NCSE MATHEMATICS PAPER 2
YEAR 2009
Section I

1. (a) **Required to calculate:** 0.35×0.12 and express the answer

(i) exactly

(ii) to 2 decimal places

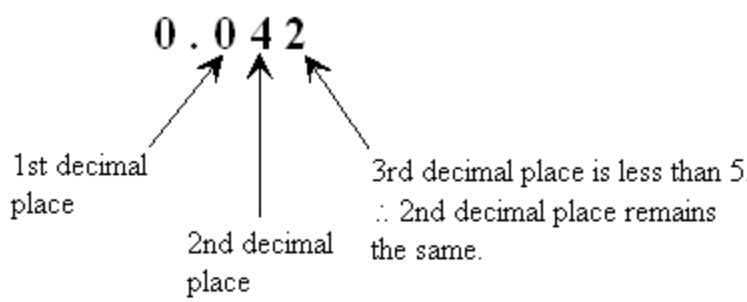
Calculation:

(i)

$$\begin{array}{r} 0.35\ \times \\ 0.12 \\ \hline 35 \\ 70 \\ \hline .0420 \\ \hline \end{array}$$

Checking 4 decimal places to get the answer to be 0.042 (exactly)

(ii)



Answer is 0.04 to 2 decimal places.

(b) **Required to calculate:** The value of $\left(\frac{4}{7}\right)^2$.

Calculation:

$$\left(\frac{4}{7}\right)^2 = \frac{4}{7} \times \frac{4}{7}$$

$$= \frac{16}{49} \text{ (exactly)}$$

(c) (i) **Data:** Cupcakes cost \$3.25 each.
Bottled water costs \$4.50 per bottle.

Cupcake \$3.25 each

Bottled Water \$4.50 each

Required to calculate: The total cost of 4 cupcakes and 2 bottles of water bought by Joshua

Calculation:

Cost of 4 cupcakes at \$3.25 each and 2 bottles of water at \$4.50 per bottle

$$=(4\times\$3.25)+(2\times\$4.50)$$
$$=\$13.00+\$9.00$$
$$=\$22.00$$

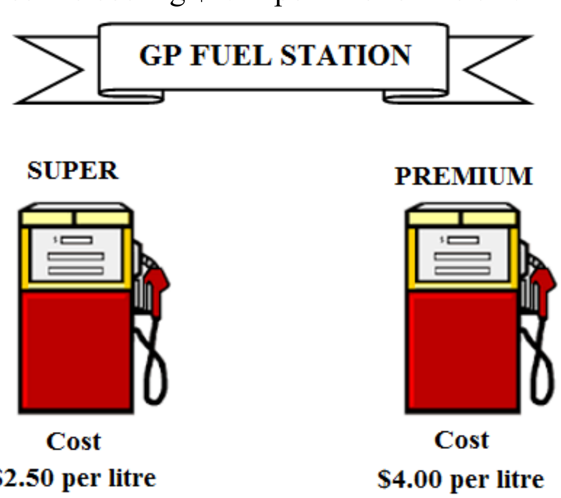
(ii) **Required to calculate:** The amount Joshua paid if \$8.00 change was received.

Calculation:

$$\text{Change received} = \text{Amount paid} - \text{Total cost of items}$$
$$\therefore \$8.00 = \text{Amount paid} - \$22.00$$
$$\therefore \text{Amount paid} = \$8.00 + \$22.00$$
$$= \$30.00$$

$\therefore$ Joshua paid \$30.00

2. (a) **Data:** Vera uses premium gasoline costing \$4.00 per litre for her car whilst Ben uses super gasoline costing \$2.50 per litre for his car.



Required to calculate: The difference in cost, if both added 25 litres of gasoline to each of their cars
Calculation:
Cost to Vera for 25 litres of premium gasoline at \$4.00 per litre
$= 25 \times \$4.00$
$= \$100.00$

Cost to Ben for 25 litres of super gasoline at \$2.50 per litre
$= 25 \times \$2.50$
$= \$62.50$

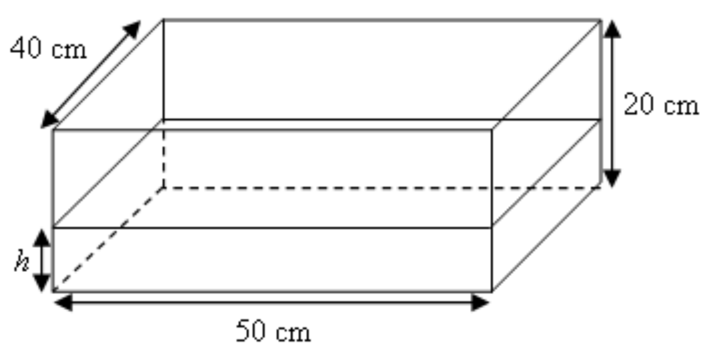
Difference in amount paid $= \$100.00 - \$62.50$
$= \$\ 37.50$

That is, Vera pays \$37.50 more than Ben does.

(b) **Data:** Vera's car uses 1 litre of fuel to cover 12 km.
Required to calculate: The distance that can be covered on \$200 worth of fuel
Calculation:
The number of litres of fuel that can be obtained for \$200 is
$= \dfrac{\text{Total amount paid}}{\text{Cost per litre}}$
$= \dfrac{\$200.00}{\$4.00 \text{ per litre}}$
$= 50 \text{ litres}$

$\therefore$ On \$200 worth of fuel, the equivalent to 50 litres of fuel, Vera's car can cover $(50 \times 12) \text{ km} = 600 \text{ km}$.

3. **Data:** The diagram, not drawn to scale, shows an aquarium containing some water.



(a) **Required to calculate:** The area of the base of the aquarium in cm^2.

Calculation:

$$\text{Area of rectangular base} = \text{length} \times \text{width}$$
$$= 50 \text{ cm} \times 40 \text{ cm}$$
$$= 2000 \text{ cm}^2$$

(b) **Required to calculate:** The volume, in litres, of the aquarium when full.

Calculation:

$$\text{Volume of cuboid aquarium} = \text{Area of base} \times \text{Vertical height}$$
$$= (2000 \times 20) \text{ cm}^3$$
$$= 40000 \text{ cm}^3$$
$$1 \text{ litre} = 1000 \text{ cm}^3$$
$$\therefore \text{Volume in litres} = \frac{40000}{1000}$$
$$= 40 \text{ litres}$$

(c) **Data:** The aquarium contains 30 litres of water.

Required to calculate: h, the height of the water

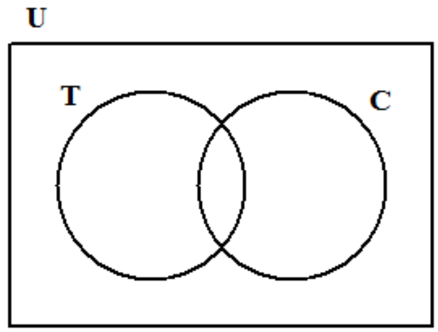
Calculation:

$$\text{Volume of water in the aquarium} = \text{Area of base} \times \text{Height}$$
$$= 2000 \times h \text{ cm}^3$$

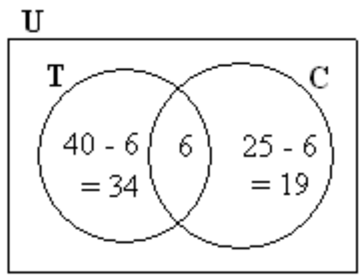
$$\text{Volume of water} = 30 \text{ litres}$$
$$= 30 \times 1000 \text{ cm}^3$$

$$\therefore 2000 \times h = 30 \times 1000$$
$$h = \frac{30 \times 1000}{2000} \text{ cm}$$
$$= 15 \text{ cm}$$

4. **Data:** Company rents tables to 40 customers (T) and rents chairs to 25 customers (C). Six customers rented both.



(a) **Required to complete:** The Venn diagram
Solution:



(b) **Required to calculate:** The number of customers who rented only chairs.
Calculation:
The number of customers who rented only chairs $= 25 - 6$
$= 19$

(Since the 25 customers who rented chairs include 6 who rented tables as well).

(c) **Required to calculate:** The number of customers that the company had in the week in which this data was given.
Calculation:
The number of customers for that particular week can be obtained by adding the numbers in the separate regions or subsets of the Venn diagram.
$= 34 + 6 + 19$
$= 59$

OR
We may calculate by using the law

$$
\begin{aligned}
n(T \cup C) &= n(T) + n(C) - n(T \cap C) \\
&= 40 + 25 - 6 \\
&= 59
\end{aligned}
$$

5. **Data:** Raj weighs *m* kg, Matt is twice as heavy as Raj and Sara is 10 kg heavier than Raj.
   (a) **Required to express:** Algebraically, the total weight of all three people.
   Solution:
   If the weight of Raj $= m$ kg
   Then the weight of Matt $= 2 \times m$
   $= 2m$ kg
   And the weight of Sara $= (m + 10)$ kg

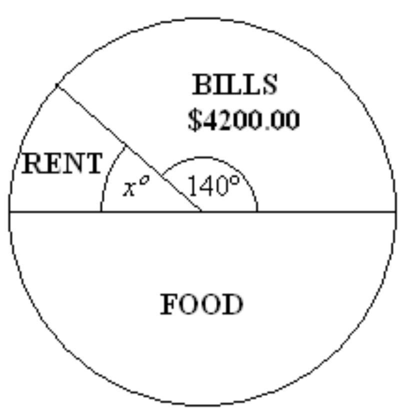
   $\therefore$ Total weight of all three people $= m + 2m + (m + 10)$
   This simplifies to:
   $(m + 2m + m) + 10 = (4m + 10)$ kg

   (b) **Data:** The total weight of all three people = 110 kg
   Required to calculate: Sara's weight
   Calculation:
   Total weight $= 4m + 10 = 110$

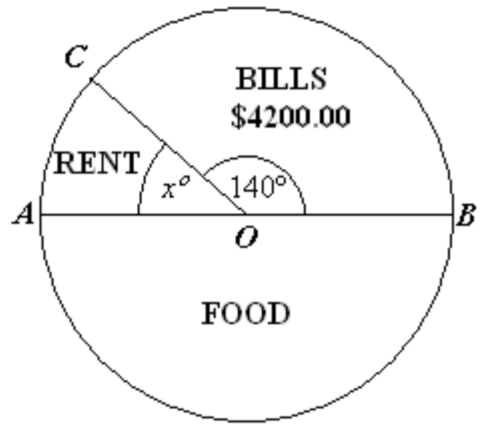
   $$\therefore 4m + 10 = 110$$
   $$4m = 110 - 10$$
   $$= 100$$
   $$m = \frac{100}{4}$$
   $$= 25$$

   Sara's weight $= (m + 10)$ kg
   Substituting $m = 25$
   $= (25 + 10)$ kg
   $= 35$ kg

6. **Data:** The pie chart below illustrates the monthly budget of the Jones Family in Trinidad and Tobago.



(a) **Required to calculate:** The size of the angle x in degrees.
Calculation:



For convenience, the points O, A, B and C are named as shown on the diagram.
Assuming that AOB is a straight line, then:

$$x + 140° = 180°$$
$$\therefore x = 180° - 140°$$
$$= 40°$$

(Angles in a straight line = 180°)

(b) **Required to calculate:** The ratio of the amount of money spent on bills to the amount of money spent on food.
Calculation:
The ratio can be obtained by using the angles of the sectors that represent the amount spent on bills and the amount spent on food.

$$\frac{\text{Amount spent on bills}}{\text{Amount spent on food}} = \frac{140°}{180°}$$
$$= \frac{7}{9} \text{ and is of the form } \frac{a}{b}\text{, as required,}$$

where $a = 7$ and $b = 9$.

(c) **Data:** Amount spent on bills is \$4200.
Required to calculate: The total monthly budget
Calculation:
The angle of the sector which measures 140° represents bills with \$4200.

$\therefore 1°$ represents an equivalent of $\frac{\$4200}{140}$

The total budget is represented by the pie chart, which measures 360°, the measure of a complete circle.

$$\therefore \text{Total budget} = \frac{\$4200}{140} \times 360°$$
$$= \$10800$$

Section II

7. **Data:** Options for the purchase of a television set.

OPTION A Cash Plan 10% Discount	OPTION B Hire Purchase Plan 20% down-payment and 12 monthly payments of $400 each

(i) **Required to calculate:** The discount using the cash plan A.
Calculation:
Cash plan A offers 10% discount
$= 10\% \text{ of } \$5400$
$= \frac{10}{100} \times \$5400$
$= \$540$

(ii) **Required to calculate:** The cash price.
Calculation:
$$\text{The cash price} = \text{Marked cash price} - \text{Discount offered}$$
$$= \$5400 - \$540$$
$$= \$4860$$

ALTERNATIVELY,
We could have found (100% – 10%) =90% of the marked price, since the discount is 10% off the marked price.

$$\text{Cash price} = \frac{90}{100} \times \$5400$$
$$= \$4860$$

(iii) **Required to calculate:** The down payment on the hire purchase plan.
Calculation:
The down payment on plan B $= 20\% \text{ of the marked price}$
$$= \frac{20}{100} \times \$5\,400$$
$$= \$1\,080$$

(iv) **Required to calculate:** The total amount spent using plan B.
Calculation:
On the hire purchase plan:

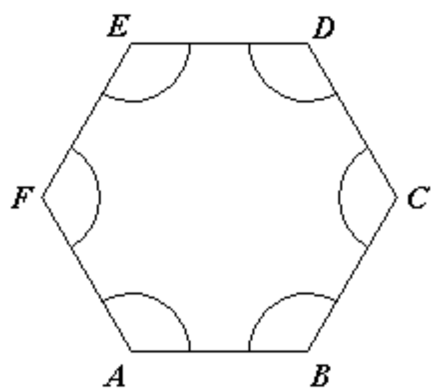
Amount spent = Deposit + Total paid in installments
= \$ 1 080 + (12 × \$ 400)
= \$ 1080 + \$ 4 800
= \$ 5 880

(v) **Required to calculate:** The difference between the two plans A and B.
Calculation:
The cost by plan A = \$4860
The cost by plan B = \$5880

Difference = \$ 5 880 - \$ 4 860
= \$ 1 020

That is, the hire purchase plan B exceeds the cash plan A by \$1 020.

8. (a) **Data:** The diagram below represents a mirror that is in the shape of a regular polygon.



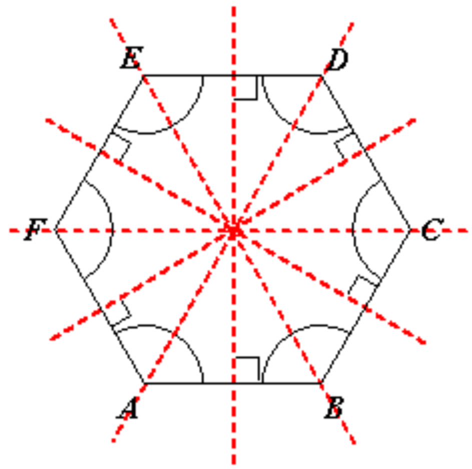
(i) **Required to calculate:** The sum of all the interior angles of the polygon.
Calculation:
The polygon has 6 sides.
The sum of all the interior angles of a polygon of n sides $=(2n-4)\times 90°$

$\therefore$ The sum of all the interior angles of the polygon (hexagon) shown
$=(2(6)-4)\times 90°$
$=8\times 90°$
$=720°$

(ii) **Required to calculate:** The size of each interior angle.
Calculation:
Since the polygon is regular, then each interior angle is equal.

$$\therefore \text{Size of each interior angle } = 720° \div 6$$
$$= 120°$$

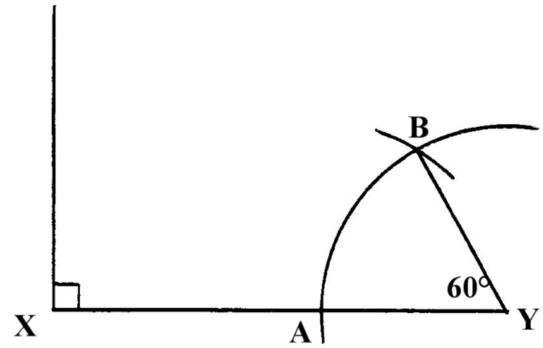
(b) **Required to draw:** All the lines of symmetry of the shape.
Solution:



There are 6 lines of symmetry or better called lines of reflective symmetry, and these are shown dotted.

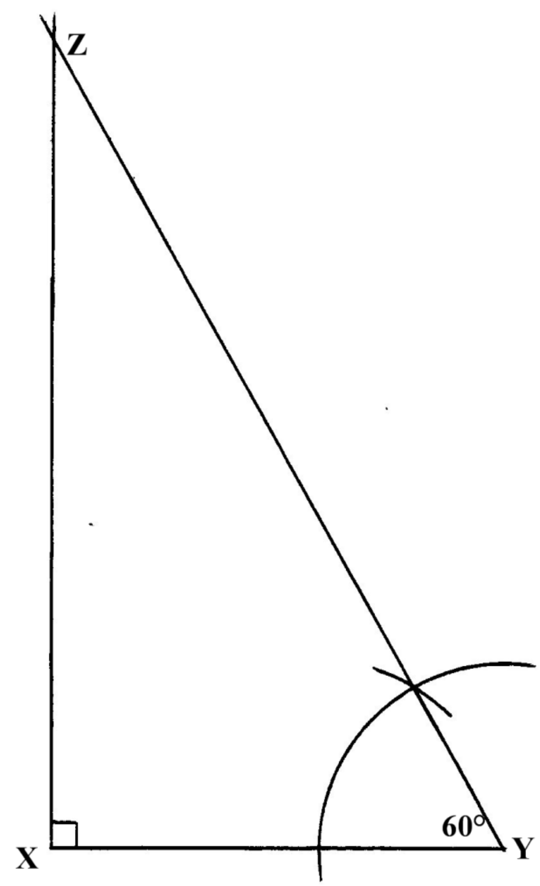
(c) **Data:** Given the line XY,
Required to:
(i) Draw a 90° angle at X.
(ii) Construct a 60° angle at Y and produce the lines drawn at X and at Y to meet at Z.
Solution:
(i) By using a protractor, measure and draw a 90° angle at X.

(ii) With centre Y, an arc is drawn to cut the line XY at A.
With centre A and the same radius, an arc is drawn to cut this first arc at B.



The angle $A\hat{Y}B = 60°$

Extend the line drawn from X which forms the 90^0 angle with XY and the line drawn from Y which forms the 60^0 angle with YX, if necessary, until they meet at Z, thus completing the ΔXYZ.



9. (a) **Required to factorise:** Completely $4x^2 - 8xh$

Solution:

$4x^2 - 8xh$ may be re-written as

$\underline{\underline{4}}.\underline{\underline{x}}.x - \underline{\underline{4}}.2.\underline{\underline{x}}.h.$

Notice $4x$ is common to both terms and can therefore be factored out and brackets introduced to give:

$4x(x-2h)$

(b) **Required to simplify:** $\frac{2x}{3}+\frac{3y}{2}$

Solution:

$$\frac{2x}{3}+\frac{3y}{2}$$

$$\frac{2(2x)+3(3y)}{6}=\frac{4x+9y}{6} \text{ or } \frac{(4x+9y)}{6} \text{ or } \frac{1}{6}(4x+9y)$$

(c) **Data:** Cost of 3 exercise books at \$x each and 1 pen for \$y is \$10. Cost of 2 exercise books and 1 pen is \$8.

(i) **Required to express:** The information as two separate equations.

Solution:

Cost of 3 books at \$$x$ each and 1 pen at \$$y$ is \$10.

$\quad 3\times x \quad + \quad 1\times y \quad =10$

$3x + y = 10$

Cost of 2 books at \$$x$ each and 1 pen at \$$y$ is \$8.

$\quad 2\times x \quad + \quad 1\times y \quad =8$

$2x + y = 8$

$\therefore$ The two equations are:

$3x + y = 10 \quad \ldots(1) \quad$ and $\quad 2x + y = 8 \quad \ldots(2)$

(ii) **Required to find:** The cost of 1 exercise book.

Solution:

Equation (1) – Equation (2)

$$\begin{array}{rl} 3x + y = 10 & - \\ \underline{2x + y = \ \ 8} & \\ \underline{x \quad = \ \ 2} & \end{array}$$

Hence, the cost of 1 exercise book is \$2.

(iii) **Required to calculate:** The cost of 4 exercise books and 2 pens.
Calculation:
Substituting $x = 2$ in equation (1) to find the value of y

$$3(2) + y = 10$$
$$\therefore y = 10 - 3(2)$$
$$= 4$$

$\therefore$ Cost of 1 pen is \$4.

$\therefore$ Cost of 4 exercise books and 2 pens $= (4 \times \$2) + (2 \times \$4)$
$= \$16$

10. **Data:** The table shows the number of night deposit bags placed in the chute of a bank during a particular week.

Days of the week	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
Number of night deposit bags	7	16	12	15	20	35

(i) **Required to find:** The day on which there was the greatest number of deposits.
Solution:
From the table shown, Saturday showed the greatest number of deposits which was 35 and which is more than those of any of the other days from Monday to Friday.

(ii) **Required to calculate:** The number of deposit (bags) placed before Friday.
Calculation:
The number of deposit bags placed before Friday = Total number of bags placed on Monday, Tuesday, Wednesday and Thursday.

$$= 7 + 16 + 12 + 15$$
$$= 50 \text{ bags}$$

(iii) **Required to calculate:** The average number of deposit bags placed in the chute, per day, from Monday to Friday.

Calculation:

Average number of bags placed in the chute between Monday and Friday

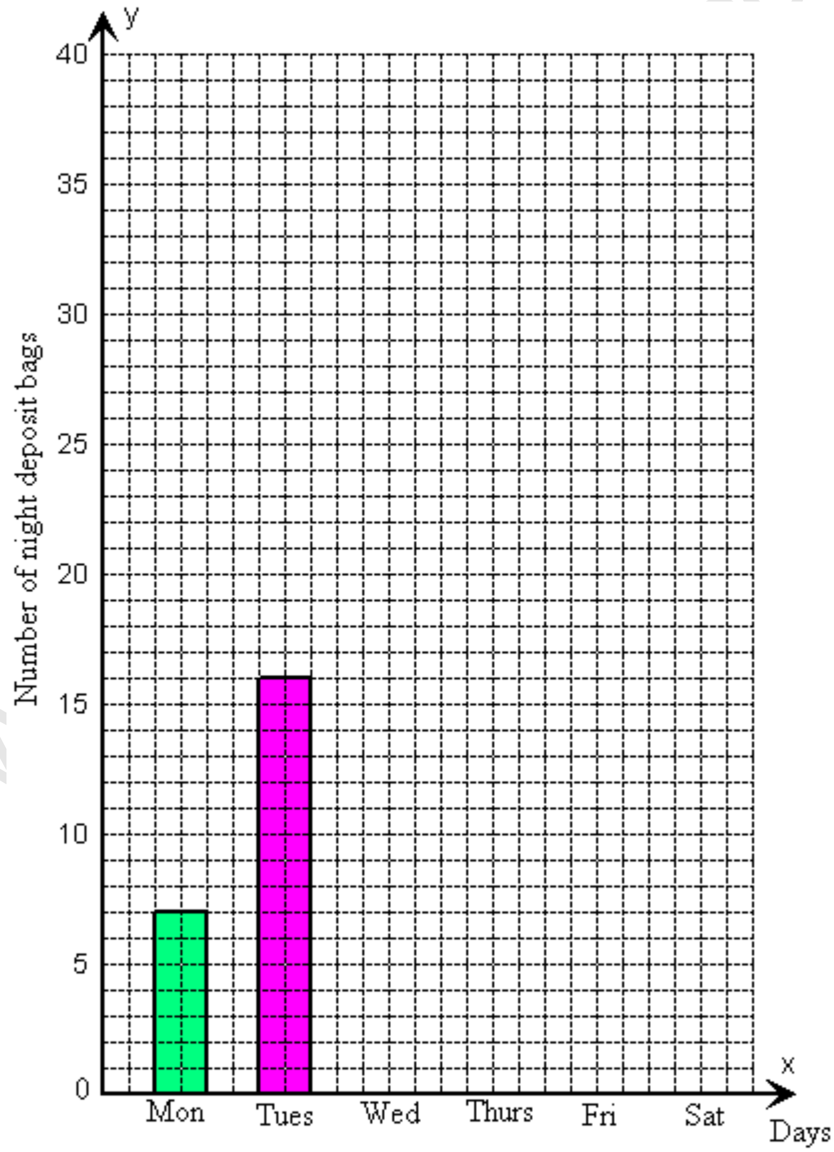
$$= \frac{\text{Total number of deposits from Monday to Friday}}{\text{Total number of days from Monday to Friday}}$$

$$= \frac{7+16+12+15+20}{5} \text{ bags}$$

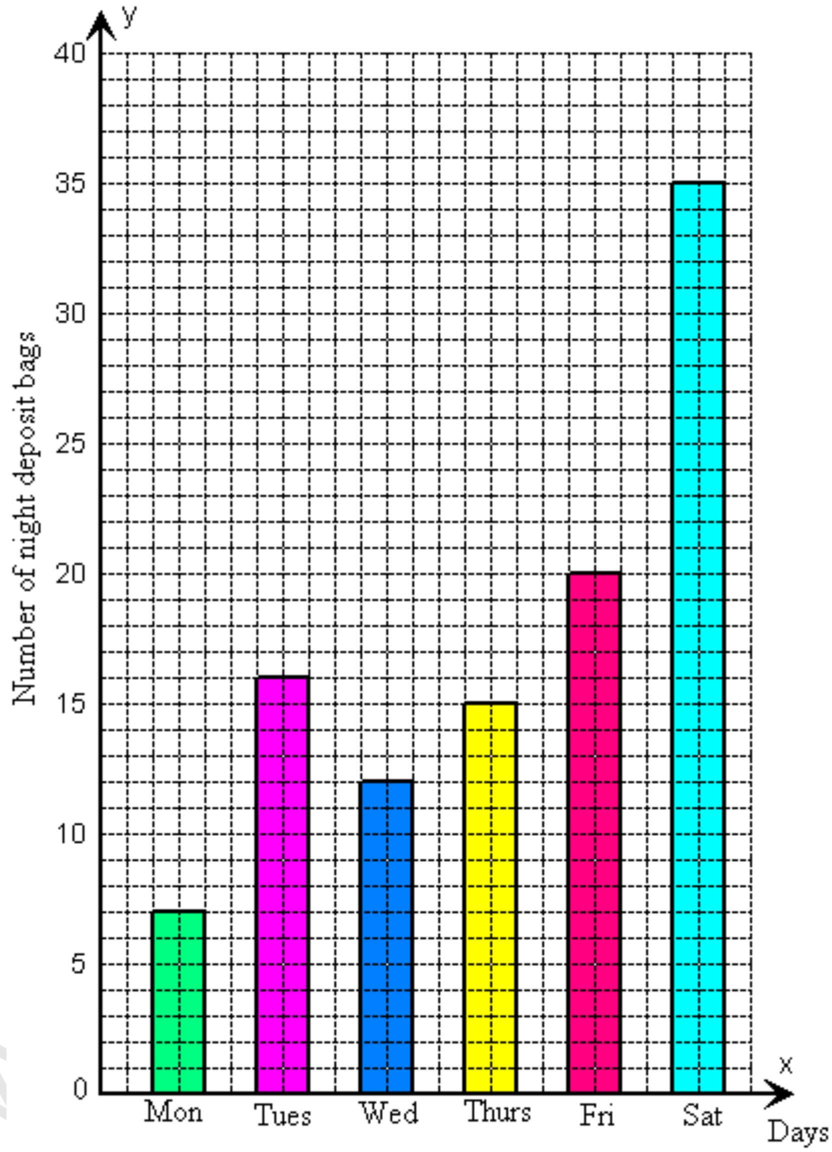
$$= \frac{70}{5} \text{ bags}$$

$$= 14 \text{ bags}$$

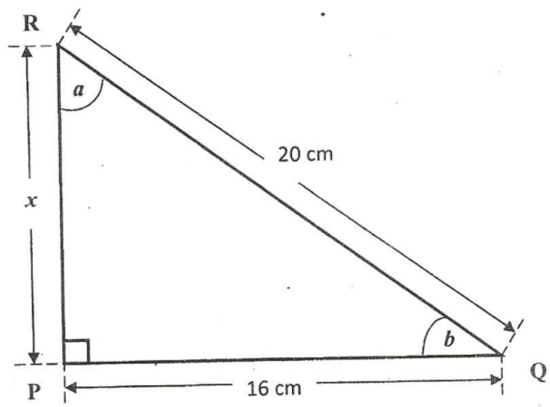
(iv) **Data:**



Solution:
The bars representing the deposits for Monday and Tuesday have been drawn. The bars are of equal width, the height of the bars represent the number of bags and the space between the bars is kept constant.



11. **Data:** The diagram shows a right – angled triangle with $R\hat{P}Q = 90°$, $PQ = 16$ cm and QR = 20 cm respectively.



(a) **Required to calculate:** The length of the side marked x.
Calculation:
The triangle PQR is right angled at P. Applying Pythagoras' Theorem.

$$x^2 + (16)^2 = (20)^2 \qquad \text{(Pythagoras' Theorem)}$$
$$\therefore x = \sqrt{(20)^2 - (16)^2}$$
$$= \sqrt{144} \text{ cm}$$
$$= 12 \text{ cm}$$

(b) (i) **Required to write:** $\sin a$ in the form of a fraction.
Solution:

$$\sin a = \frac{PQ}{RQ}$$
$$= \frac{16}{20}$$
$$= \frac{4}{5} \text{ (in the form of a fraction)}$$

(ii) **Required to compute:** $\tan a$
Solution:

$$\tan a = \frac{PQ}{RP}$$
$$= \frac{16}{12}$$
$$= \frac{4}{3}$$

(iii) **Required to state:** The value of angle *a*, in degrees.
Solution:

$$a = \tan^{-1}\left(\frac{4}{3}\right)$$
$$= 53.1° \text{ to the nearest } 0.1°$$

OR

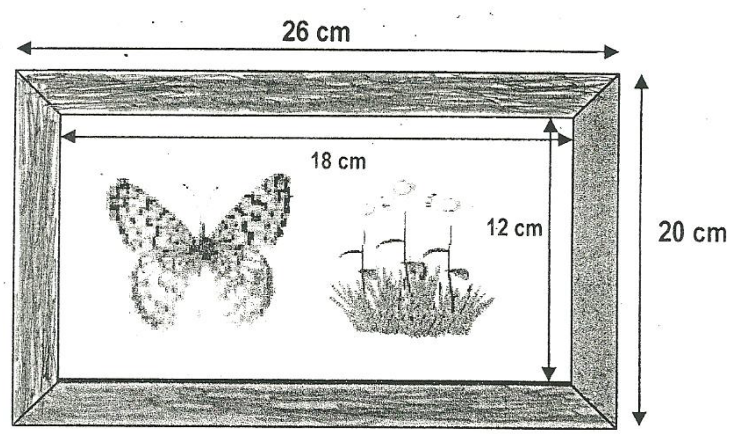
$$a = \sin^{-1}\left(\frac{4}{5}\right)$$
$$= 53.1° \text{ to the nearest } 0.1°$$

OR

$$a = \cos^{-1}\left(\frac{12}{20}\right)$$
$$= 53.1° \text{ to the nearest } 0.1°$$

(iv) **Required to find:** The smallest angle in the triangle.
Solution:
If one side of a triangle is greater than another, the side opposite the greater angle is greater than the side opposite the smaller angle. Therefore, the smallest angle is opposite the smallest side. The smallest side is PR, therefore the smallest angle is $\hat{Q} = b$.

12. (a) **Data:** The rectangular picture – frame shown in the diagram (not drawn to scale) measures 26 cm by 20 cm on the outside. It holds a picture measuring 18 cm by 12 cm.



(i) **Required to calculate:** The area of the picture enclosed by the picture – frame.

Calculation:

The area of the rectangular picture frame $= \text{Length} \times \text{Width}$

$$= 18 \text{ cm} \times 12 \text{ cm}$$

$$= 216 \text{ cm}^2$$

(ii) **Required to calculate:** The area of the picture frame.

Calculation:

Area of the picture – frame = External area of the frame – Internal area of the frame

The internal area of the frame = Area of the picture

$$\therefore \text{Area of picture – frame} = (26 \text{ cm} \times 20 \text{ cm}) - (18 \text{ cm} \times 12 \text{ cm})$$

$$= 520 \text{ cm}^2 - 216 \text{ cm}^2$$

$$= 304 \text{ cm}^2$$

(b) **Data:** A cook at a restaurant normally works 8 hours per day for five days each week. He is paid a basic salary at \$12 per hour for each hour worked. When he works overtime he is paid at the hourly rate of time and a quarter. He worked for 54 hours in a particular week.

(i) **Required to calculate:** His basic weekly wage

Calculation:

Basic hours of a normal work week = 8 hours per day $\times$ 5 days per week

= 40 hours

$$\therefore \text{Basic weekly wage} = \text{Basic hourly rate} \times 40 \text{ hours}$$

$$= \$12 \times 40$$

$$= \$480$$

(ii) **Required to calculate:** The number of hours overtime he worked for that week.

Calculation:

Number of hours overtime = Number of hours worked in total – Number of hours in a basic work week

$$= 54 - 40$$

$$= 14 \text{ hours}$$

(iii) **Required to calculate:** The amount of money he earns in overtime.

Calculation:

Overtime rate = $1\frac{1}{4}$ times the basic hourly salary

$$= 1\frac{1}{4} \times \$12 \text{ per hour}$$
$$= \$15 \text{ per hour}$$

$$\therefore \text{Overtime pay} = \text{Overtime rate per hour} \times \text{Number of hours overtime worked}$$
$$= \$15 \times 14$$
$$= \$210$$

(iv) **Required to calculate:** His total wage for the week.
Calculation:
Total wage for the week = Total basic salary + Overtime earnings
$$= \$480 + \$210$$
$$= \$690$$