

NCSE MATHEMATICS PAPER 2
YEAR 2012
Section I

1. (a) **Required to calculate:** $\left(\frac{1}{2} + \frac{1}{3}\right) \div \frac{5}{9}$

Calculation:

Working firstly the part that is written within brackets

$$\frac{1}{2} + \frac{1}{3}$$

$$\frac{3(1) + 2(1)}{6} = \frac{5}{6}$$

Hence, $\left(\frac{1}{2} + \frac{1}{3}\right) \div \frac{5}{9} = \frac{5}{6} \div \frac{5}{9}$

Inverting the denominator and multiplying, we obtain:

$$\frac{\cancel{5}}{6} \times \frac{9}{\cancel{5}} = \frac{9}{6}$$

$$= \frac{3}{2} \text{ (exactly)}$$

(b) (i) **Required to express:** $2\frac{3}{8}$ in a decimal form.

Solution:

Considering separately the fraction $\frac{3}{8}$ and converting to a decimal

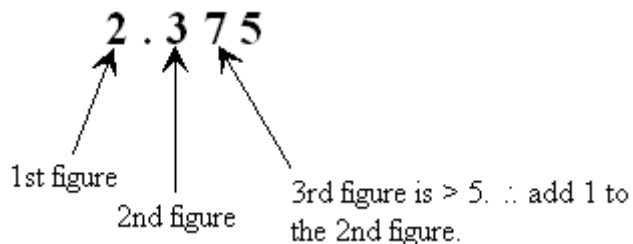
$$\begin{array}{r} 0.375 \\ 8 \overline{) 30} - \\ \underline{24} \\ 60 - \\ \underline{56} \\ 40 - \\ \underline{40} \\ 0 \end{array}$$

$\therefore 2\frac{3}{8} = 2 + 0.375$

$= 2.375 \text{ (exactly)}$

- (ii) **Required to express:** The answer to part (i) above correct to 2 significant figures.

Solution:



Answer = 2.4 correct to 2 significant figures.

2.

Data: A vendor bought 120 toys for \$1500.

- (a) (i) **Required to calculate:** The cost price of 1 toy.

Calculation:

Assuming that the toys each cost the same,

$$\begin{aligned}
 \text{Cost of 1 toy} &= \frac{\text{Cost of the toys}}{\text{Number of toys}} \\
 &= \frac{\$1500}{120} \\
 &= \$12.50
 \end{aligned}$$

- (ii) **Data:** Toys are sold to make a profit of 50%.

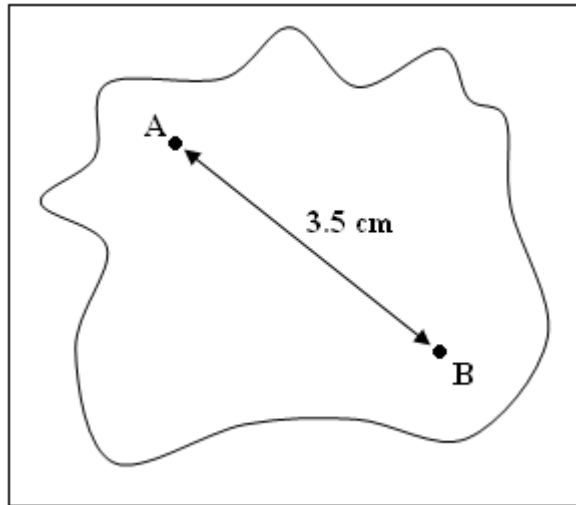
Required to calculate: The profit

Calculation:

Profit = 50% of the cost price

$$\begin{aligned}
 &= \frac{50}{100} \times \$1500 \\
 &= \$750
 \end{aligned}$$

- (b) **Data:** Scale on a map of 1 cm \equiv 15 km.
Two towns A and B are 3.5 cm apart on the map.



Required to calculate: The actual distance from A to B

Calculation:

Scale is 1 cm \equiv 15 km.

Since the distance AB on the map is 3.5 cm, the actual distance AB

$$= 3.5 \times 15 \text{ km}$$

$$= 52.5 \text{ km}$$

3. (a) **Data:** \$1000 in simple interest was earned after 5 years at the rate of 4% per annum.

Required to calculate: The principal or the amount that was invested

Calculation:

$$\text{Recall: Simple Interest} = \frac{\text{Principal} \times \text{Rate} \times \text{Time}}{100}$$

Let the principal = P

$$\therefore \frac{P \times 4 \times 5}{100} = \$1000$$

$$\begin{aligned} \therefore P &= \frac{1000 \times 100}{4 \times 5} \\ &= \$5000 \end{aligned}$$

\therefore Amount invested = \$5000

- (b) **Required to calculate:** The amount in the account at the end of the 5 years.

Calculation:

$$\begin{aligned}\text{Amount in the account} &= \text{Principal} + \text{Interest} \\ &= \$5000 + \$1000 \\ &= \$6000\end{aligned}$$

4. (a) **Data:** Book costs \$15 more than the cost of a magazine which costs \$ m .

Required to express: The cost of a book, in terms of m

Solution:

Book costs \$15 more than the cost of magazine.

$$\text{Cost of book} = 15 + m$$

$$\therefore \text{Cost of book} = 15 + m$$

$$\therefore \text{Cost of book} = \$(15 + m)$$

- (b) **Data:** The cost of 4 magazines and one book is \$50.

Required to express: The data as an equation in m

Calculation:

Cost of 4 magazines at \$ m each and one book at \$ $(15 + m)$ = $(4 \times m) + (15 + m)$, which is \$50.

Hence,

$$4m + 15 + m = 50$$

This simplifies to:

$$5m + 15 = 50$$

$$5m = 35$$

- (c) (i) **Required to calculate:** The cost of 1 magazine.

Calculation:

$$5m = 35$$

$$\therefore m = \frac{35}{5}$$

$$= 7$$

\therefore One magazine costs \$7.

- (ii) **Required to calculate:** The cost of 1 book.

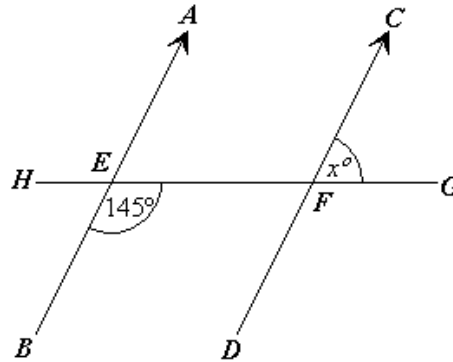
Calculation:

$$\text{Cost of 1 book} = \$(15 + m)$$

$$= \$(7 + 15)$$

$$= \$22$$

5. (a) **Data:** In the figure below, AB is parallel to CD. The line HG cuts AB and CD at points E and F respectively.



Required to calculate: The size, in degrees, of angle x , giving a reason for the answer

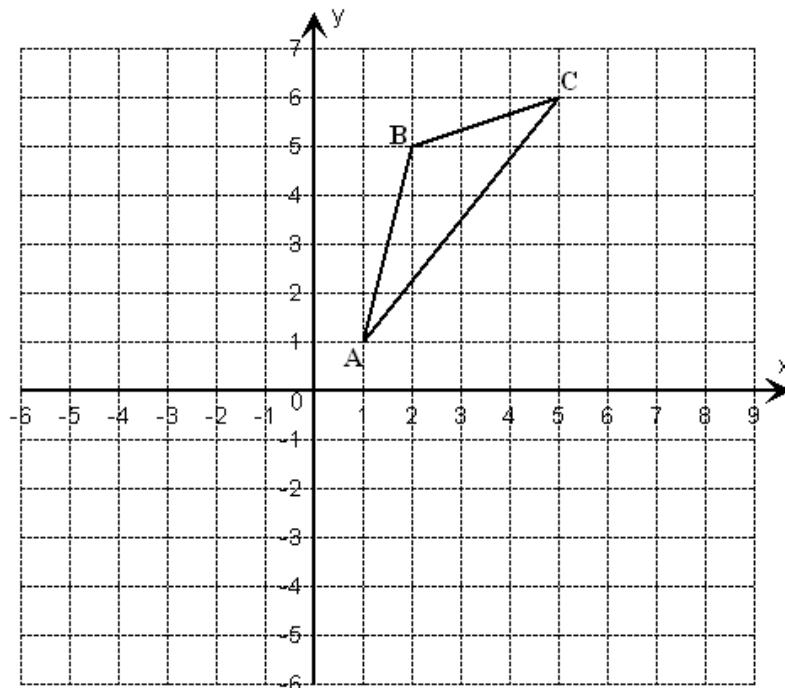
Calculation:

$$\hat{DFG} = 145^\circ \text{ (corresponding angle to } \hat{BEF}\text{)}$$

Note, in the given diagram there were 2 points on named F and we took the point at which AB cuts HG as E , leaving the other as F , as shown.

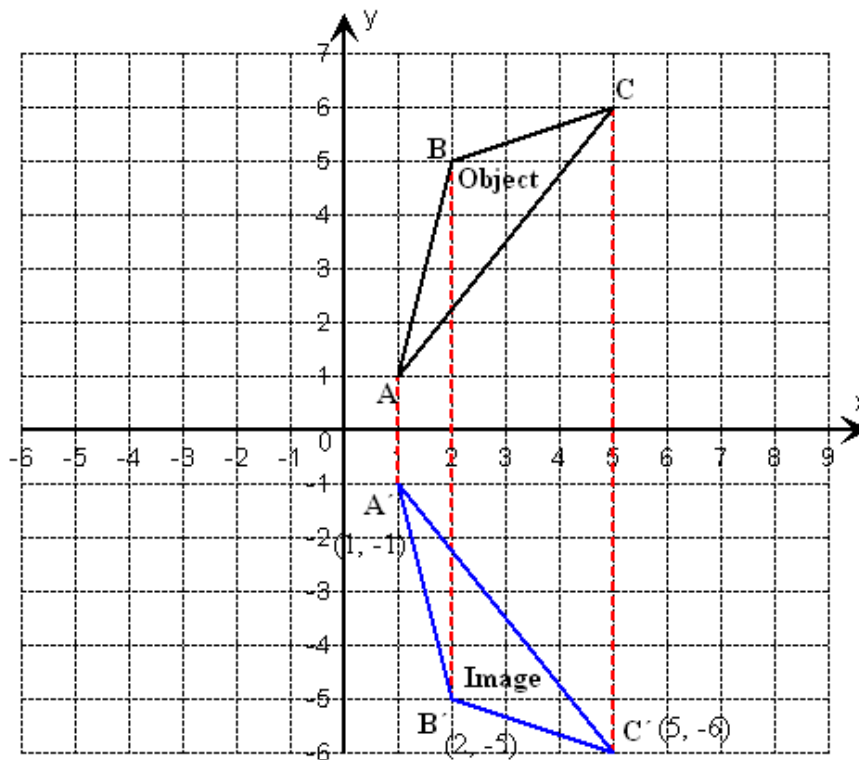
$$\begin{aligned} \hat{CFG} &= 180^\circ - 145^\circ \quad (\angle \text{ in a straight line}) \\ &= 35^\circ \end{aligned}$$

- (b) **Data:** A triangle ABC undergoes a reflection in the x – axis to form its image $A'B'C'$.



Required to: Draw and label the image, $A'B'C'$, on the diagram given.

Solution:



The image is drawn at the same perpendicular distance from the reflection plane as the object, but on the opposite side of the reflection plane as the object.

To obtain the image, we reflect each of the vertices A, B and C in turn. This is done by counting blocks or squares to give: $A' = (1, -1)$, $B' = (2, -5)$ and $C' = (5, -6)$.

6. **Data:** A teacher kept a record of the number of times that the 25 students of her class were late in the month of June.

Results: Number of students late

1	3	4	0	5
0	5	5	1	4
2	3	5	0	2
1	4	0	5	5
5	2	1	3	2

- (a) **Required to complete:** The frequency table that was given.

Solution:

We count the number of students late from the list of raw data, to complete the table and obtain:

Number of times late	Frequency
0	4
1	4
2	4
3	3
4	3
5	7

$$\sum f = 25$$

- (b) **Required to calculate:** The number of students who are late 5 times during the month.

Calculation:

During the month of June, 7 students were late 5 times. This was obtained by checking the raw data as illustrated on the diagram.

- (c) **Required to calculate:** The number of students who were late less than 3 times.

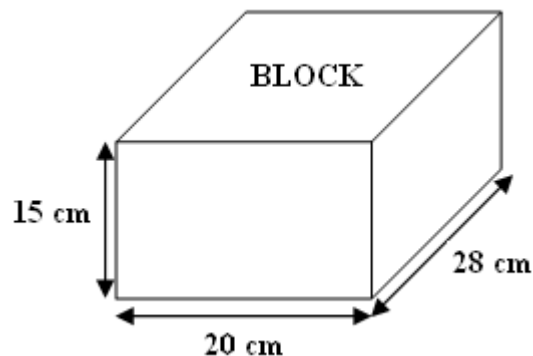
Calculation:

The number of students who were late less than 3 times
 = Number of students who were never late (0 times)
 + Number of students who were late 1 time (once)
 + Number of students who were late 2 times (twice)
 = 4 + 4 + 4
 = 12

That is, 12 students were late less than 3 times.

Section II

7. (a) **Data:** The diagram below shows a rectangular block of cheese.



- (i) **Required to calculate:** The total surface area of the block of cheese.

Calculation:

The total surface area of the block
 = Area of 2 rectangular faces that are 15 cm by 20 cm
 + Area of 2 rectangular faces that are 15 cm by 28 cm
 + Area of 2 rectangular faces that are 20 cm by 28 cm

$$\begin{aligned} &= \{2(15 \times 20) + 2(15 \times 28) + 2(20 \times 28)\} \text{ cm}^2 \\ &= \{2(300) + 2(420) + 2(560)\} \text{ cm}^2 \\ &= (600 + 840 + 1120) \text{ cm}^2 \\ &= 2560 \text{ cm}^2 \end{aligned}$$

- (ii) **Data:** $\frac{1}{2}$ of the block is used.

Required to calculate: The volume of the cheese used

Calculation:

$$\begin{aligned} \text{Volume of cheese used} &= \frac{1}{2} (\text{Volume of the block}) \\ &= \frac{1}{2} (15 \times 28 \times 20) \\ &= 4200 \text{ cm}^3 \end{aligned}$$

- (b) **Data:** Mr. Grant earns gross \$108 000 in 2010.

Non – Taxable Allowances	Amount per annum
Personal	\$60 000
House	\$18 000
Education	\$20 000

- (i) **Required to calculate:** The taxable income if the full education and house allowance were claimed.

Calculation:

Non – Taxable allowances = Total for (Self + Education + House) allowances

$$\begin{aligned} &= \$ 60\,000 + \$20\,000 + \$ 18\,000 \\ &= \$ 98\,000 \end{aligned}$$

\therefore Taxable Income = Income gross salary – Non-taxable income

$$\begin{aligned} &= \$108\,000 - \$98\,000 \\ &= \$10\,000 \end{aligned}$$

(ii) **Data:** Income tax is 25% on taxable income.

Required to calculate: Tax paid in 2010

Calculation:

Taxable income = \$10000

Rate of tax = 25% on taxable income

$$\begin{aligned} \therefore \text{Tax paid} &= \frac{25}{100} \times \$10000 \\ &= \$2500 \end{aligned}$$

8. (a) **Data:** The equation $y = 2x - 1$ represents the relationship between two variables x and y .

x	0	2	4	6
y	-1			

Required to complete: The table given for the equation $y = 2x - 1$.

Calculation:

When $x = 2$, $y = 2(2) - 1 = 3$

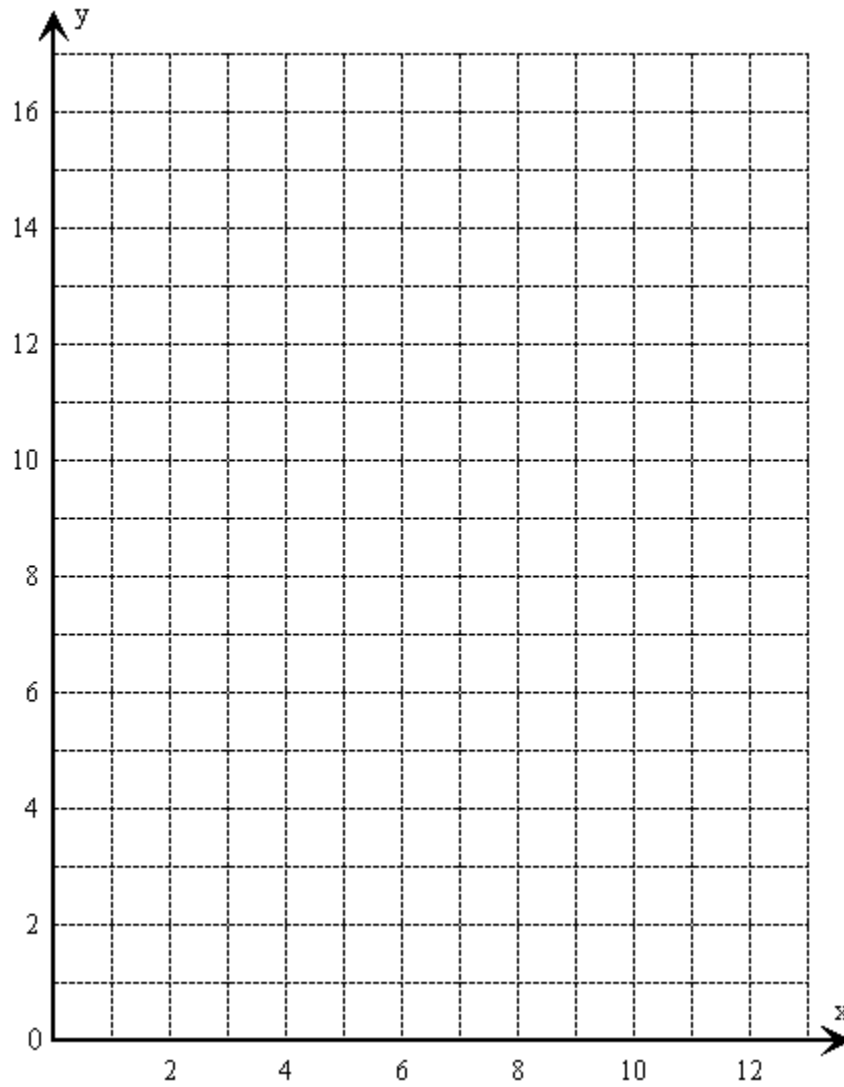
When $x = 4$, $y = 2(4) - 1 = 7$

When $x = 6$, $y = 2(6) - 1 = 11$

\therefore The completed table is:

x	0	2	4	6
y	-1	3	7	11

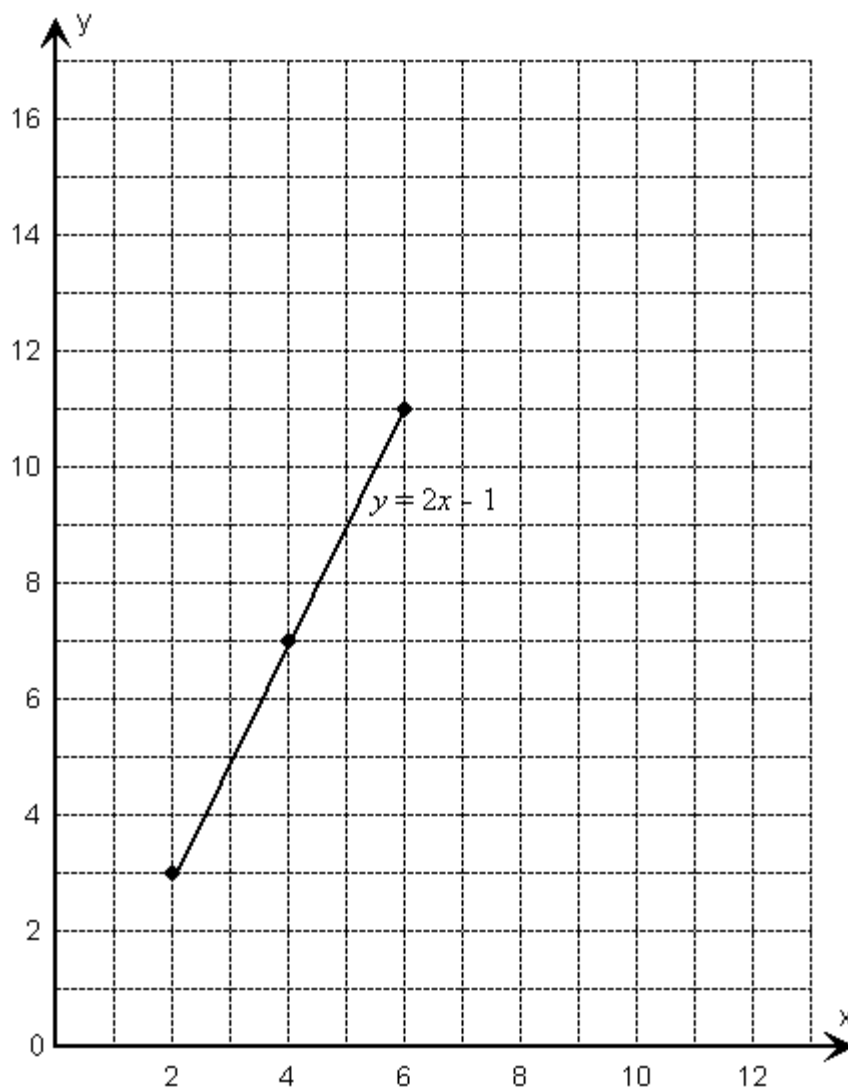
(b) **Required to plot:** The points from the table on the axes provided.



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m

Solution:



Note that that the point $(0, -1)$ cannot be plotted on the axes provided. However, the line can be plotted with three points and extended in any direction to any desired length.

- (c) (i) **Required To Draw:** The graph of $y = 6$ on the same axes.

Solution:

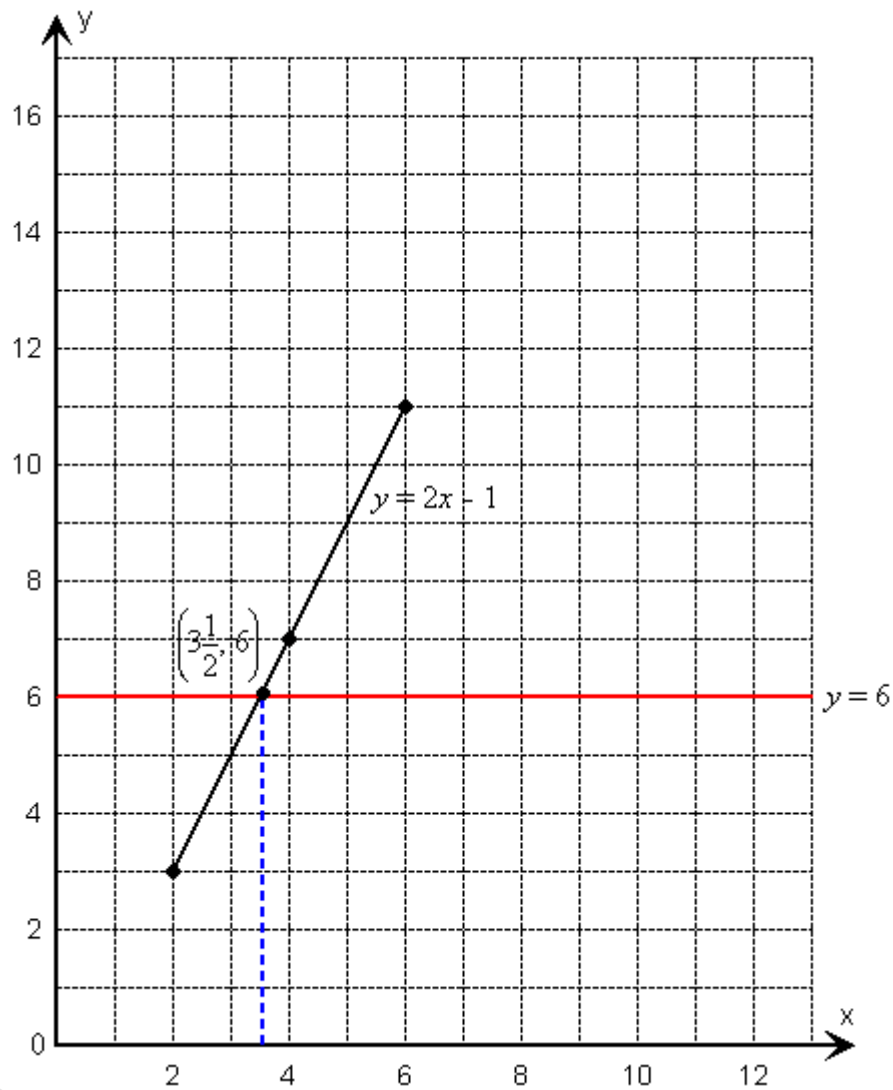
Shown in the diagram below.

- (ii) **Required to state:** The coordinates of the point of intersection of the graphs with equations $y = 2x - 1$ and $y = 6$.

Solution:

We can solve using the graphical method, by drawing the line $y = 6$ on the same axes as $y = 2x - 1$.

The line with equation $y = 6$ is a horizontal line that cuts the vertical axis at 6 (shown in red).



The point of intersection is $\left(3\frac{1}{2}, 6\right)$ obtained by a read-off

OR

We can solve algebraically the equations

$$y = 2x - 1$$

$$y = 6$$

Equating

$$2x - 1 = 6$$

$$2x = 6 + 1$$

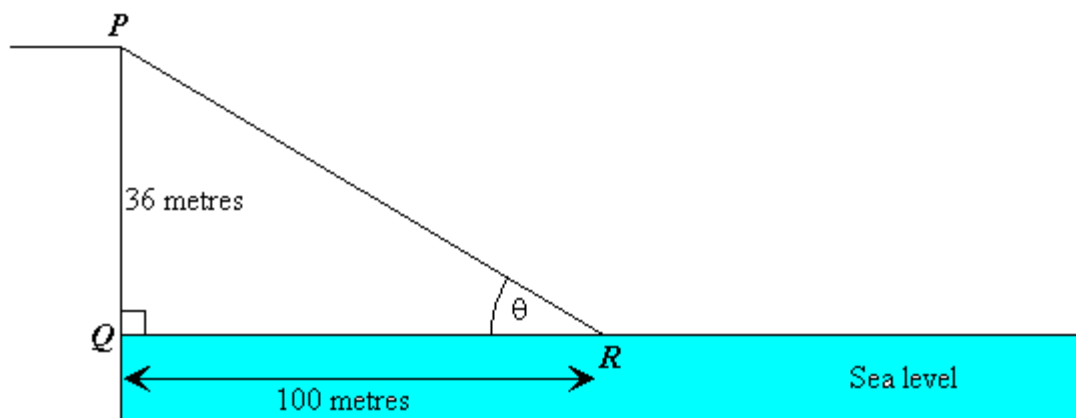
$$= 7$$

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

$$= 3\frac{1}{2}$$

\therefore Point of intersection is $\left(3\frac{1}{2}, 6\right)$.

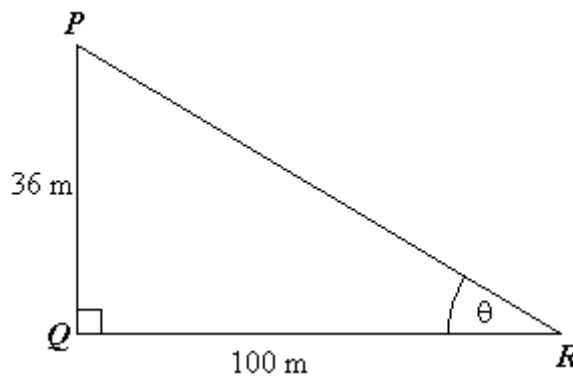
- (d) **Data:** A man stands at P on a vertical cliff and sees a coastguard vessel R out at sea. Q is a point vertically below P at sea level such that PQ = 36 metres and QR = 100 metres.



Required to calculate: The size, in degrees, of θ on the figure.

Calculation:

Consider triangle PQR.



$$\tan \theta = \frac{36}{100}$$

$$\therefore \theta = \tan^{-1} \left(\frac{36}{100} \right)$$

$$= 19.79^\circ$$

$$= 19.8^\circ \text{ to the nearest } 0.1^\circ$$

9. **Data:** Mrs. Hunte conducted a class survey to find out whether or not to have a class party. The responses of the 30 students in her class are recorded in the table below.

No. of students in favour	No. of students not in favour	No. of students with no response
18	10	2

- (a) (i) **Required to draw:** A pie chart to display the results of the survey.

Solution:

Angle of the sector to represent the number of students in favour

$$= \frac{\text{Number of students in favour}}{\text{Total number of students}} \times 360^\circ$$

$$= \frac{18}{30} \times 360^\circ$$

$$= 216^\circ$$

Angle of the sector to represent the number of students who are not in favour

$$= \frac{\text{Number of students not in favour}}{\text{Total number of students}} \times 360^\circ$$

$$= \frac{10}{30} \times 360^\circ$$

$$= 120^\circ$$

Angle of the sector to represent the number of students who gave no response

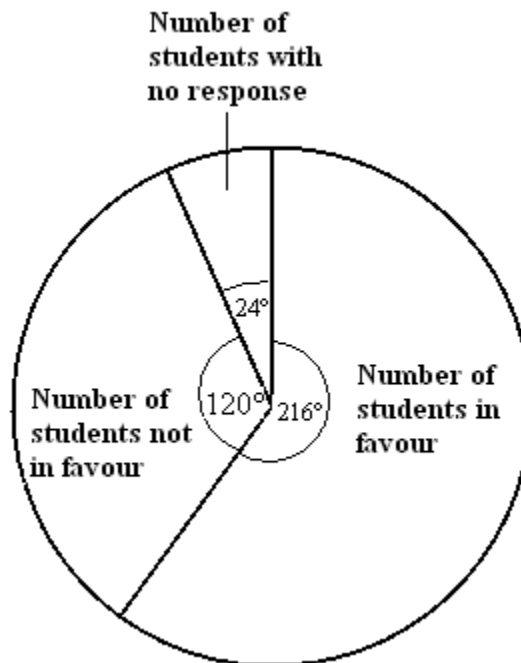
$$= \frac{\text{Number of students who gave no response}}{\text{Total number of students}} \times 360^\circ$$

$$= \frac{2}{30} \times 360^\circ$$

$$= 24^\circ$$

OR

$$360^\circ - (216^\circ + 120^\circ) = 24^\circ$$



- (ii) **Data:** Mrs. Hunte decided to have to party if more than 50% were in favour.

Required to determine: If Mrs. Hunte decided to have the party.

Solution:

The number of students who were in favour = 18

This fraction of the class is $\frac{18}{30} = \frac{3}{5}$

Since $\frac{3}{5} > \frac{1}{2}$ then Mrs. Hunte would have decided to have the party

This may be more clearly seen if $\frac{3}{5}$ and $\frac{1}{2}$ are brought to the same denominator.

$$\frac{3}{5} = \frac{6}{10}$$

$$\frac{1}{2} = \frac{5}{10}$$

And $\frac{6}{10} > \frac{5}{10}$

OR

$$50\% \text{ of the class is } \frac{50}{100} \times 30 = 15$$

Therefore 18 students were in favour and $18 > 15$.

Hence, more than 50% were in favour.

Therefore, Mrs. Hunte will decide to have the party.

- (b) **Data:** The regular price of a washing machine is \$3600.00. It can be bought in either of two ways:

PLAN A: Pay cash with a discount of 20%.

PLAN B: Buy on hire purchase by making 24 equal monthly payments of \$200.00. No deposit needed.

- (i) **Required to calculate:** The amount of money saved on the regular price if the machine is purchased by plan A.

Calculation:

By plan A : 20% discount is given off the cash price or regular price as stated.

$$= \frac{20}{100} \times \$3600$$

$$= \$720$$

\therefore By using plan A, the buyer will save \$720.

- (ii) **Required to calculate:** The discount price using plan A.

Calculation:

The discounted price paid by plan A

$$= \text{Regular price} - \text{Discount offered}$$

$$= \$3600 - \$720$$

$$= \$2880$$

- (iii) **Required to calculate:** The price paid by using plan B.

Calculation:

The price to be paid by using plan B

$$= 24 \text{ equal monthly installments}$$

$$= \$200 \times 24$$

$$= \$4800$$

- (iv) **Required to calculate:** The amount of money saved by using plan A instead of plan B.

Calculation:

$$\text{Amount to be paid using plan B} = \$4800$$

$$\text{Amount to be paid using plan A} = \$2880$$

$$\therefore \text{Amount saved by using plan A} = \$4800 - \$2880$$

$$= \$1920$$