

NCSE MATHEMATICS PAPER 2

YEAR 2008

Section I

1. (a) **Required to calculate:** The exact value of : $4\frac{1}{2} \div \frac{2}{3}$.

Calculation:

$$\begin{aligned} 4\frac{1}{2} \div \frac{2}{3} &= \frac{9}{2} \div \frac{2}{3} \\ &= \frac{9}{2} \times \frac{3}{2} \\ &= \frac{27}{4} \end{aligned}$$

\therefore Answer is $\frac{27}{4}$ or $6\frac{3}{4}$ expressed as a fraction in exact form.

- (b) **Required to convert:** $3\frac{1}{8}$ to decimal form, correct to 2 decimal places.

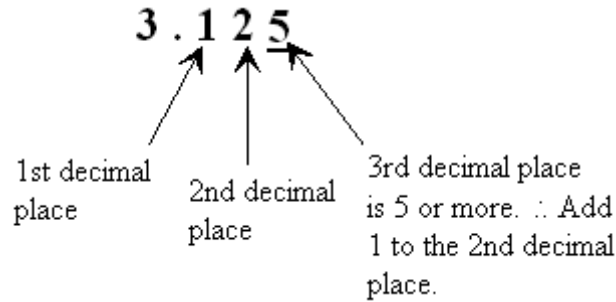
Solution: Considering the fractional part of the number

$$\begin{array}{r} 0.125 \\ 8 \overline{)10-} \\ \underline{8} \\ 20 - \\ \underline{16} \\ 40 - \\ \underline{40} \\ 0 \end{array}$$

$$\therefore \frac{1}{8} \equiv 0.125$$

$$\text{Hence, } 3\frac{1}{8} \equiv 3.125.$$

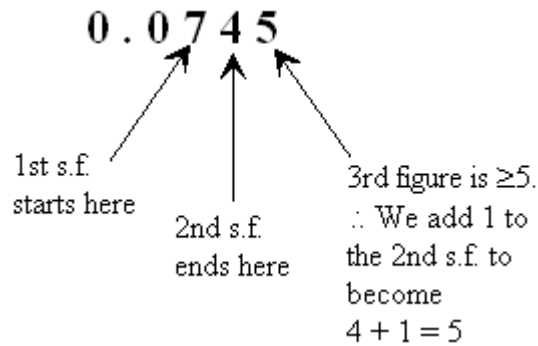
Consider 3.125,



and $3.125 = 3.13$ expressed to 2 decimal places

- (c) **Required to express:** 0.0745 correct to two significant figures.

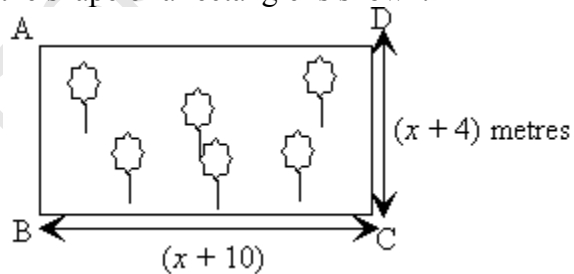
Solution:



Hence, 0.0745 is expressed as 0.075 correct to 2 significant figures.

Data: A flowerbed in the shape of a rectangle is shown.

2.



- (a) **Required to express:** In terms of x , the perimeter of the flower bed.

Solution:

$$\begin{aligned} \text{Perimeter} &= 2(\text{Length} + \text{Width}) \text{ m} \\ &= 2((x + 10) + (x + 4)) \text{ m} \end{aligned}$$

- (b) **Required to simplify:** The expression obtained in (a).

Solution: Perimeter = $2(x + x + 10 + 4)$

$$\begin{aligned}\text{Perimeter} &= 2(2x + 14) \\ &= (4x + 28) \text{ m}\end{aligned}$$

- (c) **Required to express:** In terms of x , the area of the flowerbed.

Solution:

Area of rectangular flowerbed = Length \times Width

$$\begin{aligned}&= (x + 10)(x + 4) \\ &= x^2 + 4x + 10x + 40\end{aligned}$$

Simplifying, we get:

$$\text{Area, } A = (x^2 + 14x + 40) \text{ m}^2$$

- (d) **Required to calculate:** Area, $A \text{ m}^2$, when $x = 2$.

Calculation:

$$\text{Area, } A = (x^2 + 14x + 40) \text{ m}^2$$

When $x = 2$

$$\begin{aligned}A &= (2)^2 + 14(2) + 40 \\ &= (4 + 28 + 40) \text{ m}^2 \\ &= 72 \text{ m}^2\end{aligned}$$

$$\therefore \text{Area of flowerbed} = 72 \text{ m}^2$$

3. **Data:** Gail borrowed \$3600 at 7% per annum simple interest to be repaid in 18 months.

- (a) **Required to calculate:** The simple interest on the loan.

Calculation:

Simple Interest = I

Principal = $P = \$3600$

Rate per annum = $R = 7\%$

$$\text{Time, in years} = T = \frac{18}{12} = 1\frac{1}{2} \text{ years.}$$

Recall:

$$\begin{aligned}I &= \frac{PRT}{100} \\ &= \frac{\$3600 \times 7 \times 1\frac{1}{2}}{100} \\ &= \$378\end{aligned}$$

$$\therefore \text{Total interest, } I = \$378$$

- (b) **Required to calculate:** The total amount to be repaid.

Calculation:

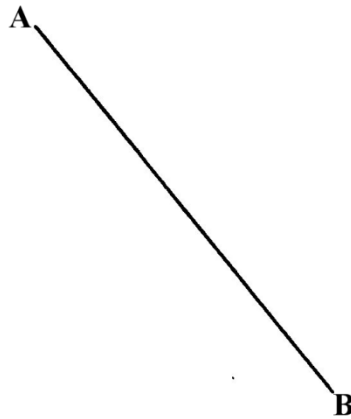
$$\begin{aligned}\text{The total amount to be repaid} &= \text{Amount borrowed} + \text{Total interest charged} \\ &= \$3600 + \$378 \\ &= \$3978\end{aligned}$$

- (c) **Required to calculate:** The amount that is repaid in each of 18 equal monthly installments.

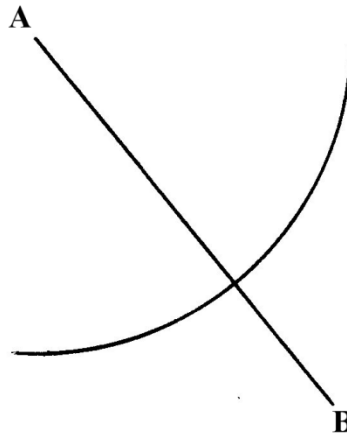
Calculation:

$$\begin{aligned}\text{Amount that is repaid in each month installment} &= \frac{\text{Total amount to be repaid}}{\text{Total number of months}} \\ &= \frac{\$3978}{18} \\ &= \$221 \text{ per month}\end{aligned}$$

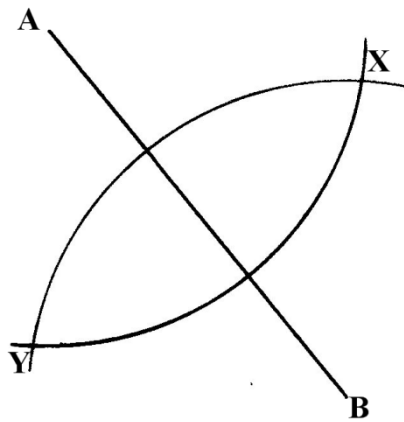
4. (a) **Required to construct:** The perpendicular bisector of the line AB.
Construction:



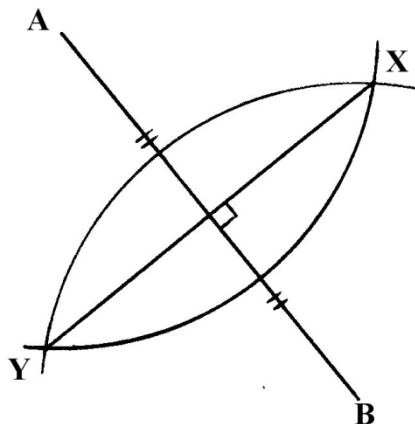
With center A and radius more than half the length of AB, an almost semi-circular arc is drawn.



With center B and the same radius as before, a similar arc is drawn to cut the first arc at X and Y, as shown

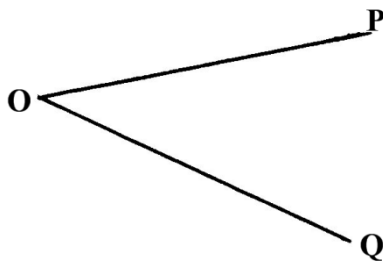


Join X to Y. The line XY is the perpendicular bisector of AB.

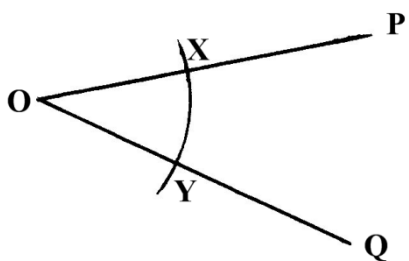


(b) **Required to construct:** The bisector of \hat{POQ} .

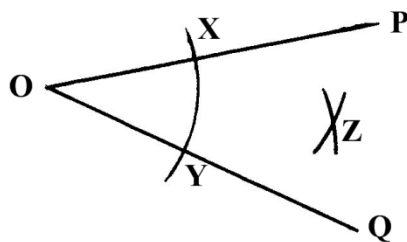
Construction:



With center O, an arc is drawn to cut OP and OQ at X and Y respectively.

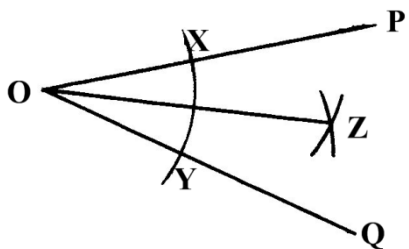


With center X and afterwards Y, two arcs are drawn so as to cut at Z.



Join O to Z.

OZ is the bisector of \hat{POQ} , that is, $\hat{POZ} = \hat{QOZ}$.

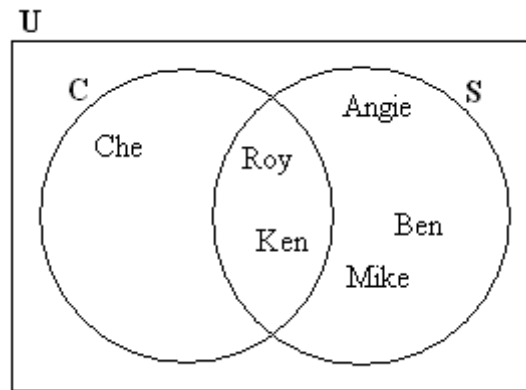


5. **Data:** The Venn diagram below shows sets, representing the preferences of 6 members of a Fitness Club.

$U = \{\text{Members of a fitness club}\}$

$C = \{\text{Members of the club who like cycling}\}$

$S = \{\text{Members of the club who like swimming}\}$



- (a) (i) **Required to calculate:** The number of members who like swimming.

Calculation:

The members who like swimming are Roy, Ken, Angie, Ben and Mike.
The total is 5.

- (ii) **Required to calculate:** The number of members who like cycling.

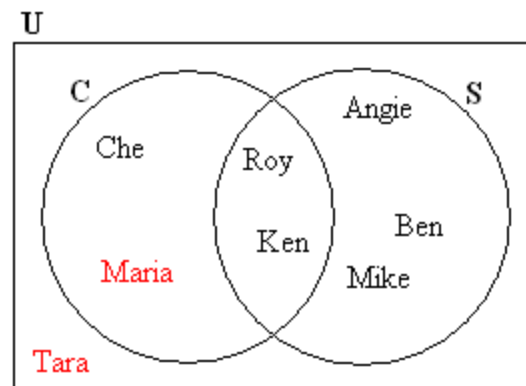
Calculation:

The members who like cycling are Che, Roy and Ken.
This total is 3.

- (b) **Data:** Maria, who likes cycling only and Tara who does not like either swimming or cycling joins the club.

Required to: Write In Maria and Tara on the Venn diagram

Solution:



- (c) **Required to list:** The names of the members who do not like swimming.

Solution:

The members who do not like swimming are Che, Maria and Tara, as shown on the Venn diagram.

6. **Data:** A vendor bought 50 crates of eggs. She checked each crate for spoilt eggs. The results were recorded in the table shown below. One entry was not recorded in the table.

Spoilt Eggs	Number of crates
0	15
1	4
2	
3	10
4	6
5	4

- (a) **Required to calculate:** The number of crates that had 2 spoilt eggs.

Calculation:

The total number of crates = 50

$$15 + 4 + (\text{Number of crates with 2 spoilt eggs}) + 10 + 6 + 4 = 50$$

$$\therefore \text{Number of crates with 2 spoilt eggs} = 50 - (15 + 4 + 10 + 6 + 4) \\ = 11$$

Spoilt Eggs	Number of crates
0	15
1	4
2	11
3	10
4	6
5	4

- (b) **Required to calculate:** The number of crates with at least 4 spoilt eggs.

Calculation:

Crates with at least 4 spoilt eggs means the number of crates with 4 spoilt eggs or 5 spoilt eggs.

$$\text{Number of such crates} = 6 + 4 \\ = 10 \text{ crates}$$

- (c) **Required to calculate:** Mean number of spoilt eggs per crate.

Calculation:

Recall: $\bar{x} = \frac{\sum fx}{\sum f}$, where

\bar{x} = mean

f = frequency (number of crates)

x = item measured (spoilt eggs)

Σ - the sum of

Hence,

$$\begin{aligned}\bar{x} &= \frac{(15 \times 0) + (4 \times 1) + (11 \times 2) + (10 \times 3) + (6 \times 4) + (4 \times 5)}{15 + 4 + 11 + 10 + 6 + 4} \\ &= \frac{0 + 4 + 22 + 30 + 24 + 20}{50} \\ &= \frac{100}{50} \\ &= 2\end{aligned}$$

\therefore Mean number of spoilt eggs per crate is 2.

Section II

7. **Data:**

Bob's Tyre Shop SPECIAL OFFER: Buy 3 and get the fourth at half price! \$250 each	Ram's Tyre Mart SALE: 25% discount on all tyres! \$280 each
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- (a) **Required to calculate:** The cost of 4 tyres at Bob's shop.

Calculation:

At Bob's tyre shop, tyres are \$250 each, if bought singly. However, if 3 are bought, then a fourth can be bought at half price.

$$\begin{aligned}\therefore \text{Cost of 4 tyres at Bob's shop} &= \underset{\text{For the first 3 tyres}}{\$250 \times 3} + \underset{\text{For the 4th tyre}}{\frac{1}{2}(\$250)} \\ &= \$750 + \$125 \\ &= \$875\end{aligned}$$

- (b) **Required to calculate:** The cost of 4 tyres at Ram's.

Calculation:

The cost of 1 tyre is marked \$280 and then given a 25% discount.

\therefore Cost of the 4 tyres = Cost of all 4 tyres at the marked price – Discount

$$= (\$280 \times 4) - 25\% \text{ of } (\$280 \times 4)$$

$$= \$1120 - \$280$$

$$= \$840$$

OR

Since there is 25% overall discount, we can find $(100 - 25)\% = 75\%$ of the total cost of the original or marked price of the tyres.

$$\begin{aligned} \text{Cost} &= \frac{75}{100} \{4 \times \$280\} \\ &= \$840 \end{aligned}$$

OR

We can find the discounted price of 1 tyre as $(100 - 25)\%$ of \$280.

Cost, after discount, of 1 tyre = 75% of \$280

$$\begin{aligned} &= \frac{3}{4} \times \$280 \\ &= \$210 \end{aligned}$$

$$\begin{aligned} \therefore \text{Cost of 4 tyres} &= \$210 \times 4 \\ &= \$840 \end{aligned}$$

- (c) **Data:** Customer wishes to buy only 1 tyre.

Required to determine: The shop where the tyre can be purchased for a cheaper price

Solution:

Cost of only 1 tyre at Bob's = \$250 (no discount unless 4 tyres are bought together)

Cost of 1 tyre at Ram's = \$280 – Discount of 25%

$$\begin{aligned} &= \$280 - \left(\frac{25}{100} \times \$280 \right) \\ &= \$280 - \$70 \\ &= \$210 \end{aligned}$$

\therefore The purchasing of only 1 tyre is cheaper at Ram's than at Bob's by $\$250 - \$210 = \$40$.

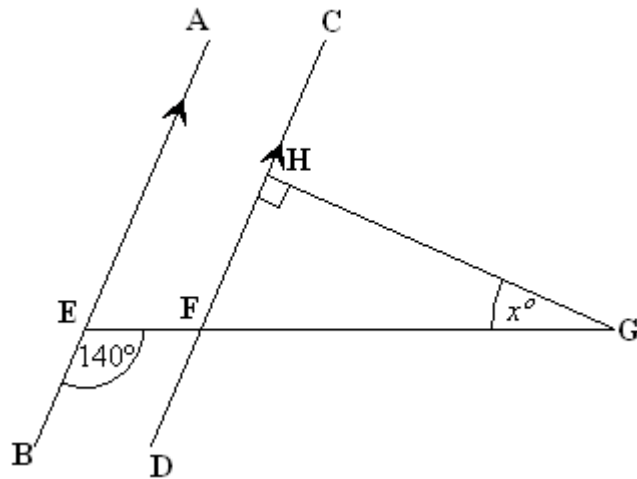
- (d) **Data:** Auto shop spends \$2 625 on tyres at Bob's.
Required to calculate: The number of tyres that were purchased
Calculation:

The cost of every 4 tyres at Bob's = \$875

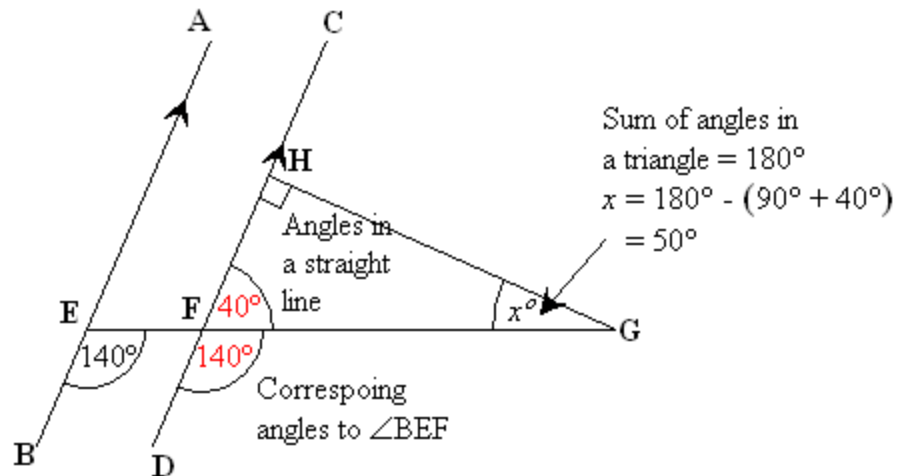
Total spent = \$2625 which is $3 \times \$875$.

\therefore The auto shop bought 3 sets of 4 tyres, that is, $3 \times 4 = 12$ tyres.

8. (a) **Data:** In the diagram below, the line AB is parallel to the line CD.
If angle FHG = 90° and angle BEF = 140° , calculate the size of the angle marked x° .



Calculation:

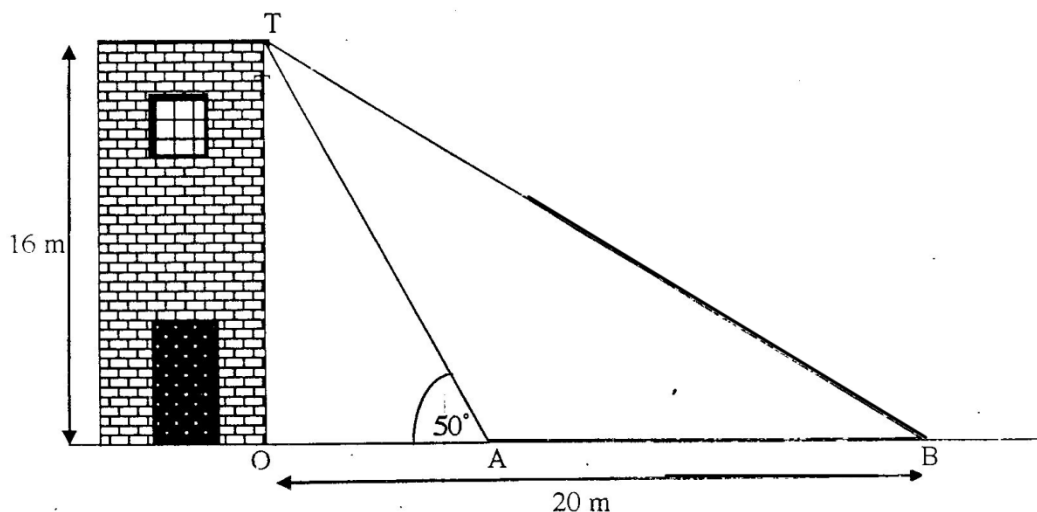


Angle $DFG = 140^\circ$ (corresponding angle to angle BEF)

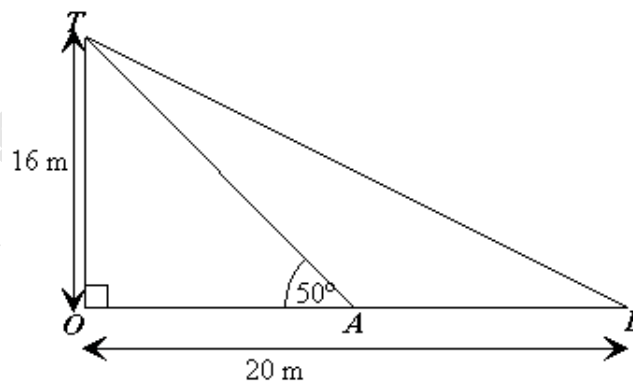
$$\begin{aligned} \angle HFG &= 180^\circ - 140^\circ \\ &= 40^\circ \end{aligned} \quad \text{(angles in a straight line)}$$

$$\begin{aligned}\hat{HGF} &= 180^\circ - (90^\circ + 40^\circ) \quad (\text{sum of angles in a triangle} = 180^\circ) \\ &= 50^\circ\end{aligned}$$

- (b) **Data:** The diagram shows the positions of two friends A and B standing on a horizontal plane in line with point O at the base of a building. The building is 16 m high. B is 20 m away from O and angle OAT is 50° .



- (i) **Required to calculate:** Distance OA.
Calculation:



$$\begin{aligned}\tan 50^\circ &= \frac{16}{OA} \\ \therefore OA \tan 50^\circ &= 16 \\ OA &= \frac{16}{\tan 50^\circ} \\ &= 13.425 \\ &= 13.43 \text{ m to 2 decimal places}\end{aligned}$$

- (ii) **Required to calculate:** The distance AB.

Calculation:

$$\text{Length of } OA + \text{Length of } AB = 20 \text{ m}$$

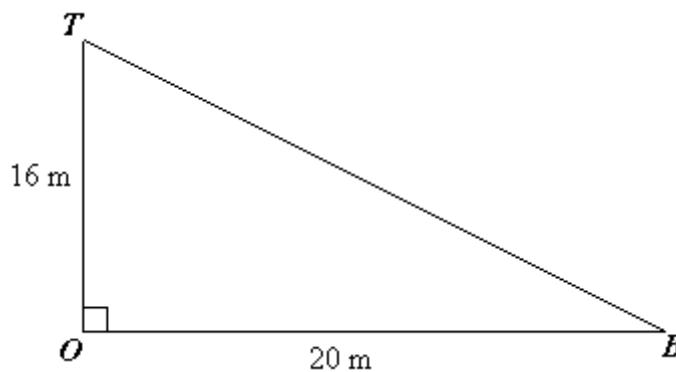
$$\therefore \text{Length of } AB = 20 - 13.425$$

$$= 6.575$$

$$= 6.58 \text{ to 2 decimal places}$$

- (iii) **Required to calculate:** Length of BT.

Calculation:



$$BT^2 = (16)^2 + (20)^2 \quad (\text{Pythagoras' Theorem})$$

$$\therefore BT = \sqrt{(16)^2 + (20)^2}$$

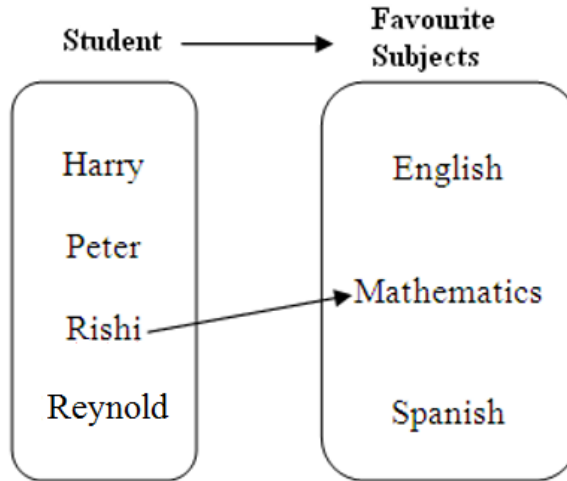
$$= \sqrt{256 + 400}$$

$$= \sqrt{656}$$

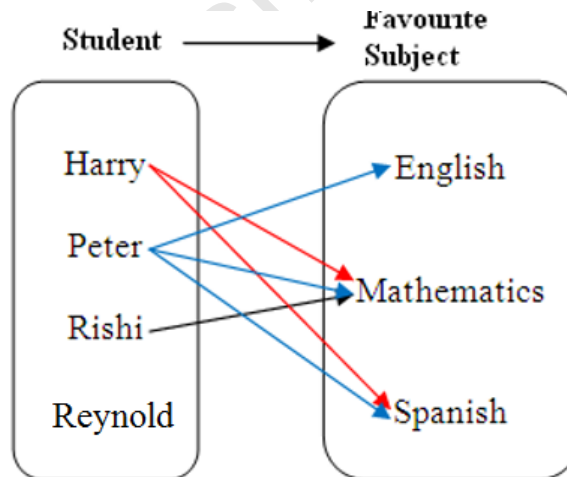
$$= 25.612 \text{ m}$$

$$= 25.61 \text{ m to 2 decimal places}$$

9. (a) **Data:** Three friends listed their favourite subjects as follows:
 Harry likes Mathematics and Spanish.
 Peter likes Spanish, English and Mathematics.
 Rishi likes Mathematics only.
 Reynold does not like any of the three subjects.

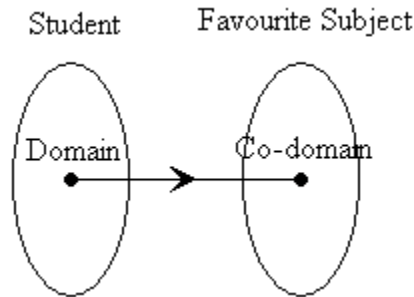


- (i) **Required to complete:** The diagram shown to represent the information.
Solution:



- (ii) **Required to state:** Two reasons why the relation is not a function.

Solution:



A relation maps elements of the domain onto elements of the co-domain.

For a relation to be a function, each element of the domain must be mapped onto only one element of the co-domain. In other words, we must see only one arrow leaving each element of the domain.

Notice:

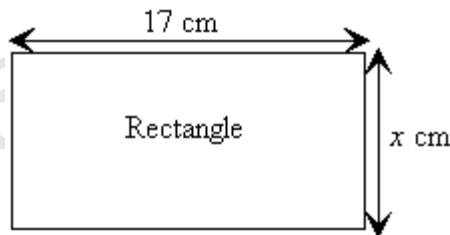
- 1) Two 'arrows' leave 'Harry' and three 'arrows' leave 'Peter'.
- 2) No 'arrow' leaves 'Reynold'.

Hence, for either of these two reasons stated, the relation is not a function.

- (b) **Data:** Rectangle of length 17 cm and width x cm.

- (i) **Required to calculate:** The area of the rectangle, in terms of x .

Calculation:



Area of rectangle = Length \times Width

$$\begin{aligned}\therefore \text{Area of given rectangle} &= (17 \times x) \text{ cm}^2 \\ &= 17x \text{ cm}^2\end{aligned}$$

- (ii) **Data:** The rectangle is at least 85 cm^2 .

Required to Express: The information as an inequality, in terms of x

Solution:

The area of the rectangle is at least 85 cm^2 .

$$\therefore 17x \geq 85$$

(iii) **Required To calculate:** The minimum value of x .

Calculation:

$$17x \geq 85$$

$$\therefore x \geq \frac{85}{17}$$

$$x \geq 5$$

\therefore The minimum value of x is 5.

10. (a) **Data:** A car is bought for \$8400 and to be sold for a profit of 25%.

(i) **Required to calculate:** The selling price of the car.

Calculation:

The selling price of car = Amount paid + Expected profit

$$= \$8400 + \frac{25}{100} \times \$8400$$

$$= \$8400 + \$2100$$

$$= \$10500$$

OR

Selling price = $(100 + 25)\%$ of \$8400

$$= \frac{125}{100} \times \$8400$$

$$= \$10500$$

(ii) **Data:** Customer gets 5% discount off the price for each payment for 2 years.

Required to calculate: The price paid by the customer

Calculation:

Price paid = Selling price quoted – 5% of the selling price quoted

$$= \$10500 - 5\% \text{ of } \$10500$$

$$= \$10500 - \$525$$

$$= \$9975$$

OR

Customer will pay $(100 - 5)\%$ of \$10500

$$= \frac{95}{100} \times \$10500$$

$$= \$9975$$

(b) **Data:** Mickel invested \$5000 at 8% per annum compound interest for 2 years.

(i) **Required to calculate:** The interest earned at the end of the first year.

Calculation:

Interest earned at the end of 1st year = 8% of \$5000

$$\begin{aligned} &= \frac{8}{100} \times \$5000 \\ &= \$400 \end{aligned}$$

(ii) **Required to calculate:** The interest at the end of the second year.

Calculation:

The principal at the start of the second year

= Principal at start of first year + Interest at the end of first year

= \$5000 + \$400

= \$5400

∴ Principal at the start of the second year = \$5400

Interest after second year = 8% of \$5400

$$\begin{aligned} &= \frac{8}{100} \times \$5400 \\ &= \$432 \end{aligned}$$

(iii) **Required to calculate:** The total compound interest earned after the two years.

Calculation:

The total compound interest after 2 years

= Interest at end of 1st year + Interest at end of 2nd year

= \$400 + \$432

= \$832

OR

We could use the formula for compound interest.

$$A = P \left(1 + \frac{R}{100} \right)^n, \text{ where}$$

A = Amount received after the period

R = Rate per annum

n = Time in years

$$\begin{aligned}\therefore A &= \$5000 \left(1 + \frac{8}{100}\right)^2 \\ &= \$5000(1.08)^2 \\ &= \$5832\end{aligned}$$

$$\begin{aligned}\therefore \text{Total compound interest} &= \text{Total earned after the period} - \text{Principal at the start} \\ &= \$5832 - \$5000 \\ &= \$832\end{aligned}$$

(This also answers (iv) of the questions where the total amount received, $A = \$5832$)

(iv) **Required to calculate:** The total amount received after the 2 years.

Calculation:

$$\begin{aligned}\text{The total amount received at the end of 2 years} &= \text{Principal(original)} + \text{Total earned in interest} \\ &= \$5000 + \$400 + \$432 \\ &= \$5832\end{aligned}$$

OR

We could have seen this from the formula used above

11. **Data:** The linear equation $y = 3x - 2$ represents the relationship between two variables x and y .

x	1	2	3	4
y				10

(a) **Required to complete:** The table given.

Solution:

$$\text{When } x = 1, y = 3(1) - 2 = 1$$

$$\text{When } x = 2, y = 3(2) - 2 = 4$$

$$\text{When } x = 3, y = 3(3) - 2 = 7$$

\therefore The completed table is:

x	1	2	3	4
y	1	4	7	10

(b) **Required to:** Use the grid provided that already shows the x and y axes to:

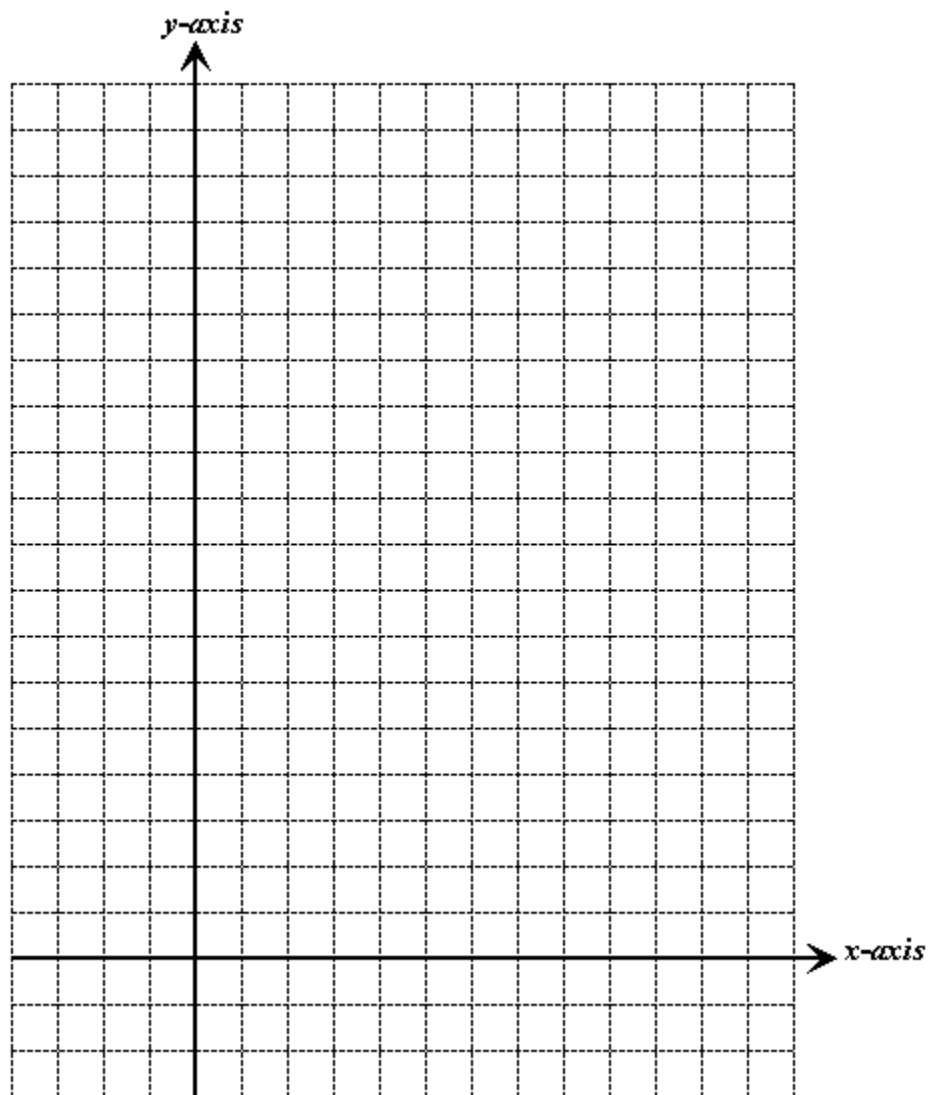
(i) Label the x - axis using a scale of 2 cm to represent 1 unit.

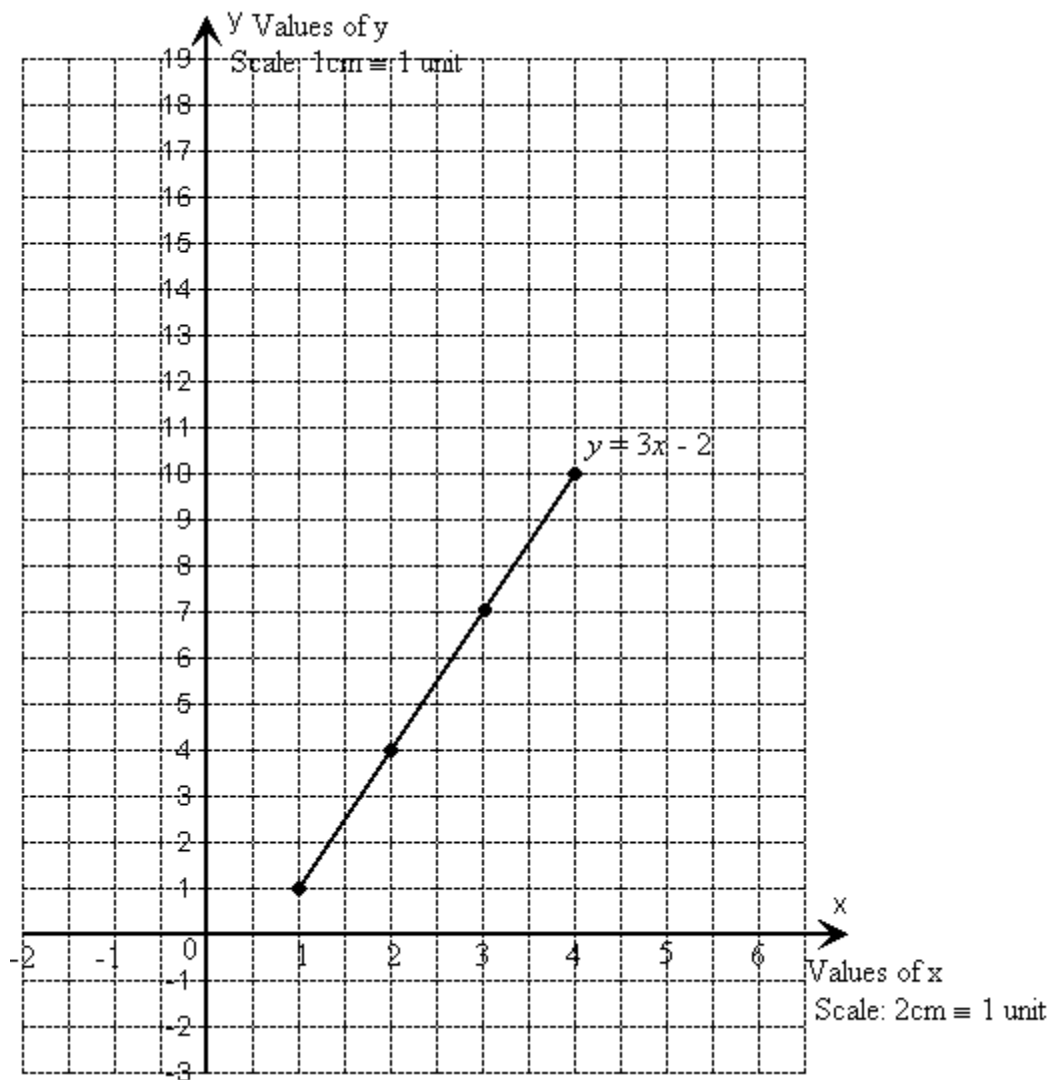
(ii) Label the y - axis using a scale of 1 cm = 1 unit

(iii) Using the values from the table in part (a), plot the graph of $y = 3x - 2$.

Solution:

Given grid:

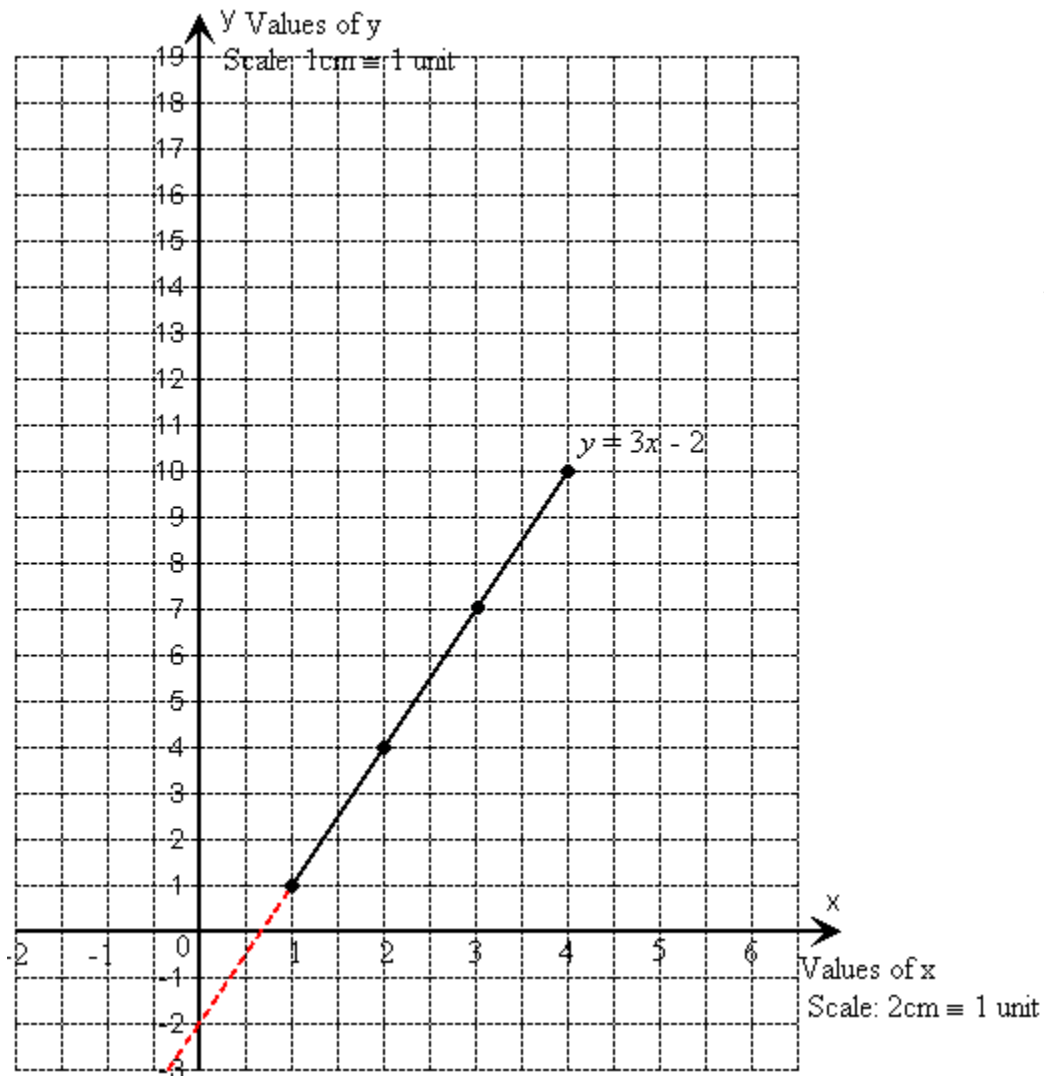




- (c) (i) **Required to extend:** The graph to cut the y – axis.

Solution:

The line was extended as shown.



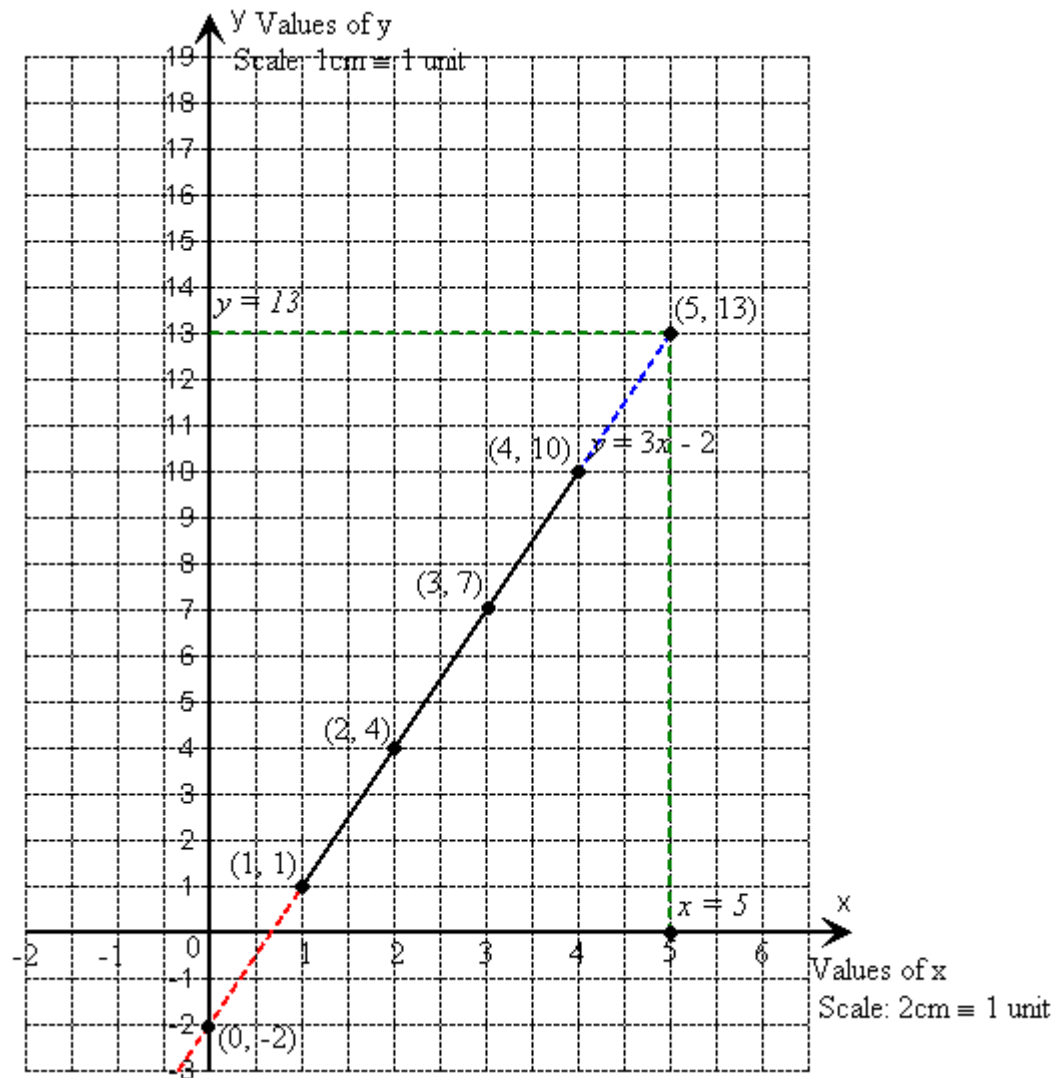
- (ii) **Required to state:** The coordinates of the point where $y = 3x - 2$ cuts the y – axis.

Solution:

The line cuts the y – axis at $(0, -2)$.

- (iii) **Required to use:** The graph, or otherwise, to find x when $y = 13$.

Solution:



When $y = 13$, $x = 5$, obtained by a read off.

OR

$$\begin{aligned}
 \text{When } y &= 13 \\
 13 &= 3x - 2 \\
 13 + 2 &= 3x \\
 3x &= 15 \\
 \div 3 & \\
 x &= 5
 \end{aligned}$$

12. **Data:** Table showing the number of seats won by the political parties PCP, NPL and NAC in the 2007 National elections.

Political Party	Number of seats won
PCP	4
NPL	8
NAC	

- (a) **Required To Find:** The number of seats won by NAC?

Solution:

Number of seats won by NAC

= Total number of seats contested – Number of seats won by PCP and NPL

$$= 24 - (4 + 8)$$

$$= 24 - 12$$

$$= 12$$

- (b) **Required To Calculate:** The size of the angle in a sector representing the number of seats won by NAC on a pie chart.

Calculation:

Angle of sector representing number of seats won by NAC

$$= \frac{\text{Number of seats won by NAC}}{\text{Total number of contested seats}} \times 360^\circ$$

$$= \frac{12}{24} \times 360^\circ$$

$$= 180^\circ$$

- (c) **Required To Find:** The percentage of the total number of seats contested that was won by NPL.

Solution:

Percentage of the total number of seats won by NPL

$$= \frac{\text{Number of seats won by NPL}}{\text{Total number of seats contested}} \times 100$$

$$= \frac{8}{24} \times 100\%$$

$$= 33\frac{1}{3}\%$$

- (d) **Required To Construct:** A pie chart displaying the results of the elections.

Solution:

Angle of sector representing the number of seats won by NPL

$$= \frac{8}{24} \times 360^\circ$$

$$= 120^\circ$$

Angle of sector representing the number of seats won by PCP
 $= 360^\circ - (180^\circ + 120^\circ)$
 $= 60^\circ$

