frac{22}{7} \times (70)^2}$$

$$\begin{aligned} &= 18 \frac{62}{231} \text{ cm} \\ &= \left[ \frac{1}{2} \times 4 \times \frac{22}{7} \times (70)^2 \right] + \left[ 2 \times \frac{22}{7} \times 70 \times 18 \frac{62}{231} \right] \end{aligned}$$

$$\text{Total surface area in contact with water} = 38838 \frac{2}{21} \text{ cm}^2$$

Ans: (a)  $91 \frac{23}{75}$  min [3]

(b) 0 cm<sup>3</sup> / 0l / no spillage [1]

(c)  $38838 \frac{2}{21}$  cm<sup>2</sup> [6]

19. Answer the whole of this question on a sheet of graph paper.

- (a) The table below shows the corresponding values of  $x$  and  $y$  for the equation  $y = 5 + 3x - x^2$ . Write down the values of  $a$  &  $b$ .

$x$	-2	-1	0	1	2	3	4	5
$y$	-5	1	$a$	7	7	$b$	1	-5

[2]

- (b) Using a scale of 1 cm to represent 1 unit on both axes, draw the graph of  $y = 5 + 3x - x^2$  for  $-2 \leq x \leq 5$ .

[4]

- (c) Write down the equation of the line of symmetry for the graph of  $y = 5 + 3x - x^2$ . [1]

- (d) From the graph, estimate

- (i) the values(s) of  $y$  when  $x = -0.5$ , [1]

- (ii) the values(s) of  $x$  when  $y = 6$ . [1]

- (e) Using the graph, solve the equation  $5 + 3x - x^2 = 0$ . [1]

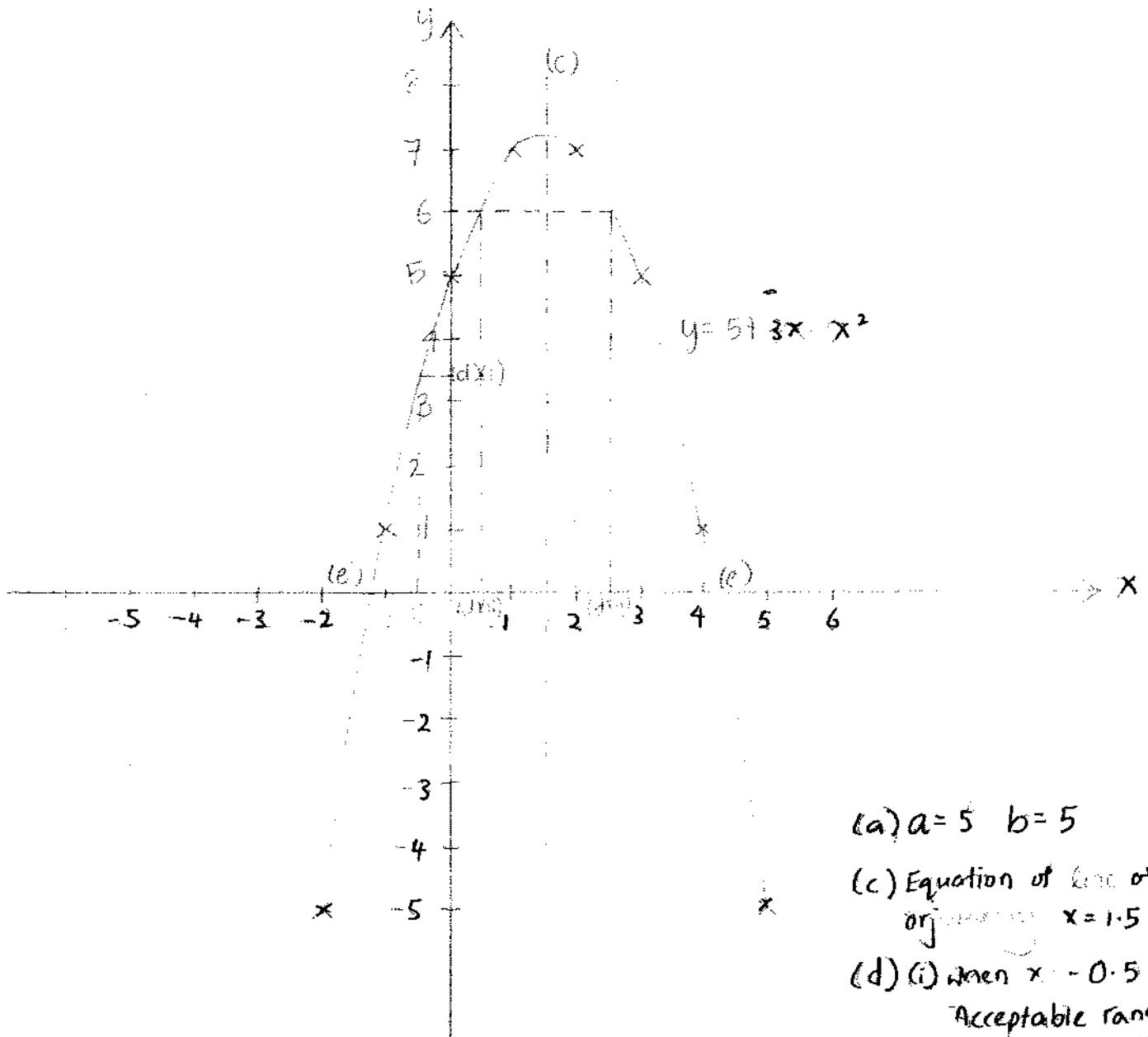
- End of Paper -

Answer for S2 Maths EOY Qn 19

x	-2	-1	0	1	2	3	4	5
y	-5	1	5	7	7	5	1	-5

Scale

x-axis : 1cm rep 1 unit  
y-axis : 1cm rep 1 unit



(a)  $a = 5$   $b = 5$

(c) Equation of line of symmetry  $x = 1.5$

(d) (i) when  $x = -0.5$

Acceptable range of  $y = 3.0$  to  $3$

(ii) when  $y = 6$ ,

Acceptable ranges

$x = 0.5$  to  $0.6$

or  $4$  to  $2.8$

(e) To solve  $5 + 3x - x^2$

Acceptable ranges of

$-1$  to  $-1.4$ ,

$4$  to  $4$