



## 2

# Statistics

### *Concept*

#### 2.1 Pie charts

### *Learning Outcomes*

Pupils should be able to:

- (a) read and interpret pie charts.
- (b) solve 1-step problems using information presented in pie charts.

## Introduce

### Pie Chart

**Pie chart** is a graphical way of organizing numerical data. The data is represented using **sectors** cut-out of a **circle**.

- ✎ In a *pie chart*, numerical information can be shown clearly without using a lot of words. It is a *circle*, cut into slices (*sectors*) so that the size of each slice represents the proportion of each group to the whole.
- ✎ All *pie charts* compare parts of a whole. The whole is equal to **100%**, which is the same as **1**.
- ✎ A *pie chart* uses *percentages* or *fractions* to compare the data. There are **two** methods we can use to create a *pie chart*:
  - ❶ Using a *pie chart scale*.
  - ❷ Using a *protractor*.

### ❶ Using a Pie Chart Scale

#### Example

- The table below shows how a woman spent 24 hours. Draw a *pie chart* to illustrate this information.

Activity	Sleep	Work	Leisure	Meals	Travel
Number of hours	8	4	6	3	3

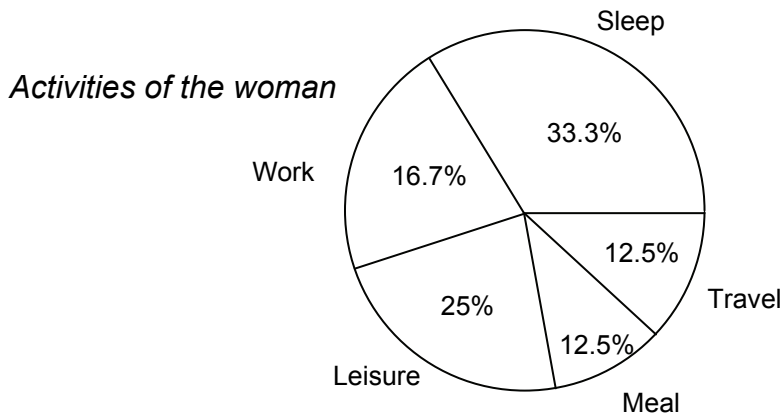
To construct a *pie chart*, we start with a full circle or 100% to share. First find the number in each category as a fraction of the total. She spent 8 hours on Sleep, that is,  $\frac{8}{24}$ . Therefore, this occupies  $\frac{8}{24}$  of the circle

and its percentage is  $\frac{8}{24}$  of 100, that is, 33% and it is equivalent to  $\frac{1}{3}$  of the circle, *i.e.*,  $\frac{1}{3} \times 360^\circ = 120^\circ$ .

Deduce:

Activity	Sleep	Work	Leisure	Meals	Travel
Number of hours	8	4	6	3	3
Number of hours	33.3%	16.7%	25%	12.5%	12.5%
Size of sector	$\frac{1}{3}$ ( $120^\circ$ )	$\frac{1}{6}$ ( $60^\circ$ )	$\frac{1}{4}$ ( $90^\circ$ )	$\frac{1}{8}$ ( $45^\circ$ )	$\frac{1}{8}$ ( $45^\circ$ )

We can now draw a *pie chart* for these activities. Draw a *circle* of a suitable size. Start at any point to divide it up into slices. Use a *pie chart scale* and the *percentages* in the table. Give the *pie chart* a title and label the slices.



## ② Using a Protractor

### Examples

- An international committee has 18 members, 6 from Great Britain, 7 from America, 3 from Japan and 2 from France.

Illustrate this information in a *pie chart*.

Country	Great Britain	America	France	Japan
Number of Members	6	7	2	3

To construct a *pie chart*, we start with a full circle or  $360^\circ$  and divide among these countries. First, find the number in each category as a *fraction* of the total. In a Great Britain, there are 6 members, that is,  $\frac{6}{18}$ .

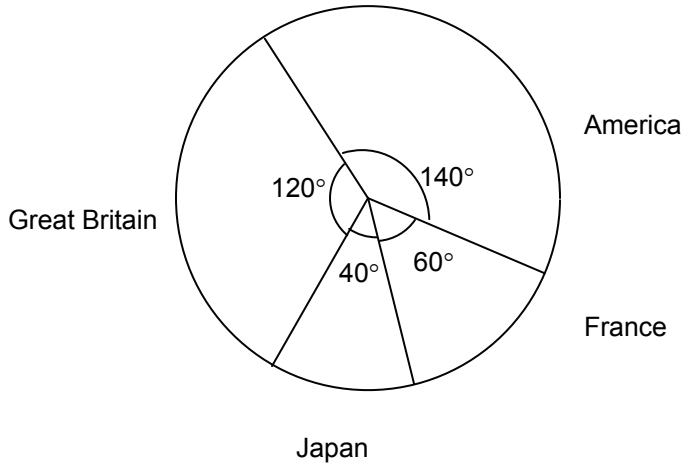
Therefore, this occupies  $\frac{6}{18}$  of the circle and its *sector* is  $\frac{6}{18}$  of  $360^\circ$  or  $\frac{6}{18} \times 360^\circ = 120^\circ$ .

Deduce:

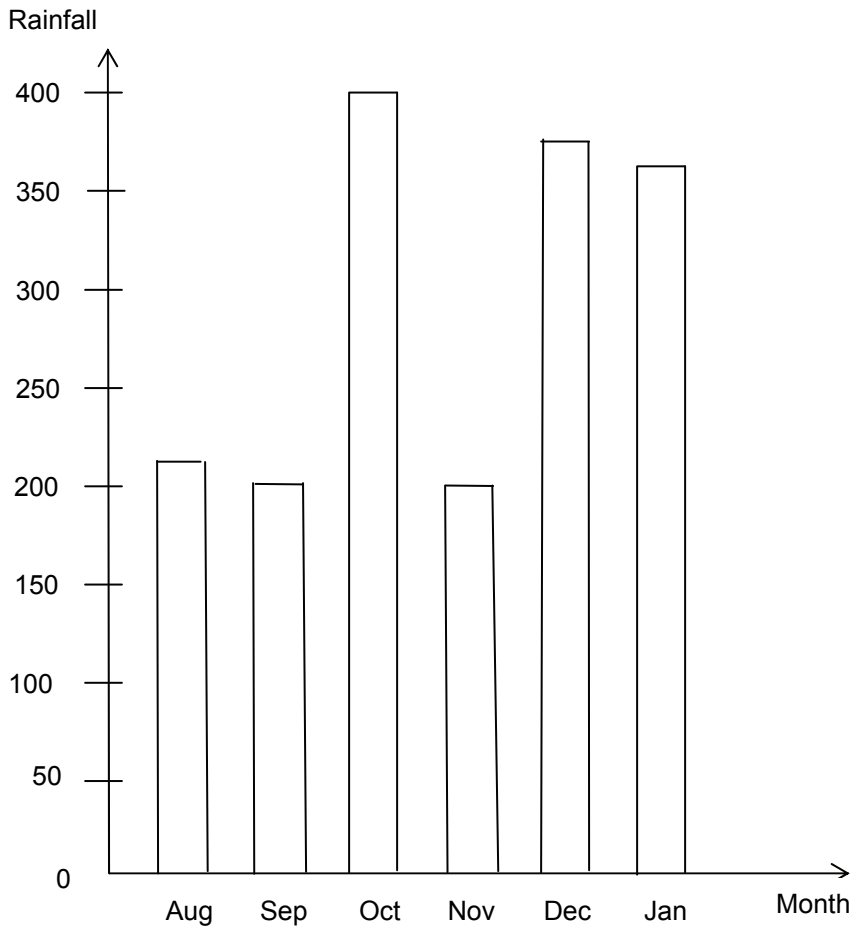
Country	Great Britain	America	France	Japan
Number of Members	6	7	2	3
Pie Chart angle	$120^\circ$	$140^\circ$	$40^\circ$	$60^\circ$

We can now draw a *pie chart*. Draw a circle of a suitable size. Start at any point to divide it up into slices. Use a protractor and the angles in the table.

### Nationality of Committee Members



- Illustrating the graph information in a *Pie Chart*



The above column graph shows the rainfall of Town X.

From this column graph, we can find out the rainfall in each month:

August, September, October, November, December and January.

We can illustrate these information in the below table:

Month	Rainfall
August	225
September	200
October	400
November	200
December	350
January	325

To construct a *pie chart*, we must first find the rainfall in each month as a fraction of the total. For the month of

August, the rainfall is  $\frac{225}{1700}$ . Therefore, August

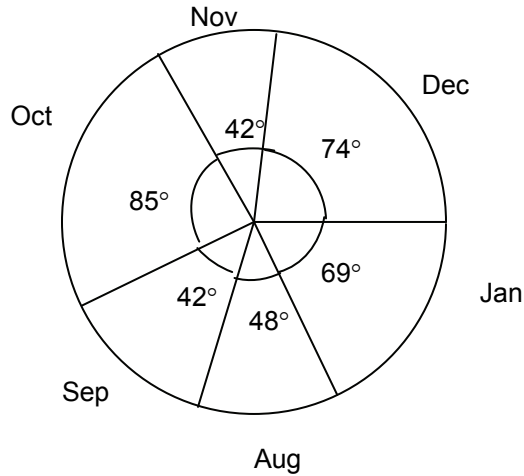
occupies  $\frac{225}{1700}$  of the circle and its angle is  $\frac{225}{1700}$  of  $360^\circ$

or  $\frac{225}{1700} \times 360^\circ = 48^\circ$ .

Deduce:

Month	Rainfall	Degree
August	225	$48^\circ$
September	200	$42^\circ$
October	400	$85^\circ$
November	200	$42^\circ$
December	350	$74^\circ$
January	325	$69^\circ$

We can now draw the *pie chart*.



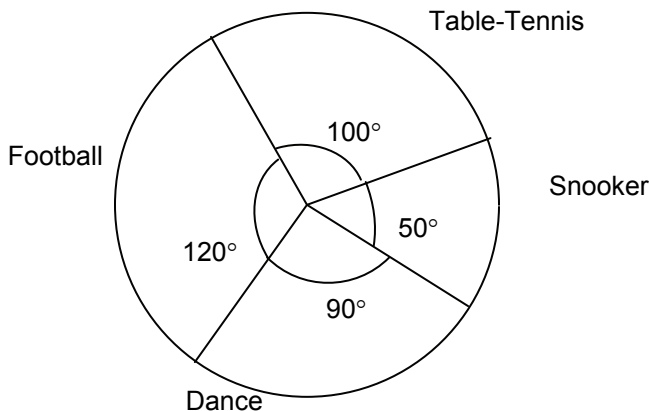
- ☺ if you find it difficult to follow, please use a calculator to help you.
- ☺ During actual examinations, questions on statistics would have “nicer” (easier) numerical values.

## Worked Examples

### Example 1

The youth club offers the following activities:  
Football, Snooker, Table Tennis, Dance

All the members of the club are asked which of these activities they favour. The *pie chart* represents their responses:



- (a) Which of the activity is the most popular?  
 (b) The club has 180 members. How many members like Dance?

**Solution:**

(a) The football is the *most* popular activity in this club.

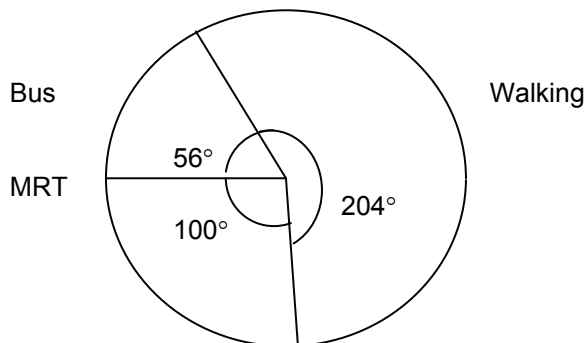
Since the degree for the football ( $120^\circ$ ) is greater than the other activities. (ans)

$$\begin{aligned} \text{(b) Number of members who like Dance} &= \frac{90}{360} \times 180 \\ &= 45 \quad (\text{ans}) \end{aligned}$$



**Example 2**

720 students were asked how they travelled to school. The *pie chat* shows the results of this survey.



- (a) How many of the students travelled to school by bus?  
 (b) How many of the students walked to school?

**Solution:**

$$\begin{aligned} \text{(a) Number of students travelled to school by bus} \\ &= \frac{56}{360} \times 720 \\ &= 112 \text{ students.} \quad (\text{ans}) \end{aligned}$$

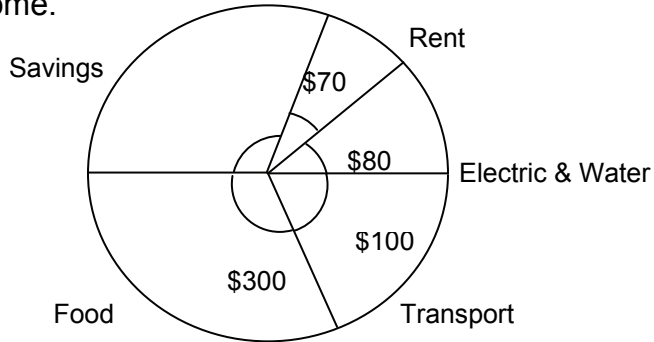
$$\begin{aligned} \text{(b) Number of students walked to school} &= \frac{204}{360} \times 720 \\ &= 408 \text{ students} \quad (\text{ans}) \end{aligned}$$





**Example 3**

The *pie chart* below shows how Mr. Eng spends his monthly income.



- (a) If the ratio of Mr. Eng's savings to his expenditure on food is 5 : 6, what is his monthly income?
- (b) What percentage of Mr. Eng's monthly income is spent on rent?

**Solution:**

- (a) 6 portions = \$300  
1 portion =  $\frac{300}{6} = \$50$   
5 portions =  $50 \times 5 = \$250$

Therefore, his savings = \$250

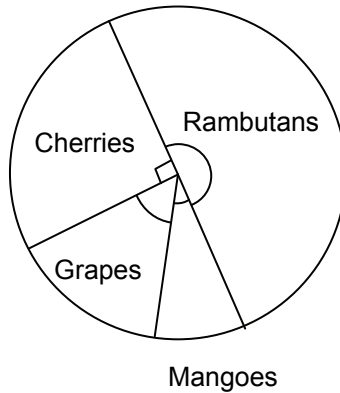
His monthly income =  $\$250 + \$300 + \$100 + \$80 + \$70$   
= \$800 (ans)

- (b) The percentage he spent on rent =  $\frac{70}{800} \times 100$   
= 8.75% (ans)



**Example 4**

The *pie chart* shows the favorite fruits of a group of children. The number of children who like *grapes* is the same as the number of children who like *mangoes*. If 15 children like *mangoes*, find the total number of children in the group?



**Solution:**

The number of children who like grapes is 15.

The number of children who like mangoes and grapes is 30\*.

\* This means  $90^\circ$  represents 30 children.

Number of children who like cherries = 30

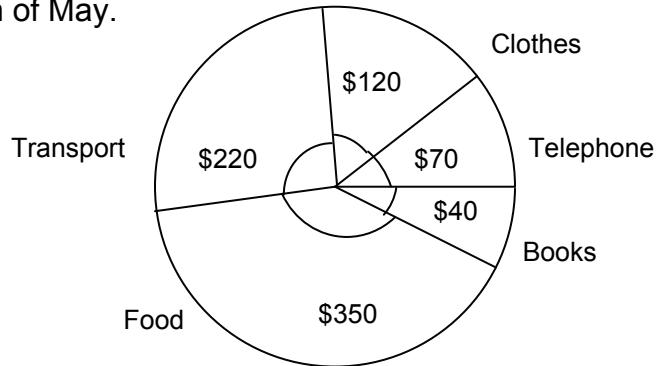
Number of children who like rambutans is 50% (or  $180^\circ$ \*)  
=  $30 \times 2 = 60$

Number of children in the group =  $60 + 30 + 30 = 120$   
(ans)



**Example 5**

The *pie chart* below shows the expenses of Mrs Lee for the month of May.



- (a) What percentage of her money was spent on *clothes*?
- (b) How many more percent was spent on *clothes* than on *books*?

**Solution:**

(a) Percentage of her money spent on clothes =  $\frac{120}{800} \times 100$   
= 15% (ans)

(b) Percentage of money spent on books =  $\frac{40}{800} \times 100$   
= 5% (ans)

Therefore, she spent 10% more on books than on clothes. (ans)



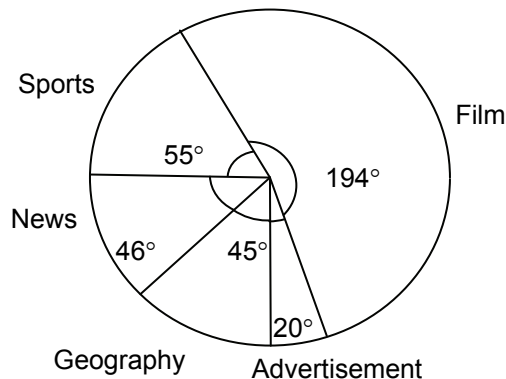
# Worked Problems

## Example 1

Helen watched television for 3 hours 15 minutes. The figure gives information about the programmes she watched.

- (a) How long did the *news* last?
- (b) How long did the *film* last?
- (c) What fraction of her time is spent on watching *sports*?

Give your answer *in* its simplest form.



### Solution:

- (a) Altogether, she spent 3 hours 15 minutes on television, that is,  $(3 \times 60 + 15)$  minutes = 195 min.

$$\text{The news lasted for } \frac{195}{360} \times 46 = 25 \text{ minutes (ans)}$$

- (b) The film lasted for  $\frac{195}{360} \times 194 = 105$  minutes  
= 1 hour 45 minutes (ans)

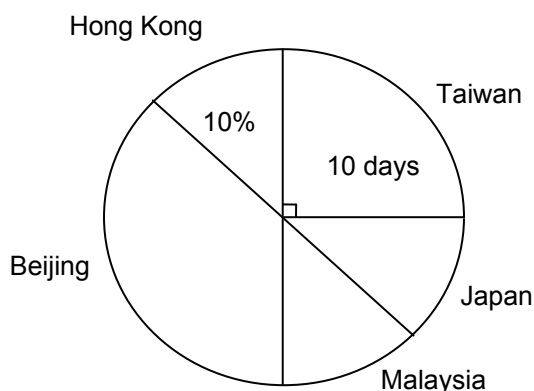
- (c) The sports lasted for  $\frac{195}{360} \times 55 = 30$  minutes

$$\text{In fraction} = \frac{30}{195} = \frac{2}{13} \text{ (ans)}$$



**Example 2**

Lim's family went to different places for their holidays. The details are given in a *pie chart*.



- (a) How many days did they stay in *Beijing*?
- (b) What percentage of the holidays was spent in Malaysia and *Taiwan*?
- (c) How many days were there in their holidays?
- (d) What fraction of the holidays was spent in *Hong Kong* and *Malaysia*?

**Solution:**

- (a) They stayed in Taiwan for 10 days.

In the pie chart,  $90^\circ = 10$  days

Therefore,  $360^\circ = 10 \times 4 = 40$  days

Altogether, they spent 20 days in Beijing and Hong Kong.

In Hong Kong, they spent  $\frac{10}{100} \times 40 = 4$  days

In Beijing, they spent  $20 - 4 = 16$  days (ans)

- (b) Malaysia and Hong Kong have the same angles.

Therefore, in Malaysia, they also spent 4 days.

Therefore, the percentage of the holidays spent in

Malaysia and Taiwan =  $\frac{14}{40} \times 100\% = 35\%$  (ans)

- (c) There were 40 days in their holidays. (ans)

(d) The fraction of days they spent in Hong Kong and

$$\text{Malaysia} = \frac{8}{40} = \frac{1}{5} \quad (\text{ans})$$

