NCSE 2014

Section I

1. (a) **Required to calculate:** $2\frac{3}{4} \div \frac{5}{8}$

Calculation:

$$2\frac{3}{4} \div \frac{5}{8} = \frac{(2\times4)+3}{4} \div \frac{5}{8}$$
$$= \frac{11}{4} \div \frac{5}{8}$$
$$= \frac{11}{4} \times \frac{8}{5}$$
$$= \frac{22}{5} \text{ as an improper fraction}$$
$$= 4\frac{2}{5} \text{ as a mixed fraction}$$

(b) **Required to convert:** $2\frac{7}{8}$ to decimal form, correct to 1 decimal place.

Solution:

Consider the fractional part of $2\frac{7}{8}$ and which is $\frac{7}{8}$.

We convert this fraction to a decimal form,

$$\begin{array}{r} 0.875 \\ 8\overline{)7.0} \\ -\underline{64} \\ 60 \\ -\underline{56} \\ 40 \\ -\underline{40} \\ \underline{0} \end{array}$$

$\therefore \frac{7}{8} = 0.875$ and so $2\frac{7}{8} = 2.875$.

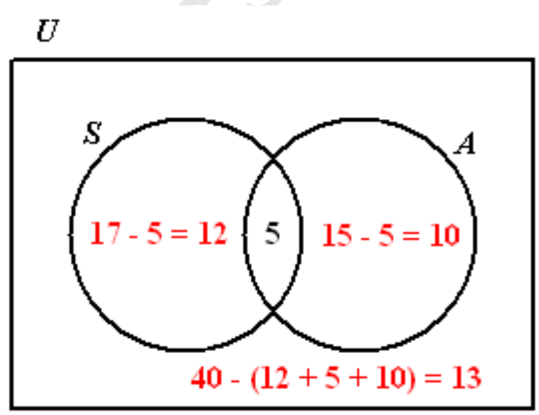
$$2.8\underline{\underline{7}}5$$
$$\uparrow$$
deciding digit ≥ 5

(So we add 1 to the first digit after the decimal point and ignore all digits to the right of the first decimal place)

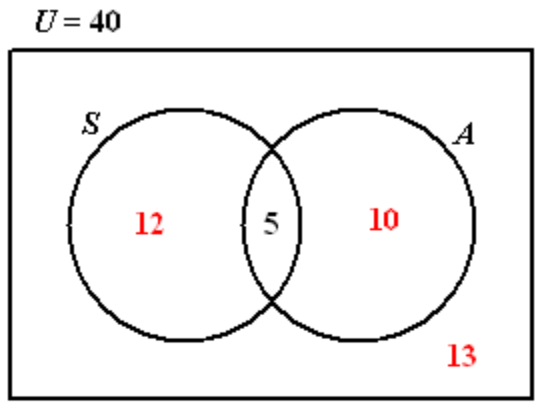
Hence, $2\frac{7}{8} \approx 2.9$ (correct to 1 decimal place)

(c) **Required to express:** 14.995 correct to 2 significant figures.
Solution:
$14.\underline{\underline{9}}95$
$\uparrow$
deciding digit ≥ 5
$\therefore 14.995 \approx 14 + 1$ (and we ignore all digits to the right)
≈ 15 (correct to 2 significant figures)

2. **Data:** In a class of 40 students, 17 students do Science, 15 students do Art and 5 students do both Science and Art.
   (a) **Required to complete:** The Venn diagram given.
   Solution:
   Let
   $S = \{\text{Students who do Science}\}$
   $A = \{\text{Students who do Art}\}$



(b) **Required to find:** The number of students doing only one subject.
Solution:



Number of students who do Science only = 12
Number of students who do Art only = 10

Hence, the number of students who study only one of the mentioned subjects (Science or Art) $= 12 + 10$
$= 22$

(c) **Required to find:** The probability that a student chosen at random does both subjects.
Solution:

$$P(\text{Student does both subjects}) = \frac{\text{No. of students doing both subjects}}{\text{No. of students in the class}}$$
$$= \frac{5}{40}$$
$$= \frac{1}{8}$$

3. (a) (i) **Required to simplify:** $8a - 4b + 5b$
Solution:

$$8a - 4b + 5b = 8a + 5b - 4b$$
$$= 8a + b$$

(ii) **Required to simplify:** $2x(3x+5) - 6x^2$
Solution:

$$2x(3x+5) - 6x^2 = 6x^2 + 10x - 6x^2$$
$$= 6x^2 - 6x^2 + 10x$$
$$= 10x$$

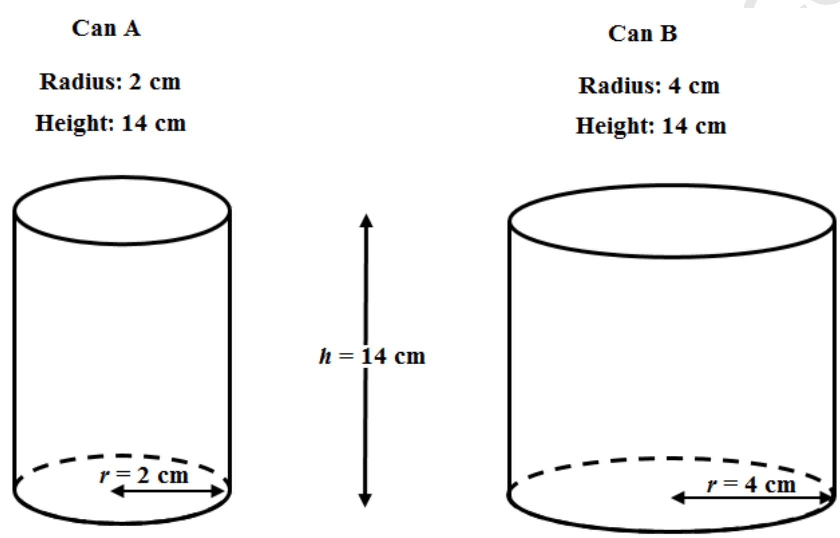
(b) (i) **Required to factorise:** $2a+4b$
Solution:

$$2a+4b=2(a)+2(2b)$$
$$=2(a+2b)$$

(ii) **Required to factorise:** $5ab^2-15a^2b^3$
Solution:

$$5ab^2-15a^2b^3=5ab^2\times 1-5ab^2\times 3ab$$
$$=5ab^2(1-3ab)$$

4. **Data:** Diagrams showing the radius and vertical height of Can A and Can B.



(a) **Required to find:** The volume of Can A, in cm^3.
Solution:
Can A is a cylinder.

$V=\pi r^2 h$ (r = radius, h = vertical height)

$$V=\frac{22}{7}\times 2\times 2\times 14\text{ cm}^3$$

$$V=176\text{ cm}^3$$

(b) **Required to convert:** The volume of Can A from cm^3 to litres.
Solution:

$$1000\ \text{cm}^3 = 1\ \text{litre}$$

$$\therefore 1\ \text{cm}^3 = \frac{1}{1000}\ \text{litre}$$

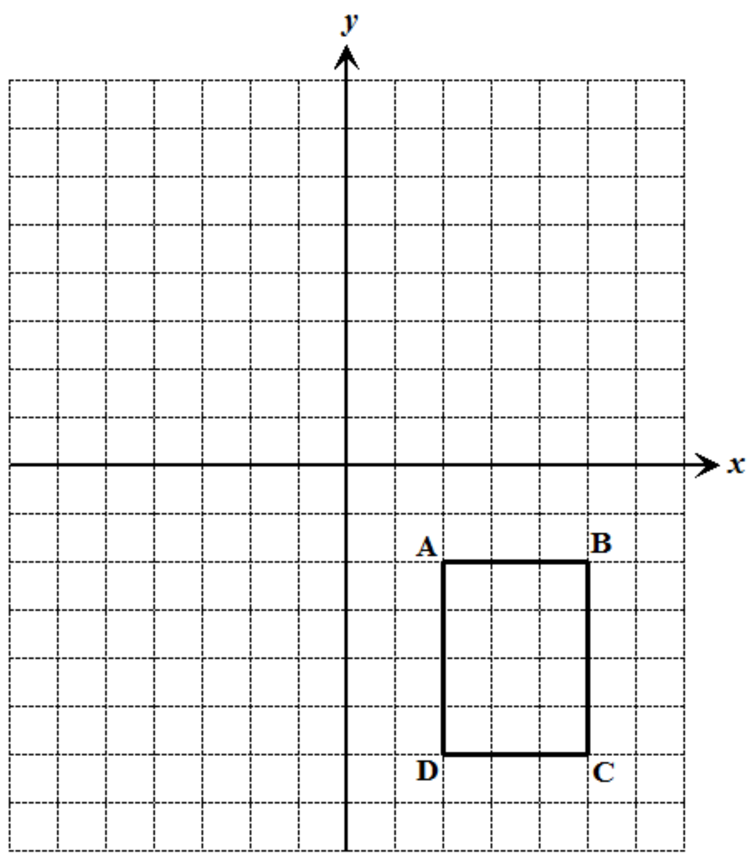
$$176\ \text{cm}^3 = \frac{1}{1000} \times 176\ \text{litre}$$
$$= 0.176\ \text{litre}$$

(c) **Required to calculate:** The ratio of the volume of Can A to the volume of Can B.
Calculation:

Volume of Can A : Volume of Can B

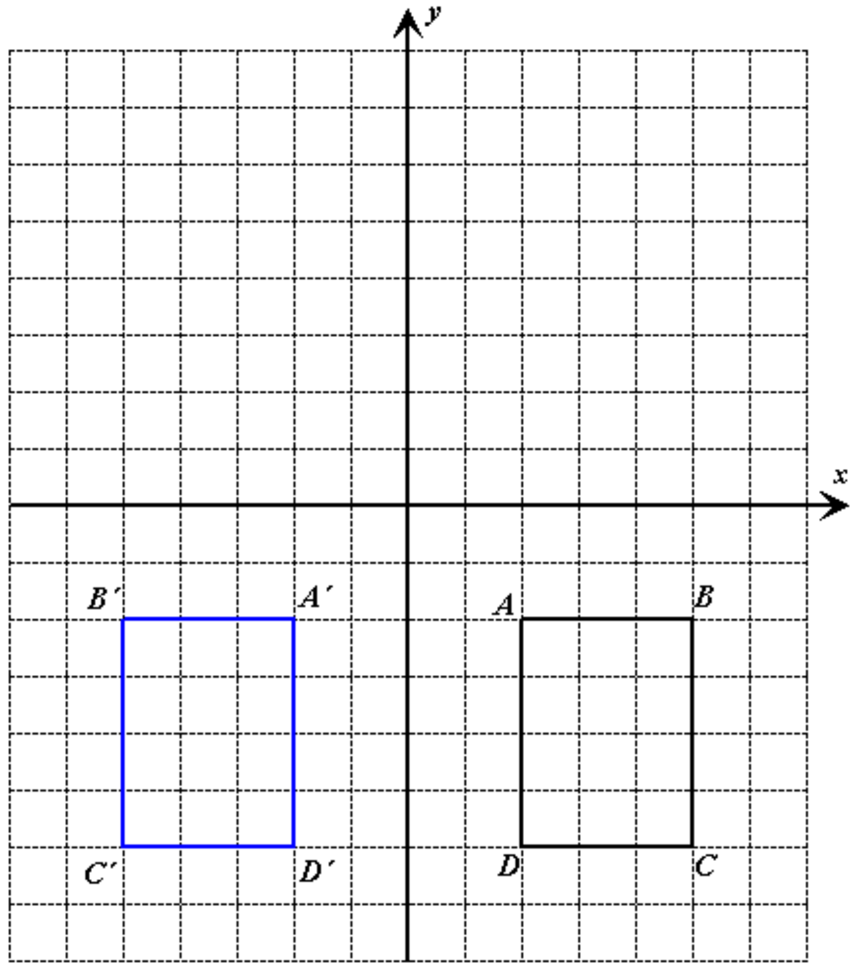
$$\pi(2)^2 \times 14 : \pi(4)^2 \times 14$$
$$2^2 : 4^2$$
$$4 : 16$$
$$1 : 4$$

5. **Data:** Diagram showing quadrilateral $ABCD$. $ABCD$ is reflected in the y – axis to produce image $A'B'C'D'$.

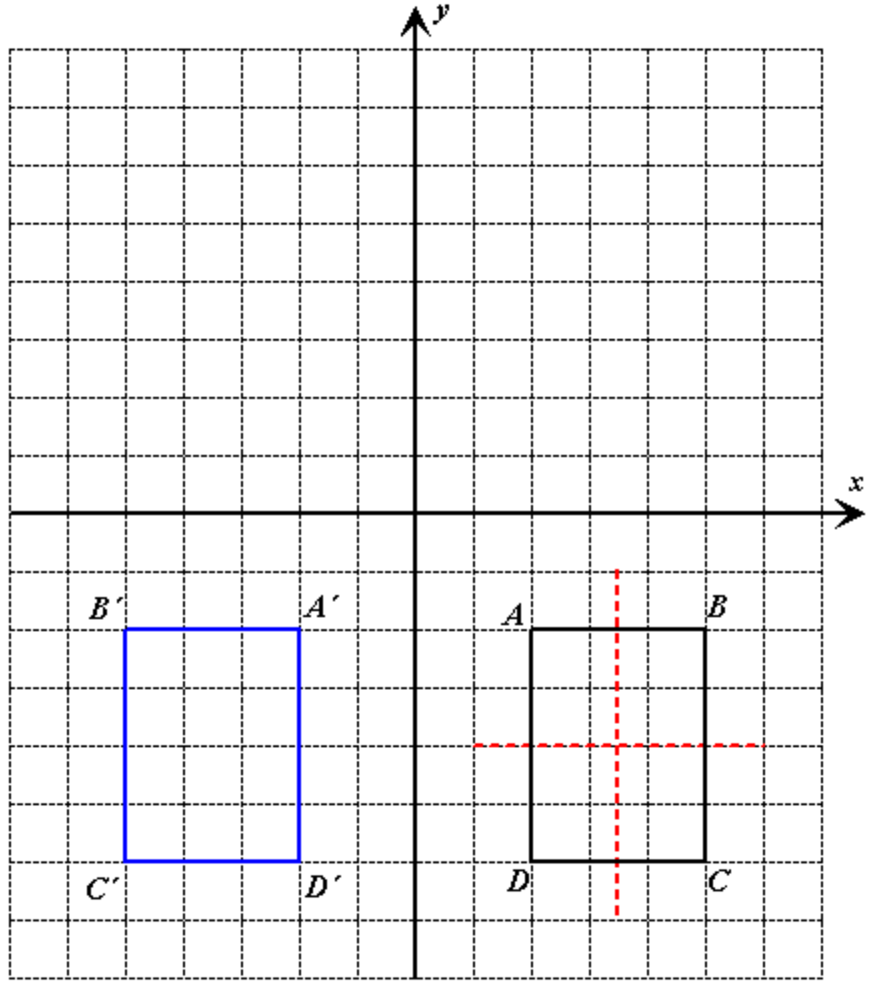


(a) **Required** to draw and label $A'B'C'D'$.

Solution:
ABCD is a rectangle of width 3 blocks and length 4 blocks.
The image is always the same perpendicular distance away from but on the opposite side of the reflective plane, as the object.



(b) **Required to draw:** The lines of symmetry for *ABCD* on the diagram above.
Solution:



6. **Data:** A calendar showing the number of texts that Ria sent each day for the month of April.

April						
Sun	**Mon**	**Tue**	**Wed**	**Thu**	**Fri**	**Sat**
1 **5**	2 **1**	3 **4**	4 **3**	5 **2**	6 **5**	7 **3**
8 **5**	9 **3**	10 **2**	11 **4**	12 **1**	13 **1**	14 **2**
15 **4**	16 **3**	17 **3**	18 **5**	19 **3**	20 **3**	21 **1**
22 **2**	23 **5**	24 **1**	25 **3**	26 **2**	27 **4**	28 **5**
29 **3**	30 **2**					

(a) **Required to find:** The number of texts sent on Thursday 19th April.
Solution:
From the table, we can see that 3 texts were sent on that day.

(b) **Required to complete:** The frequency table for the given data.
Solution:

Number of texts	Tally	Frequency
1	~~||||~~	5
2	~~||||~~ |	6
3	~~||||~~ ||||	9
4	||||	4
5	~~||||~~ |	6
		$\sum f = 30$

(c) **Required to calculate:** The total number of texts Ria sent.
Calculation:

Total number of texts sent $= \sum fx$

1 text on 5 days $= 1 \times 5$
= 5 texts

2 texts on 6 days $= 2 \times 6$
= 12 texts

3 texts on 9 days $= 3 \times 9$
= 27 texts

4 texts on 4 days $= 4 \times 4$
= 16 texts

5 texts on 6 days $= 5 \times 6$
= 30 texts

Total number of texts sent $= 5 + 12 + 27 + 16 + 30$
= 90 texts

(d) **Required to calculate:** The mean number of texts Ria sent per day.
Calculation:

$$\text{Mean number of texts sent per day} = \frac{\sum fx}{\sum f}$$
$$= \frac{\text{Total no. of texts sent}}{\text{No. of days}}$$
$$= \frac{90}{30}$$
$$= 3 \text{ texts}$$

SECTION II

7. (a) **Data:** The 10% down payment on a vacation is $120 US.
US $1.00 = TT $6.50

(i) **Required to calculate:** The down payment in TT dollars.
Calculation:
Down payment = US $120
$$= \text{TT}(\$120 \times 6.50)$$
$$= \text{TT}\$780.00$$

(ii) **Required to calculate:** The total cost of the vacation in TT dollars.
Calculation:
10% of the cost of the vacation costs = TT $780
$$\therefore 1\% \text{ of the cost of the vacation will cost } = \text{TT}\frac{\$780}{10}$$
$$= \$78$$
$$\text{The total cost of the vacation (100\%) will have a cost} = \$78 \times 100$$
$$= \$7\,800$$

(b) **Data:** Principal = $7200, rate = 8% per annum and time = 7 years.

(i) **Required to calculate:** The interest earned on the investment.
Calculation:
$$\text{Simple interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$$
$$= \frac{\$7200 \times 8 \times 7}{100}$$
$$= \$4032$$

(ii) **Required to calculate:** The total amount she will receive from her investment.

Calculation:

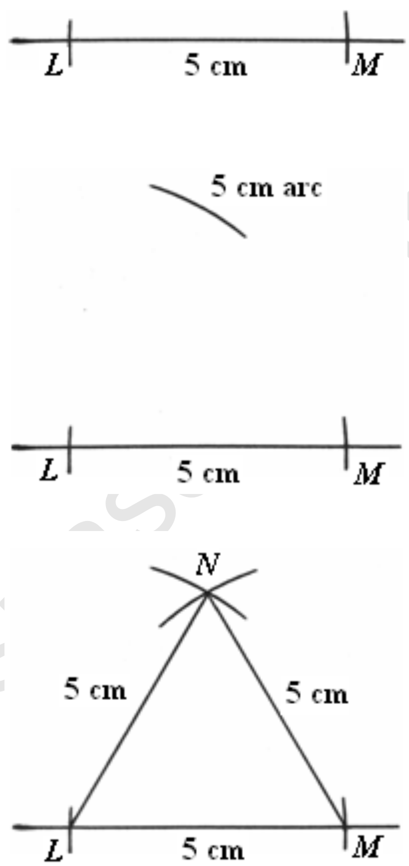
Amount that Mrs. Gift will receive = Amount deposited + Interest earned

$= \$7200 + \$4032$

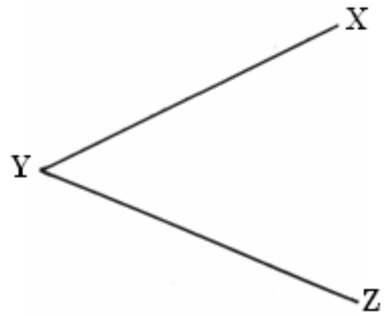
$= \$11232$

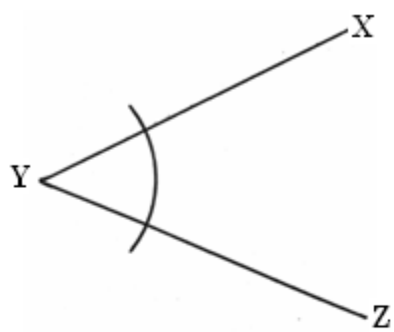
(c) (i) **Required To Construct:** Triangle LMN with lengths $LM = MN = LN = 5$ cm.

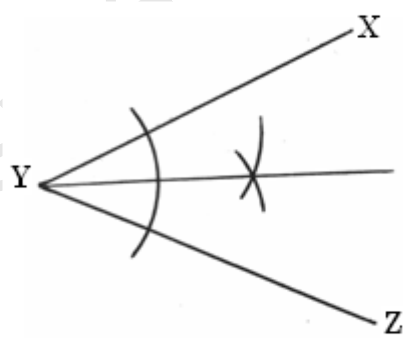
Construction:



(ii) **Required to bisect:** Angle *XYZ*.
Solution:



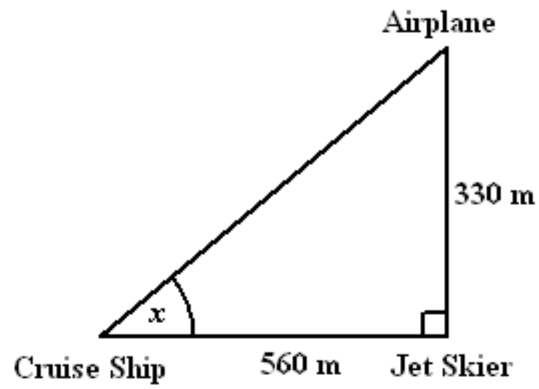




8. (a) **Data:** Diagram showing an airplane, a cruise ship and a jet skier.

(i) **Required to calculate:** The distance between the airplane and the cruise ship.

Calculation:



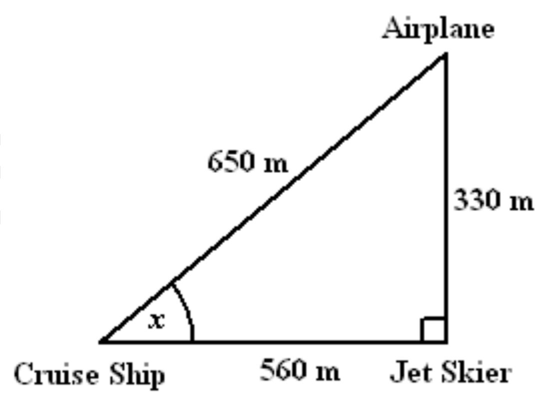
The distance between the airplane and the cruise ship

$= \sqrt{(330)^2 + (560)^2}$ (Pythagoras' Theorem)

$= 650$ m

(ii) **Required to calculate:** The size of the angle x.

Calculation:



$$\tan x = \frac{330}{560}$$

$$x = \tan^{-1}\left(\frac{330}{560}\right)$$

$$= 30.5\underline{\underline{1}}^\circ$$

$$= 30.5^\circ \text{ (to the nearest } 0.1^\circ)$$

OR

$$x = \sin^{-1}\left(\frac{330}{650}\right)$$

$$x = \cos^{-1}\left(\frac{560}{650}\right)$$

$x = 30.5^0$ (to the nearest 0.1^0 or 1 d.p.)

(b) **Data:** Paul goes to Rita's house to study. He leaves home at 3:55 pm and arrives at Rita's house at 4:35 pm. Paul lives 800 m away from Rita. Paul and Rita's homework assignment is to draw a map of the neighborhood, using a scale of 1 cm to represent 200 m.

(i) **Required to determine:** The number of centimetres used to represent the actual distance between Paul's house and Rita's house.

Solution:

Actual distance = 800 m

Scale is

$$200 \text{ m} \equiv 1 \text{ cm}$$

$$\therefore 1 \text{ m} \equiv \frac{1}{200} \text{ cm}$$

$$800 \text{ m} \equiv \frac{1}{200} \times 800 \text{ cm}$$

$$= 4 \text{ cm}$$

(ii) **Required to determine:** The distance from Paul's house to Rita's house in kilometres.

Solution:

$$1000 \text{ m} = 1 \text{ km}$$

$$1 \text{ m} = \frac{1}{1000} \text{ km}$$

$$800 \text{ m} = \frac{1}{1000} \times 800 \text{ km}$$

$$= 0.8 \text{ km}$$

(iii) **Required to determine:** The length of time, Paul took to arrive at Rita's house.

Solution:

Time of arrival	4 : 3 5 pm
Time of departure	3 : 5 5 pm
	: 4 0

Time taken = 40 minutes

(iv) **Required to determine:** The time taken, in hours, for Paul to arrive at Rita's house.
Solution:
Time taken by Paul = 40 minutes

$$60 \text{ minutes} = 1 \text{ hour}$$

$$1 \text{ minute} = \frac{1}{60} \text{ hour}$$

$$40 \text{ minutes} = \frac{1}{60} \times 40 \text{ hour}$$

$$= \frac{2}{3} \text{ hour}$$

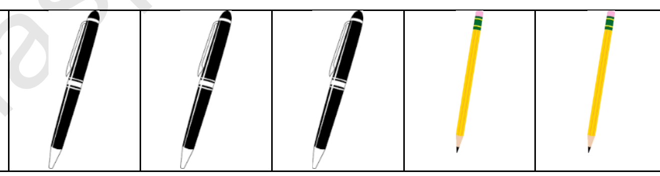
(v) **Required to determine:** Paul's average speed while walking from his house to Rita's house.
Solution:

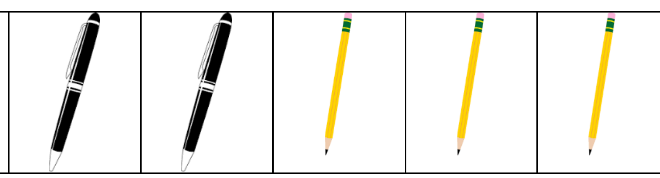
$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{0.8 \text{ km}}{\frac{2}{3} \text{ hour}}$$

$$= 1.2 \text{ kmh}^{-1}$$

9. (a) **Data:** Table showing the number of pens and pencils and the amount spent by Raj and Ana. Cost of 1 pen = $\$x$. Cost of 1 pencil = $\$y$.

Raj		Total Cost **$51.00**

Ann		Total Cost **$39.00**

(i) **Required to write:** An equation, in *x* and *y*, to represent the total cost of the pens and pencils Raj bought.
Solution:
Raj spent \$51 to purchase 3 pens and 2 pencils.
Hence,

$$(3\times x)+(2\times y)=51$$
$$3x+2y=51 \quad ...(1)$$

(ii) **Required to determine:** The cost of 1 pen and 1 pencil using a pair of simultaneous equations.
Solution:
Ann spent \$39 to purchase 2 pens and 3 pencils.
Hence,

$$(2\times x)+(3\times y)=39$$
$$2x+3y=39 \quad ...(2)$$

Equation (1) $\times 2$
$6x + 4y = 102 \ldots(3)$

Equation (2) $\times -3$
$-6x-9y=-117 \quad ...(4)$

Equation (3) + Equation (4)

$$\begin{array}{rr} & 6x+4y= \ \ 102 \\ + & -6x-9y=-117 \\ \hline & -5y=-\ \ 15 \\ \hline \end{array}$$

Hence,

$$y=\frac{-15}{-5}$$
$$=3$$

When $y=3$, substitute into (1)

$$3x+2(3)=51$$
$$3x=51-6$$
$$3x=45$$
$$x=\frac{45}{3}$$
$$x=15$$

Hence, the cost of 1 pen = \$15 and the cost of 1 pencil = \$3.

The method used was the method of elimination.

We could have solved the two equations by other methods.

Alternative method:

$3x+2y=51 \quad ...(1)$

$2x+3y=39 \quad ...(2)$

From equation (1)

$3x=51-2y$

$x=\dfrac{51-2y}{3}$

Substitute in equation (2)

$$\frac{2(51-2y)}{3}+3y=39$$

$$\frac{2(51-2y)}{3}+\frac{3y}{1}=\frac{39}{1}$$

$\times 3$

$$2(51-2y)+3(3y)=3(39)$$

$$102-4y+9y=117$$

$$5y=15$$

$$y=3$$

Substitute $y=3$

$$x=\frac{51-2(3)}{3}$$

$$=15$$

The above method was the method of substitution

Alternative Method:

Consider both equations as straight lines and draw the lines on the same axes.

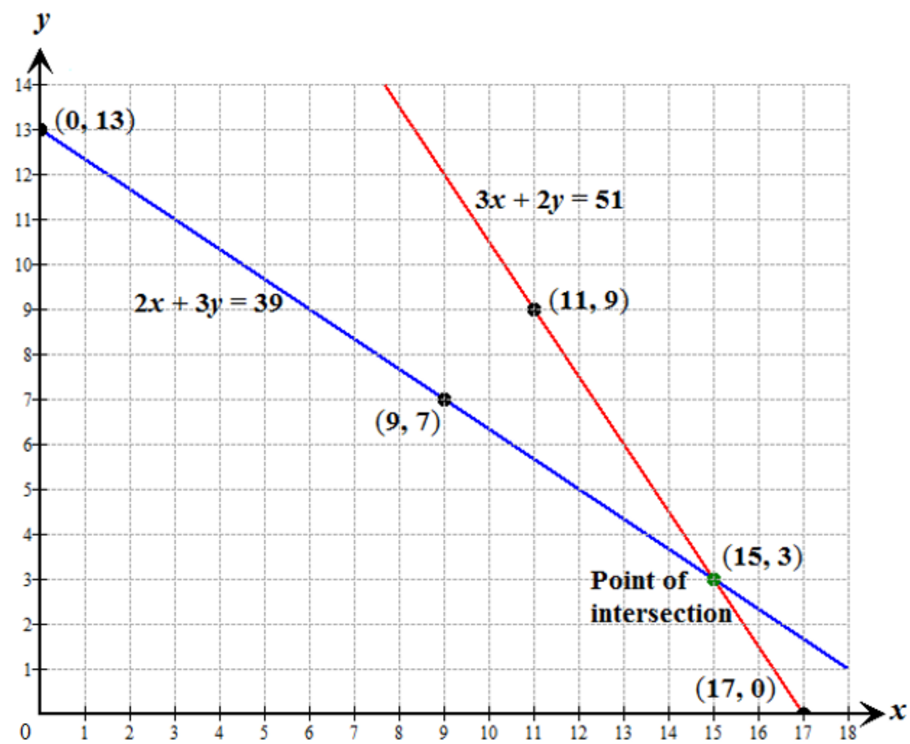
In each case, we choose any two values of *x* and find the corresponding values of *y*. The *x* value chosen and the corresponding *y* value, represents the (*x*, *y*) coordinates of a point on the line. We need only two points to draw any straight line. We join these two points and can extend the line to any desired length.

$3x+2y=51$

x	y
11	9
17	0

$2x+3y=39$

x	y
0	13
9	7



The above method is the graphical method

(b) **Data:** $y=2x+1$

(i) **Required to complete:** The table given, using the equation given.

Solution:

When $x=0$
$y=2(0)+1$
$=1$

When $x=2$
$y=2(2)+1$
$=5$

When $x=3$
$y=2(3)+1$
$=7$

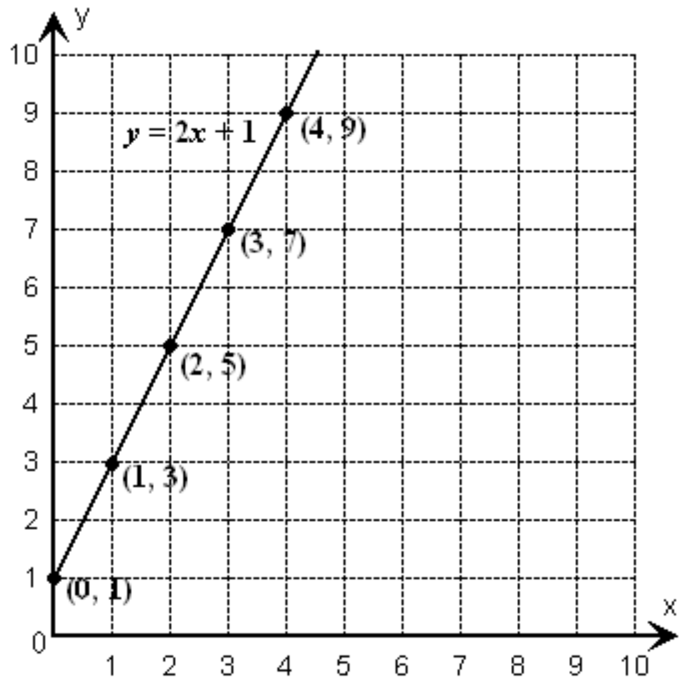
When $x=4$
$y=2(4)+1$
$=9$

The completed table looks like:

x	0	1	2	3	4
y	**1**	3	**5**	**7**	**9**

(ii) **Required to draw:** The graph of $y = 2x + 1$.

Solution:



(iii) **Required to state:** The y – intercept for the graph of $y = 2x + 1$.

Solution:

The y – intercept of $y = 2x + 1$ is 1, that is, the line $y = 2x + 1$ cuts the y – axis at (0, 1).