

NCSE MATHEMATICS PAPER 2
YEAR 2013
Section I

1. (a) **Required to calculate:** The exact value of $\left(\frac{4}{7} - \frac{1}{3}\right) \times \frac{7}{10}$

Calculation:

$$\begin{aligned} & \frac{4}{7} - \frac{1}{3} \\ & \frac{3(4) - 7(1)}{21} = \frac{12 - 7}{21} \\ & = \frac{5}{21} \end{aligned}$$

Hence,

$$\begin{aligned} \left(\frac{4}{7} - \frac{1}{3}\right) \times \frac{7}{10} &= \frac{\cancel{5}^1}{\cancel{21}_3} \times \frac{\cancel{7}^1}{10} \\ &= \frac{1}{6} \text{ (the exact value)} \end{aligned}$$

- (b) **Required to express:** 2.125 as an improper fraction

Solution:

$$2.125 = 2 + 0.125$$

$$= 2 + \frac{125}{1000}$$

$$\frac{125}{1000} = \frac{1}{8}$$

$$\therefore 2.125 = 2 + \frac{1}{8}$$

$$= 2\frac{1}{8}$$

$$= \frac{17}{8} \text{ (as an improper fraction)}$$

- (c) **Required to express:** 5 678 in standard form

Solution:

$$5\ 678 = 5\ 678.$$



We move the decimal point 3 places to the left to get 5.678.

$$\text{Hence, } 5\ 678 = 5.678 \times 10^3.$$

5.678 can be written as 5.68 to 2 decimal places or 5.7 to 1 decimal place.

Hence, 5 678 can be written in standard form as 5.678×10^3 (exactly) or approximated to 5.68×10^3 or 5.7×10^3 .

2. (a) **Data:** Ribbon is cut into two pieces in the ratio 3 : 7 . The shorter piece is 45 cm.

Required to calculate: The length of the longer piece.

Calculation:

The shorter piece of the ribbon is represented by '3 parts' = 45 cm.

$$\text{Therefore, '1 part' } = \frac{45}{3} = 15 \text{ cm.}$$

$$\begin{aligned} \text{The longer piece of the ribbon} &= 7 \text{ parts} \\ &= 15 \times 7 \\ &= 105 \text{ cm} \end{aligned}$$

- (b) (i) **Data:** Bds \$2.00 \equiv US \$1.00
Required to convert: Bds \$140 into US\$.

Solution:

$$\text{Bds } \$2.00 \equiv \text{US } \$1.00$$

$$\therefore \text{Bds } \$1.00 \equiv \text{US } \frac{1.00}{2.00}$$

$$\begin{aligned} \text{Hence, Bds } \$140.00 &= \text{US } \frac{1.00}{2.00} \times 140 \\ &= \text{US } \$70.00 \end{aligned}$$

- (ii) **Data:** A tax of 2% is charged on the transaction when Bob converts Bds \$140.00 into US \$.

Required to calculate: The amount that Bob received after tax.

Calculation:

$$\text{Tax} = 2\% \text{ of } \$70.00$$

$$= \frac{2}{100} \times \text{US } \$70.00$$

$$= \text{US } \$1.40$$

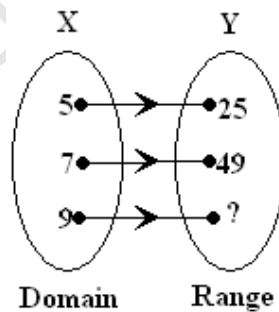
$$\begin{aligned} \therefore \text{Amount received after tax} &= \text{US}(\$70.00 - \$1.40) \\ &= \text{US } \$68.60 \end{aligned}$$

OR

$$\text{Tax} = 2\%$$

$$\begin{aligned} \therefore \text{Amount received} &= (100 - 2)\% \text{ of US } \$70.00 \\ &= 98\% \text{ of US } \$70.00 \\ &= \frac{98}{100} \times \text{US } \$70.00 \\ &= \text{US } \$68.60 \end{aligned}$$

3. (a) **Data:**



Mapping diagram between the members of set X and the members of set Y

- (i) **Required to state:** The relationship between x and y .

Solution:

Assuming that $x \in X$ and $y \in Y$, we notice

$$5 \rightarrow 25 = (5)^2$$

$$7 \rightarrow 49 = (7)^2$$

$$\text{i.e. } x \rightarrow (x)^2 = y$$

We arrive at the relationship $y = x^2$.

(ii) **Required To State:** The image of 9.

Solution:

When $x = 9$

$$y = (9)^2$$

$$= 81$$

\therefore The image of 9 is 81.

(iii) **Required to state:** If the relation is one to one, many to one or one to many.

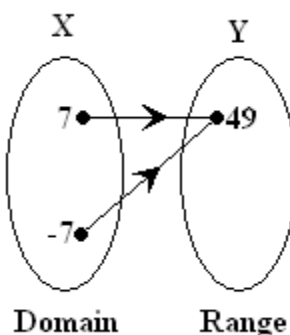
Solution:

Each element of X is mapped onto one element of Y and each element of Y is mapped onto only one element of X.

Hence, the relation is one to one.

NOTE:

In the relation $y = x^2$



If negative integers are considered, then the relation could be many to one.

(b) **Data:** Lucas ran 400 m in 50 seconds.

Required to calculate: Lucas' speed in metres per second.

Calculation:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\therefore \text{Lucas' Speed} = \frac{400 \text{ m}}{50 \text{ s}}$$

$$= 8 \text{ ms}^{-1}$$

4. **Data:** Deposit from Mr. Brown = \$12 000

Simple interest rate at bank = 8%

(a) **Required to calculate:** Time taken to earn interest of \$2 400

Calculation:

Recall:

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

$$\therefore 100 \times S.I. = P \times R \times T$$

$$T = \frac{100 \times S.I.}{P \times R}$$

$$\text{Time, } T = \frac{100 \times 2400}{12000 \times 8} \text{ years}$$

$$= 2\frac{1}{2} \text{ years}$$

(b) **Required to calculate:** The amount earned after 5 years.

Calculation:

Assuming that the question means the amount of interest earned on the deposit, we can calculate this interest in several ways.

Method 1

Interest earned in $2\frac{1}{2}$ years = \$2 400

\therefore Interest earned in 5 years $\left(2 \times 2\frac{1}{2}\right)$ will be $\$2400 \times 2 = \4800

Method 2

Interest earned in 1 year = 8% of \$12 000

$$= \frac{8}{100} \times \$12000$$

$$= \$960$$

\therefore Interest earned in 5 years = $\$960 \times 5$
= \$4 800

Method 3

$$\begin{aligned} \text{S.I.} &= \frac{P \times R \times T}{100} \\ &= \frac{\$12\,000 \times 8 \times 5}{100} \\ &= \$4800 \end{aligned}$$

5. **Data:** Pack of 8 exercise books cost \$x. Pen costs \$12 more than a pack of exercise books.

- (a) **Required to write:** The cost of 1 pen, in terms of x.

Solution:

Cost of 1 pack of books = \$x

Cost of 1 pen is \$12 more than the cost of 1 pack of books = \$(x+12)

- (b) **Data:** The cost of 1 pack of exercise books and 1 pen = \$76

Required to express: The above information as an equation in x.

Solution:

Cost of 1 pack of books and 1 pen = $x + (x + 12)$

$$\therefore x + (x + 12) = 76$$

$$2x + 12 = 76$$

- (c) **Required to solve:** The equation in (b) to find the cost of 1 exercise book.

Solution:

$$2x + 12 = 76$$

$$\therefore 2x = 76 - 12$$

$$= 64$$

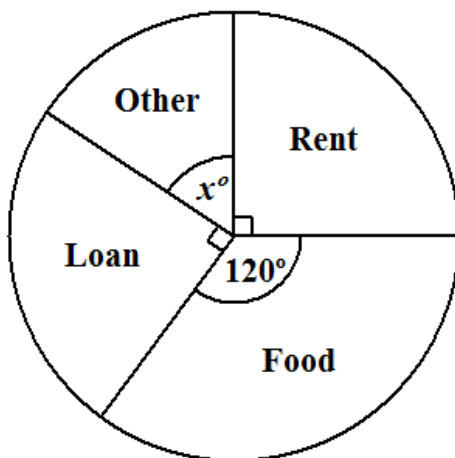
$$x = \frac{64}{2}$$

$$= 32$$

\therefore Cost of 1 pack of 8 exercise books is \$32.

$$\begin{aligned} \therefore \text{Cost of 1 exercise book} &= \frac{\$32}{8} \\ &= \$4 \end{aligned}$$

6. (a) **Data:** A pie chart showing how Miss Chen spends her monthly income.



- (i) **Required to calculate:** Miss Chen's loan payment.

Calculation:

The angle of the sector representing loan is 90° .

$$\begin{aligned} \therefore \text{Amount of the loan} &= \frac{\angle \text{ of sector representing loan}}{360^\circ} \times \text{Total Income} \\ &= \frac{90^\circ}{360^\circ} \times \$6\,000 \\ &= \$1\,500 \end{aligned}$$

- (ii) **Required to calculate:** The value of x .

Calculation:

The sum of all the angles of the sectors of the pie chart must total 360° .

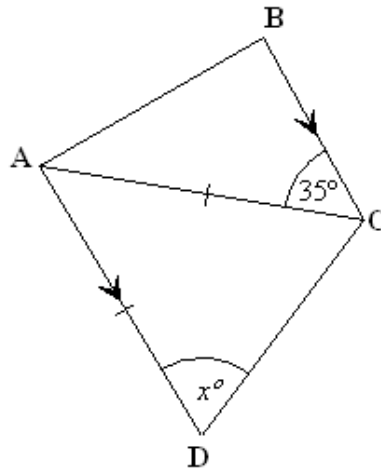
$$\therefore x^\circ + 90^\circ + 120^\circ + 90^\circ = 360^\circ$$

$$x^\circ = 360^\circ - (90^\circ + 120^\circ + 90^\circ)$$

$$x^\circ = 60^\circ$$

Hence, $x = 60$.

(b) **Data:**

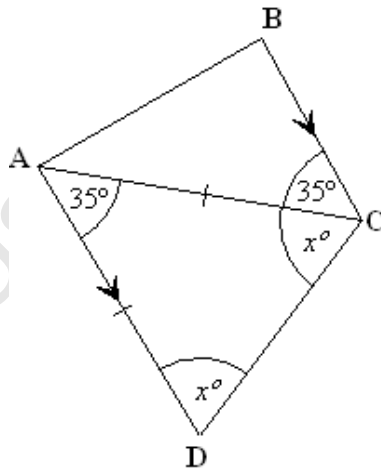


Trapezium ABCD with BC parallel to AD, $\hat{ACB} = 35^\circ$ and $AC = AD$.

Required to calculate: The value of x .

Calculation:

The angle $CAD = 35^\circ$ (Alternate angles)



Since $AC = AD$, triangle ACD is isosceles.

$\hat{ADC} = \hat{ACD} = x^\circ$ (Base angles of an isosceles triangle are equal)

$\therefore x^\circ + x^\circ + 35^\circ = 180^\circ$ (Sum of the interior angles in a triangle = 180°)

$\therefore 2x^\circ = 180^\circ - 35^\circ$

$$2x^\circ = 145^\circ$$

$$x = \frac{145}{2}$$

$$= 72\frac{1}{2}$$

Section II

7. (a) **Data:** Prices of a television by hire purchase and by cash payments.

HIRE PURCHASE

Down Payment \$480.00
Monthly Installment of \$320.00
for $2\frac{1}{2}$ years.

CASH PURCHASE

Cash Price \$9800.00
+
10% Discount on Cash Price

- (i) **Required to calculate:** The total cost of the television under hire purchase.

Calculation:

$$\text{Down payment} = \$480$$

$$\begin{aligned} 2\frac{1}{2} \text{ years} &= 2\frac{1}{2} \times 12 \\ &= 30 \text{ months} \end{aligned}$$

$$\begin{aligned} \text{Total monthly installments} &= \$320 \times 30 \\ &= \$9\,600 \end{aligned}$$

$$\begin{aligned} \therefore \text{Total amount paid by the hire purchase plan or method} &= \$480 + \$9\,600 \\ &= \$10\,080 \end{aligned}$$

- (ii) **Required to calculate:** The amount paid by using the cash purchase method.

Calculation:

$$\text{Marked price} = \$9\,800$$

Discount on marked price is 10%.

$$\begin{aligned} &= \frac{10}{100} \times \$9\,800 \\ &= \$980 \end{aligned}$$

$$\begin{aligned} \text{Cash Price} &= \text{Marked Price} - \text{Discount} \\ &= \$9\,800 - \$980 \\ &= \$8\,820 \end{aligned}$$

OR

Since there is a 10% discount then the customer, who is paying cash, will be paying (100-10)% of the marked price.

$$\begin{aligned} \text{This will be } 90\% \text{ of } \$9\,800 \\ &= (90/100) \times \$9\,800 \\ &= \$8\,820 \end{aligned}$$

- (iii) **Required to calculate:** The amount saved by using the cash payment plan as opposed to the hire purchase plan.

Calculation:

$$\text{Cost by the hire purchase plan} = \$10\,080$$

$$\text{Cost by the cash purchase plan} = \$8\,820$$

$$\begin{aligned} \therefore \text{Difference} &= \$10\,080 - \$8\,820 \\ &= \$1\,260 \end{aligned}$$

Jamal would save \$1 260 if he used the cash purchase plan over the hire purchase plan.

- (b) **Data:** Cost of 1 T-shirt = \$15.00. Total cost of T-shirts = \$2 625.00

- (i) **Required to calculate:** The number of T-shirts bought.

Calculation:

$$\begin{aligned} \text{Number of T-shirts bought} &= \frac{\text{Total cost of all T-shirts}}{\text{Cost of 1 T-shirt}} \\ &= \frac{\$2\,625}{\$15} \\ &= 175 \end{aligned}$$

- (ii) **Data:** Selling price of 1 T-shirt = \$22.00.

Required to calculate: Profit made after selling all the T-shirts

Calculation:

$$\begin{aligned} \text{Profit on 1 T-shirt} &= \text{Selling price} - \text{Cost price} \\ &= \$22 - \$15 \\ &= \$7 \end{aligned}$$

$$\begin{aligned} \text{Total profit made} &= \text{Profit on 1 T-shirt} \times \text{No. of T-shirts} \\ &= \$7 \times 175 \\ &= \$1\,225 \end{aligned}$$

OR

$$\begin{aligned} \text{Profit} &= \text{Total selling price} - \text{Total cost price} \\ &= \$3\,850 - \$2\,625 \\ &= \$1\,225 \end{aligned}$$

8. (a) **Data:** Equation $y = 3x - 4$ represents the relationship between variables x and y and an incomplete table of values.

(i) **Required To Complete:** The incomplete table given.

Solution:

When $x = 4$ $y = 3(4) - 4 = 8$

When $x = 6$ $y = 3(6) - 4 = 14$

When $x = 8$ $y = 3(8) - 4 = 20$

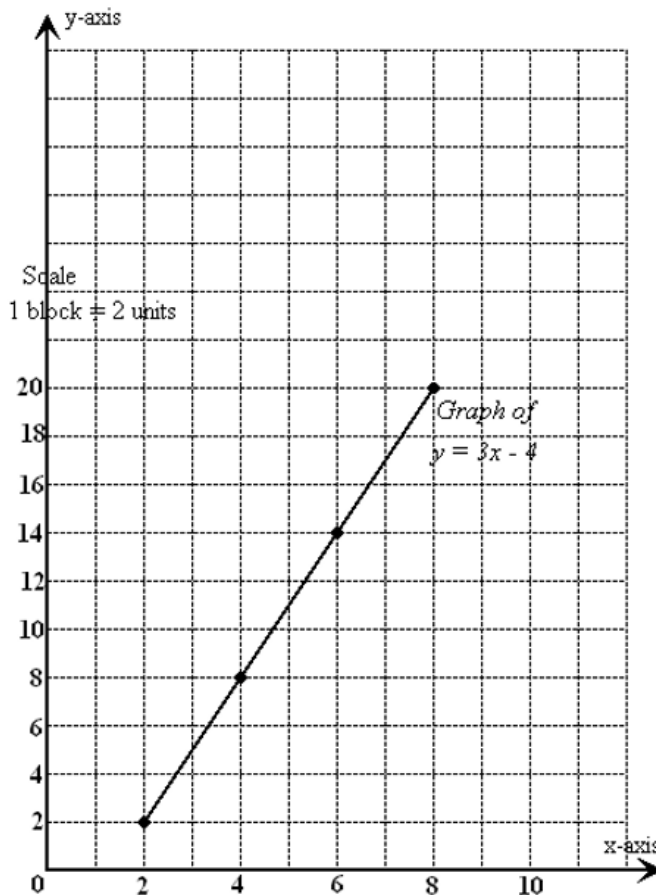
∴ The completed table will be

x	2	4	6	8
y	2	8	14	20

(ii) **Required To Plot:** The points from the table and draw the graph of $y = 3x - 4$.

Solution:

A convenient scale to use on the y or vertical axis is 1 block \equiv 2 units. The points are plotted and the graph of $y = 3x - 4$ for the points on the table is shown.

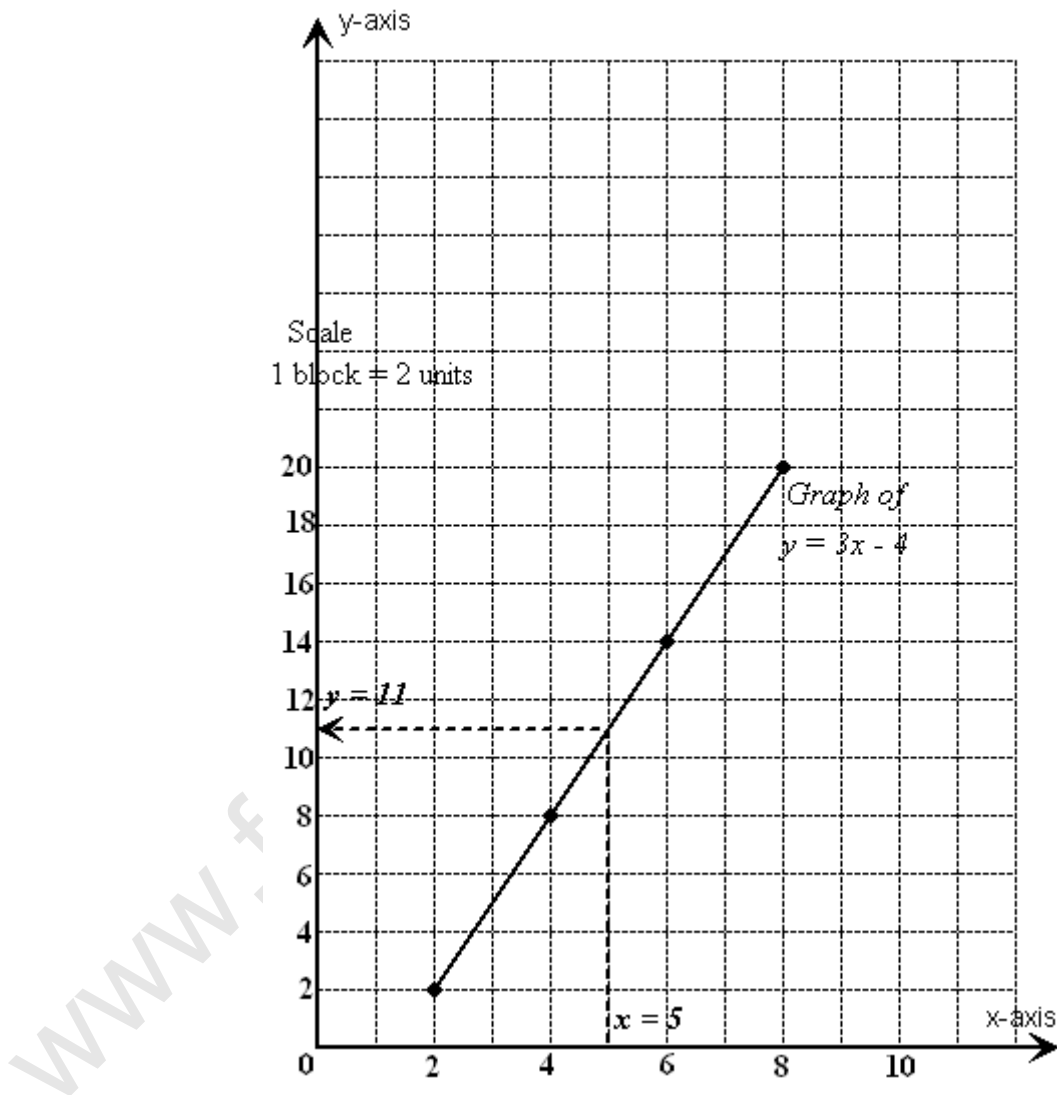


- (iii) **Required To Determine:** From the graph drawn, the value of y when $x = 5$.

Solution:

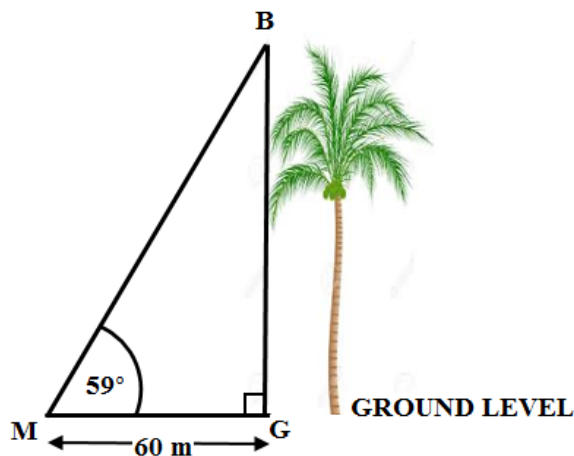
A vertical line at $x = 5$ is drawn to meet the line $y = 3x - 4$.

At the point where the vertical line meets the line $y = 3x - 4$, a horizontal line is drawn to meet the y or vertical axis. The value of y is read off.

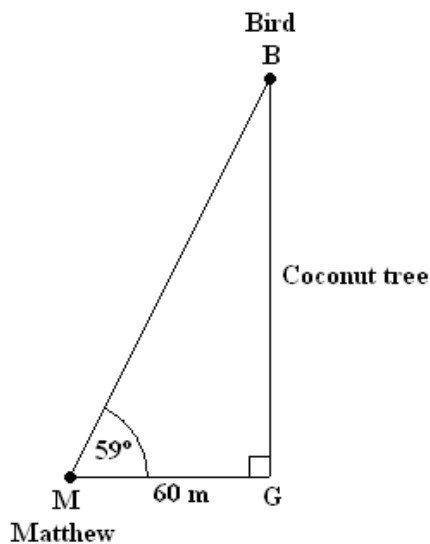


When $x = 5$, $y = 11$ (by read off).

- (b) **Data:** Diagram showing a tree, a bird at the top and Matthew standing on the ground.



Required to calculate: The height of the tree
Calculation:



Let the coconut tree be of height h m.

$$\tan \theta = \frac{\text{opp}}{\text{adj}}$$

$$\tan 59^\circ = \frac{BG}{MG}$$

$$= \frac{h}{60}$$

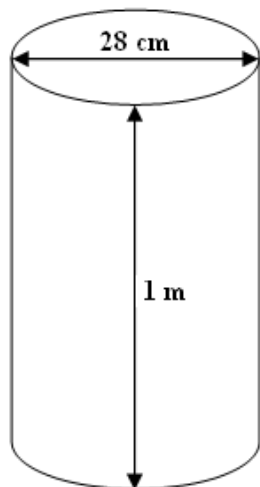
$$\therefore h = 60 \times \tan 59^\circ$$

$$\text{Height of tree} = 99.856 \text{ m}$$

$$= 99.86 \text{ m to 2 decimal places}$$

(NOTE: This is not a realistic figure for the height of a coconut tree)

9. (a) **Data:** Cylindrical barrel with given dimensions.



$$\pi = \frac{22}{7}$$

- (i) **Required to calculate:** The volume, in cm^3 , of the barrel.

Calculation:

$$\text{Volume of a cylinder} = \pi r^2 h$$

$$r = \text{radius} = \frac{28}{2} = 14 \text{ cm}$$

$$h = \text{height} = 1 \text{ m} = 1 \times 100 = 100 \text{ cm}$$

$$\begin{aligned} \therefore V &= \left(\frac{22}{7} \times (14)^2 \times 100 \right) \text{ cm}^3 \\ &= 61600 \text{ cm}^3 \end{aligned}$$

- (ii) **Required to calculate:** The number of containers, each holding $12\,320 \text{ cm}^3$ will be required to fill the barrel.

Calculation:

$$\begin{aligned} \text{No. of containers required} &= \frac{\text{Volume of barrel}}{\text{Volume of each container}} \\ &= \frac{61600}{12320} \\ &= 5 \end{aligned}$$

- (b) **Data:** Table showing the preferred snacks by students in a class.

Type of snacks	Chocolate	Peanuts	Donuts	Biscuits	Fruits
Number of students	8	6	9	2	5

- (i) **Required to find:** The favourite snack of the students in the survey.

Solution:

The favourite snack is donuts since more students chose donuts than any other snack.

- (ii) **Required to calculate:** How many more students chose chocolate than fruits.

Calculation:

Number of students who chose chocolate = 8

Number of students who chose fruits = 5

Difference = $8 - 5$

$$= 3$$

\therefore 3 more students chose chocolate than fruits.

- (iii) **Required to calculate:** The total number of students in the survey.

Calculation:

The number of students in the survey = $8 + 6 + 9 + 2 + 5$

$$= 30$$

- (c) **Data:** An ordinary fair die is thrown.

- (i) **Required to list:** All the possible outcomes.

Solution:

All the possible outcomes are 1 or 2 or 3 or 4 or 5 or 6.

- (ii) **Required to calculate:** The probability of obtaining an odd number.

Calculation:

The probability of obtaining an odd number = $\frac{\text{No. of odd numbers}}{\text{No. of possible outcomes}}$

The possible odd numbers are 1, 3 or 5.

The possible outcomes are 1, 2, 3, 4, 5, or 6.

$$P(\text{Odd numbers}) = \frac{3}{6}$$

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