

Averages

Remember :

$$\text{The Mean} = \frac{\text{total of all the scores}}{\text{number of scores}}$$

If we look at this set of data : 1, 1, 1, 1, 2, 3, 26

$$\Rightarrow \text{The mean would be } \frac{1+1+1+1+2+3+26}{7} = \frac{35}{7} = 5$$

Can you see that this is not the most suitable of averages since five out of the six numbers are all below the mean of 5 ?

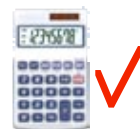
Any **average** should indicate a "measure of central tendency" but should also indicate what the distribution of data looks like.

This is why we have **three** different types of averages to consider.

1. The **Mean** (total of all the scores ÷ number of scores).
2. The **Median** (put the data in order then use the middle number).
3. The **Mode** (the number that appears most often).

Can you see that for the above data the median (= 1) or mode (= 1) are better averages ?

Exercise 1



1. Calculate the **mean** for each set of data :-
 

(a) 1, 2, 3, 4, 5, 6, 7, 8, 9	(b) 3, 4, 7, 8, 8, 13, 17, 20
(c) 11, 12, 14, 17, 17, 19	(d) 0.1, 0.2, 0.4, 0.5, 0.7, 0.7, 0.9
(e) 21, 23, 23, 26, 36, 81	(f) 12, 17, 9, 16, 22, 8, 17, 11, 12, 3
  
2. Find the **median** for each set of data :- (Remember to put the numbers in order first)
 

(a) 5, 8, 4, 2, 1, 6, 3, 9, 7	(b) 11, 21, 14, 16, 27, 9, 15
(c) 1.6, 2.2, 1.3, 2.4, 1, 1.7, 2.2	(d) 142, 153, 96, 204, 175, 150, 188

If there is not a single middle number, take the **mean of the middle two numbers**.

**Example :**      1, 1, 3, (4, 5), 6, 7, 9

The **median** is  $(4 + 5) \div 2 = 4.5$

3. Find the **median** for the following :-
 

(a) 4, 11, 7, 8, 12, 7	(b) 4, 6, 7, 15, 3, 17, 12, 8, 10, 9
(c) 11, 7, 8, 6, 4, 7, 3, 10	(d) 1.3, 1.4, 0.8, 1.7, 2.3, 1.6, 0.9, 1

4. Find the **mode** for each set of data :-
- (a) 1, 2, 3, 4, 5, 6, 7, 7, 8                      (b) 11, 22, 13, 54, 11, 13, 31, 10, 13
- (c) 1·7, 2·1, 2·3, 1·4, 2·1, 6·0, 2·8                (d) 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1
- (e) 131, 210, 113, 124, 21, 120, 124            (f)  $\frac{3}{4}, \frac{1}{4}, \frac{2}{3}, \frac{1}{2}, \frac{3}{4}, \frac{4}{5}, \frac{1}{4}, \frac{3}{4}$

The **RANGE** is a mathematical tool used to measure how widely spread a set of numbers are.

$$\Rightarrow \text{Range} = \text{highest score} - \text{lowest score}$$

**Example** :- For the data set, 2, 2, 3, 5, 7, 7, 8, 10, 12, 12  $\Rightarrow$  range = 12 - 2 = 10.

5. Calculate the **range** for each set of data in :- (a) question 3            (b) question 4.

6. Look at this data set :-

**5, 6, 1, 7, 9, 1, 2, 3, 56**

- (a) Find the **range**.
- (b) Find the **mean, median and mode**.
- (c) Which average is best suited to this data set.
- (d) Explain why you think the other two averages are less suitable.
7. Calculate the **mean, median, mode and range** of each data set below :-
- (a) 1, 2, 2, 2, 4, 8, 16                                  (b) 5·6, 2·2, 4·3, 4·3, 5·0, 4·3, 3·7
- (c) 107, 106, 93, 114, 106, 98                      (d) 30, 32, 23, 41, 55, 36, 27, 30
- (e) 15, 15, 13, 14, 17, 16, 17, 17                (f) 15 000, 12 000, 17 000, 12 000, 21 000.

8. The weights of six children are shown :-

40 kg    50 kg    63 kg    40 kg    47 kg    49 kg.



- (a) Find the **range** of their weights.
- (b) Calculate the **mode** and **median** weights.
- (c) Choose which is the better average of the two and explain why.
9. Rory buys 10 Easter Eggs. The number of chocolates in each is listed below :-

8, 7, 9, 6, 8, 7, 8, 11, 5, 9



- (a) Calculate the **mean, median and mode**.
- (b) How many eggs have **less than** the mean number of chocolates ?
10. (a) Calculate the **mean** of the first 10 **prime** numbers.
- (b) Calculate the **mean** of the first ten **square** numbers.

11. The weights of six children are shown opposite.

Bob says, " the average weight is 24 kg."

Bill says, " the average weight is 33 kg."

Ben says, " the average weight is 34 kg"

24 kg,	24 kg,	33 kg,
35 kg,	40 kg,	42 kg

(a) Explain why, technically, all three could be correct.

(b) Which of the three would be least likely to be used ?

12.



The mean weight of two crates is 26 kilograms.

If one of the crates weighs 19 kg, what must the weight of the other crate be ?

13. The mean age of four children is 13 years old.

Three of the children's ages are 9, 12 and 16.

What is the age of the fourth child ?



14.



A group of five people at a meeting have a mean age of 32 years.

When a sixth person joins the meeting, the mean age then increases to 35 years.

What is the age of that sixth person ?

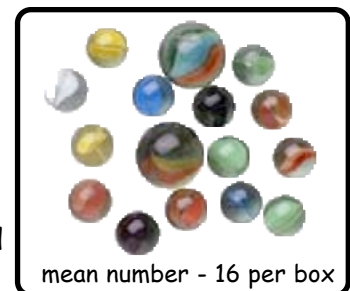
15. The contents of ten boxes of marbles are examined.

The boxes contain the following marbles : -

15, 17, 13, 16, 14, 15, 14, 14, 17, 15.

(a) Why is the manufacturer's claim incorrect ?

(b) An eleventh box is examined. How many marbles would need to be in that box in order for the manufacturer's claim to **then** be considered to be correct ?



16.



At an archery contest the mean score for the first nine contestants was 27.

Contestant number ten pushed the mean score up to 29.

What must contestant number ten have scored ?

17. At a bowling alley the mean score of the six children was 127.

The mean score of the five adults with them was 139.

Calculate the mean score of the whole eleven in the group.



18.



Megan's dad will give her £50 if she can get a mean score of at least 75% for her five Maths tests this year.

In her first four tests Megan scored : 71%, 66% 82% and 54%.

Can Megan possibly do well enough to get the £50 ? (Explain !!)

## Class Intervals

When a set of data is large, the numbers have to be grouped into "class intervals."

- Each interval must have the same **number** of values.
- Ideally, there should be between 6 and 10 intervals.

**Example** : - The test scores of a group are to be entered into a frequency table. (The first 6 have been done)

12 23 41 55 77 15 32 40  
 51 69 21 12 16 43 56 71  
 32 75 34 42 55 76 21 73  
 22 56 41 19 20 47 78 17

Can you see that there are 7 class intervals and each interval contains 10 numbers ?

Class Intervals	Tally	Frequency
10 - 19		
20 - 29		
30 - 39		
40 - 49		
50 - 59		
60 - 69		
70 - 79		

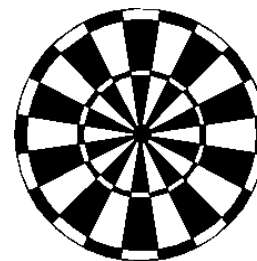
### Exercise 2

- (a) Copy and complete the frequency table above.  
 (b) How many students scored over 49 ?  
 (c) Draw a neat labelled **bar graph** to show this information.



- Each number below shows the score of 3 darts thrown by each member of class 1A<sub>3</sub>.

15 13 31 42 64 34 32 20 11 8 21  
 55 19 51 45 64 35 75 50 46 55 67  
 21 33 12 6 40 79 76 47 29 10 15



- How many numbers are in each interval ?
- How many intervals will there be in the table ?
- Copy and complete the table.
- How many pupils are in class 1A<sub>3</sub> ?
- How many pupils scored under 30 ?
- Draw a neat labelled bar graph showing this information.

Class Intervals	Tally	Frequency
0 - 9		
10 - 19		
20 - 29		
30 - 39		
40 -		

- The number of pets in each class in a school is shown below.

1 14 8 27 16 7 12 15 21 20 17 0 11 15 10  
 12 14 4 5 10 14 11 9 19 15 21 13 4 11 16

Show this information on a frequency table. (Use class intervals of 0 - 4, 5 - 9, 10 - 14, etc)

4. A class were asked to tidy their bedrooms and say how many coins they found!

The number of coins found by each pupil is shown.

- (a) Find the range.  
 (b) Which of these would be the best class interval to start with : -  
 (0 - 9) or (0 - 3) or (0 - 4) or (0 - 2) ?  
 (c) Construct a frequency table using your chosen class interval.  
 (d) Draw a neat labelled bar graph to show this information.



4	3	18	15	31	9	0	2
11	6	27	15	12	11	15	4
22	15	16	26	25	17	13	3
9	7	1	9	16	7	21	10
12	20	1	14	19	3	0	12

5. A list of waiting times (in minutes) in a doctors surgery are shown.

- (a) Find the range.  
 (b) Which of these would be the best class interval to use : -  
 (0 - 9) or (0 - 1) or (0 - 4) or (0 - 3) ?  
 (c) Construct a frequency table showing this information.



0	4	22	11	11	19	10	12
5	8	26	25	15	17	18	2
20	13	19	21	22	13	23	13
8	9	1	6	26	8	18	10
14	10	3	24	17	5	3	22

6. For each table below, construct a frequency table using an appropriate class interval.

(a)

14	13	18	15	11	9	4	1
15	34	32	25	12	16	15	14
9	15	18	25	25	19	14	3
9	8	2	7	16	27	23	20
22	20	11	13	16	30	4	22

(b)

10	35	28	45	71	69	50	42
11	36	27	15	62	72	65	54
42	35	26	16	25	37	43	53
69	52	47	31	29	19	47	31
20	12	60	51	24	49	43	40

(c)

127	152	163	174	101	133	167	155	171	110	117	129
111	134	125	164	115	122	150	160	129	144	141	153
130	128	166	154	122	169	140	151	163	162	100	174

(d)

3.6	2.3	4.6	1.7	5.6	4.2	1.1	4.0	5.2	6.3	6.9	4.1
2.5	2.8	1.3	2.5	6.6	5.1	1.4	4.6	2.2	3.3	5.1	0.4
5.0	2.9	4.3	2.1	5.4	4.6	5.3	6.1	2.2	5.7	5.8	1.3

## Mean from a Frequency Table

When given a frequency table, adding a third column will help us find the total number of items and the **mean**.

This table shows the number of coins in the pockets of some children.

$$\Rightarrow \text{Mean number of coins} = \frac{40}{16} = 2.5$$

Each pupil has an "average" of 2.5 coins.

No. of coins ( $x$ )	Freq ( $f$ )	$f \times x$
1	5	$1 \times 5 = 5$
2	5	$2 \times 5 = 10$
3	1	$3 \times 1 = 3$
4	3	$4 \times 3 = 12$
5	2	$5 \times 2 = 10$
<b>TOTALS</b>	<b>16</b>	<b>40</b>

Total pupils

Total coins

### Exercise 3



1. This table shows the results from a group of students who were asked how many pens they carried to college.

- (a) Copy and complete the table.  
 (b) How many students were asked?  
 (c) How many pens in total were there?  
 (d) Calculate the mean number of pens.



No. of pens ( $x$ )	Freq ( $f$ )	$f \times x$
0	1	$0 \times 1 = 0$
1	7	$1 \times 7 = \dots$
2	12	$2 \times \dots = \dots$
3	5	$\dots \times \dots = \dots$
4	5	$\dots \times \dots = \dots$
...	...	...

2. The table shows the number of goals scored by a school football team each week.

- (a) Copy and complete the frequency table.  
 (b) Find the total number of games.  
 (c) Find the total number of goals scored.  
 (d) Calculate the mean number of goals.



No. of goals ( $x$ )	Freq ( $f$ )	$f \times x$
0	4	
1	6	
2	10	
3	3	
4	2	
...	...	...

3. Copy and complete each of the following tables, add a third column and calculate the mean.

(a)

No. of cars ( $x$ )	Freq ( $f$ )
1	7
2	10
3	5
4	2
5	6

(b)

No. of sides ( $x$ )	Freq ( $f$ )
3	2
4	8
5	3
6	5
7	1
8	1

(c)

No. of runs ( $x$ )	Freq ( $f$ )
5	2
6	7
7	3
8	5
9	1
10	1
11	0
12	1

4. Look at the tables in question 3.

Question (a) has range  $(5 - 1) = 4$ . Question (b) has range  $(8 - 3) = 5$ .

Find the range for 3 (c).

5. Shown are the test scores of class 1A<sub>2</sub>.

(a) How many pupils are in class 1A<sub>2</sub> ?

(b) Find the range of scores.

(c) Find the mean score for class 1A<sub>2</sub>.

(d) Can you find the median from this table ?

(Hint : it is the middle number from 10, 12, 12, 12, 12, 14...).



Test score ( $x$ )	Freq ( $f$ )
10	1
12	4
14	10
16	5
18	5

6. A group of 18 year old girls were asked how old they were when they went out on their first "date".

The results are shown in this bar graph.

(a) Form a frequency table from the information in the bar graph.

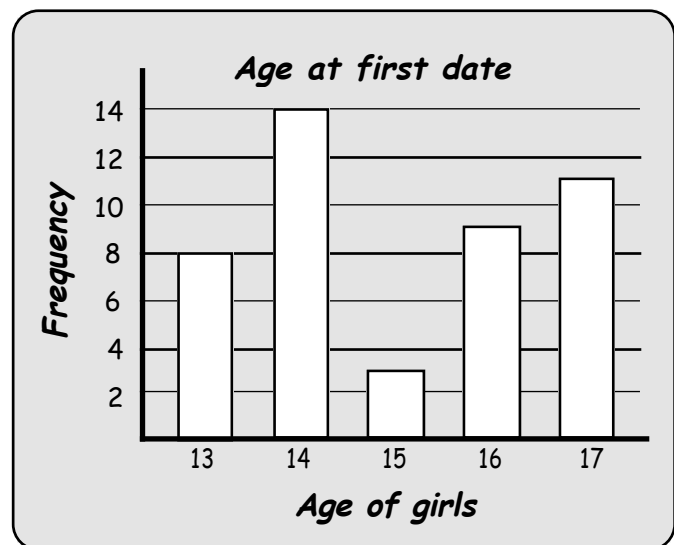
(b) Calculate the : -

(i) mode

(ii) range

(iii) mean

(iv) median.



## Cumulative Frequency Tables

This frequency table shows the number of eggs laid by a clutch of chickens each day over a seven day period.

A third column has been added to keep a running total.

This makes it easier to get the total number of items.

Other information can be more easily obtained from this column.

e.g. 12 eggs had been collected by day four.  
(The **cumulative frequency** on day 4 is 12).

Day	Frequency (no. collected)	Cumulative freq. (total so far)
1	2	2
2	3	5
3	1	6
4	6	12
5	5	17
6	8	25

(2 + 3)

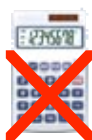
(5 + 1)

**Median :-** If 29 eggs were collected altogether, then the 15th egg must be the **median**.  
(14 eggs either side of this 15th egg).

=> The 15th egg (median) was collected on day 5.

### Exercise 4

1. A hospital noted the number of cases of a specific viral infection.



The results are shown in the frequency table.

Week	Frequency (no. of cases)	Cumulative freq. (total so far)
1	4	4
2	9	13
3	11	...
4	24	...
5	16	...
6	7	...
7	2	...

- (a) Copy and complete the table.  
(b) How many patients in total were there ?  
(c) How many patients had been infected by the end of week 5 ?  
(d) Which week was the infection at its worst ?  
(e) Find the median.

2. For each of the frequency tables below :-

- (i) add a cumulative frequency column      (ii) find the median.

(a)

Pets	Frequency
0	2
1	11
2	17
3	8
4	4
5	2
6	1

(b)

Grade	Frequency
0	1
1	3
2	4
3	10
4	21
5	7
6	4

(c)

No.	Frequency
10	7
11	7
12	10
13	20
14	15
15	20
16	5

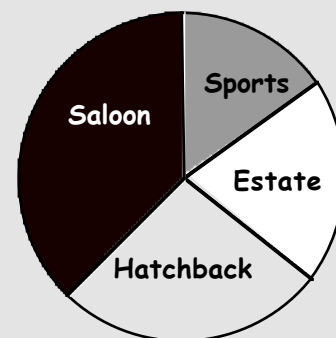
## Pie Charts

The table of data shows the number of different vehicles bought from a car showroom.

When drawing a pie chart, it is sometimes easier to add columns to the table for calculations.

Type of Car	Number
Saloon	34
Hatchback	24
Estate	18
Sports	14

Type of Car	Number	Fraction	Angle
Saloon	34	$\frac{34}{90}$	$\frac{34}{90} \times 360 = 136^\circ$
Hatchback	24	$\frac{24}{90}$	$\frac{24}{90} \times 360 = 96^\circ$
Estate	18	$\frac{18}{90}$	$\frac{18}{90} \times 360 = 72^\circ$
Sports	14	$\frac{14}{90}$	$\frac{14}{90} \times 360 = 56^\circ$
<b>TOTAL</b>	<b>90</b>	<b>1</b>	<b>360°</b>



- step 1 is to add all the "numbers" together to get a total (90).
- step 2 is to express each "number" as a fraction of this total. (e.g.  $\frac{34}{90}$ ).
- step 3 is to find that fraction of  $360^\circ$  each time (e.g.  $\frac{34}{90} \times 360 = 136^\circ$ ).
- step 4 is now to draw the pie chart using the angles in the table and a protractor.



### Exercise 5

1. (a) Copy and complete the table showing a group of 180 people's favourite season.

Season	Number	Fraction	Angle
Spring	20	$\frac{20}{180}$	$\frac{20}{180} \times 360 = 40^\circ$
Summer	90	$\frac{90}{180}$	$\frac{90}{180} \times 360 = \dots^\circ$
Autumn	10	$\frac{\dots}{180}$	$\frac{\dots}{180} \times 360 = \dots^\circ$
Winter	60	$\frac{\dots}{180}$	$\frac{\dots}{180} \times 360 = \dots^\circ$
<b>TOTAL</b>	<b>180</b>	<b>1</b>	<b>360°</b>

- (b) Construct a pie chart using a compass, a protractor and the table information.

2. (a) Copy and complete the table showing the number of grades a class obtained in their last test.

Grades	Number	Fraction	Angle
A	5	$\frac{5}{45}$	$\frac{5}{45} \times 360 = 40^\circ$
B	20	$\frac{20}{45}$	$\frac{20}{45} \times 360 = \dots^\circ$
C	18	$\frac{\dots}{45}$	$\frac{\dots}{45} \times 360 = \dots^\circ$
D	2	$\frac{\dots}{45}$	$\frac{\dots}{45} \times 360 = \dots^\circ$
<b>TOTAL</b>	<b>45</b>	<b>1</b>	<b>360°</b>

- (b) Construct an accurate pie chart showing this information.

3. (a) Copy and complete the table showing a class's eye colour.

Eye colour	Number	Fraction	Angle
Brown	10	$\frac{10}{30}$	$\frac{10}{30} \times 360 = \dots^\circ$
Blue	12		$\times 360 = \dots^\circ$
Green	7		$\times 360 = \dots^\circ$
Grey	1		$\times 360 = \dots^\circ$
<b>TOTAL</b>	<b>30</b>		<b>360°</b>

(b) Construct an accurate pie chart showing this information.

4. For each table below, copy each table (add new columns to show your working) then construct an accurate pie chart to show the information.

(a)

Favourite sport	Number
Football	36
Tennis	20
snooker	4
Netball	12
<b>TOTAL</b>	<b>....</b>

(b)

People's ages	Number
10 - 19	400
20 - 29	240
30 - 39	70
40 - 49	10
<b>TOTAL</b>	<b>....</b>

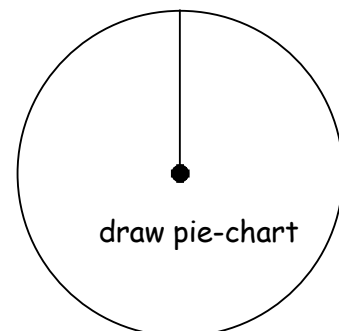
5. The table shows the results of a survey asking people's favourite holiday destination.

America	France	Italy	Spain	Italy	Spain	France	America
Spain	Italy	France	Spain	France	Spain	Italy	Spain
France	Spain	U.K	America	France	U.K	Spain	Spain
Italy	France	U.K	Spain	Spain	America	U.K	Italy
France	Spain	Spain	Spain	France	Spain	France	America

(a) Copy and complete the table below :-

(add any columns you might need to help you make a pie chart).

Destination	Tally Mark	Number
America		
France		
Italy		
Spain		
U.K		



(b) Construct an accurate pie chart for this information.

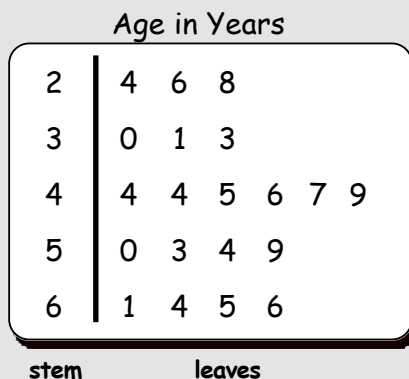
## Stem-and-leaf Graphs

A stem and leaf graph is another way of displaying information.

This stem and leaf graph shows the ages of people waiting in a queue at a post office.

The key explains what each number in the graph represents.

The first line reads 24, 26 and 28 years of age.



Key :-

2 | 4 means 24

### Exercise 6

1. The 2nd line of the above graph reads 30, 31 and 33 years of age.

- Write the ages given by each line in the graph above.
- (i) What age was the youngest person in the queue?  
(ii) What age was the oldest person in the queue?
- How many people were in the queue?



2. The ages of a group of people waiting in a queue at a bank were recorded and put into the stem and leaf graph shown.

- The first line (level 2) reads 21 years, 22 years, 24 years and 27 years.

Write out the ages in level 3.

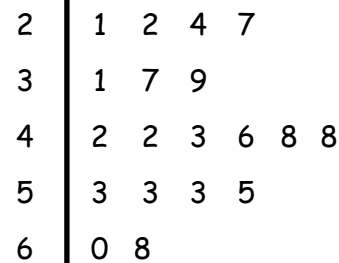
- Write out the ages of level 4.

- What age was the :-

(i) youngest person                      (ii) oldest person?

- Were most of the people in their 20's, 30's or 40's?

#### Age in years



Key :

2 | 4 means 24

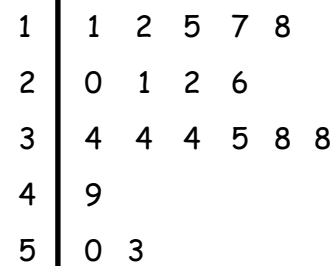
3. Some pupils were asked how much money they had. The results are shown in the stem and leaf graph.

- List the amount of money each pupil had.
- Which level has the most data?
- Which amount of money appears the most often (mode)?
- How many pupils were asked in the survey?

Key :

1 | 2 means £1.20

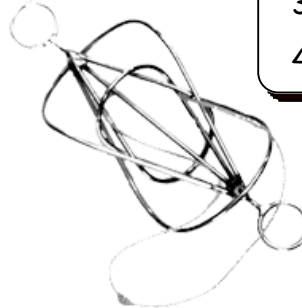
#### Pupil's money



4. The table shows the time it took in seconds for a puzzle to be solved by some students.
- Write a key for this stem and leaf graph.
  - State what was the :-
    - fastest time
    - slowest time,
 taken for the puzzle.
  - How many pupils tried the puzzle.
  - How many pupils took more than 22 seconds to complete the puzzle ?
  - Find the modal time (mode).
  - Work out the median (middle) time.

**Puzzle Time**

0	9
1	6 8 9
2	0 1 1 1 1 4
3	
4	1 7



5. This stem and leaf graph has not been put in order.

**Javelin throw**

0	9
1	
2	7 2 6 8 2
3	9 6 1 9 2 9
4	2 1 5 0



The graph shows the lengths (in metres) thrown in a javelin competition.

- Copy the graph, but this time show the distances in order.
- Write a key for this graph.
- What was the :-
  - greatest distance thrown ?
  - least distance thrown ?
- What does the empty space at "1" mean ?
- Find the :-
  - mode
  - median.

6. For each set of data :-
- Construct an ordered stem and leaf graph with a key.
  - Find the mode and median.

(a)

14	13	18	15	11	9	4	1
15	34	32	25	12	16	15	14
9	15	18	25	25	19	14	3
9	8	2	7	16	27	23	20
22	20	11	13	16	30	4	22

(b)

11	22	27	49	61	68	60	52
45	34	47	25	52	62	65	45
24	52	62	61	52	31	63	33
59	42	37	21	29	19	47	34
30	22	60	41	34	59	53	10

(c)

137	142	153	164	111	123	157	165	161	104	107	119
101	124	135	154	125	132	140	160	139	154	151	123
140	138	156	164	132	159	160	111	143	152	110	164

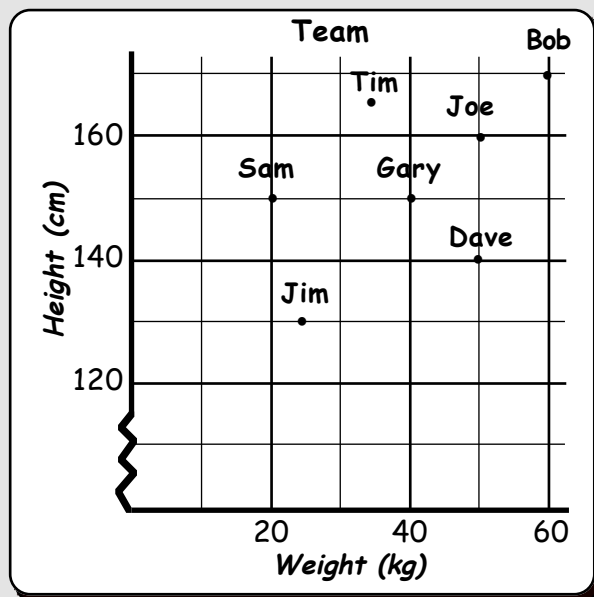
## Scattergraphs

This scattergraph displays the **heights** and **weights** of a sevens football team.

Gary weighs 40 kg.

Joe is 160 cm tall.

Jim is 130 cm tall and weighs approximately 25 kg.



### Exercise 7

1. For the scattergraph above, write down the height and weight of each player.

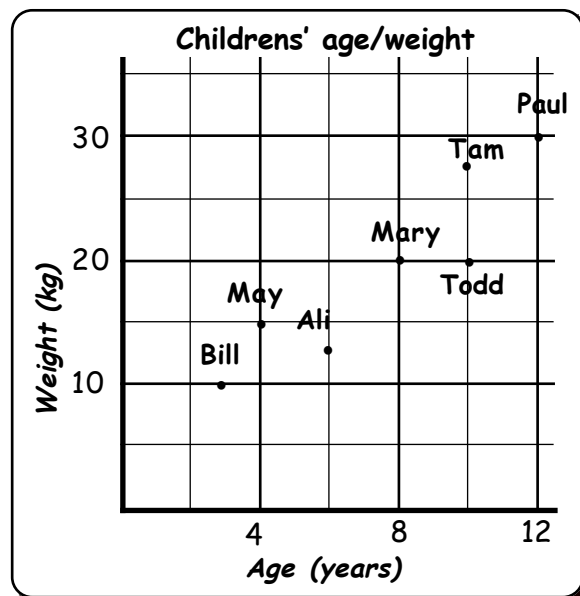


2. This scattergraph shows the ages and weights of several children.

- (a) Who is :-
- the youngest
  - the lightest
  - the oldest
  - the heaviest child ?

(b) Write down the age and weight of each child.

When two quantities are strongly connected, we say there is a strong **correlation** between them.



3. Say whether you think there will be a **correlation** between :-

- the temperature and the sales of ice-cream.
- the temperature and the amount of people on a beach.
- the amount of rain and the sales of umbrellas.
- the distance a taxi travels and the fare.
- the temperature and the sales of gloves.
- the number of workmen and the time taken to build a wall.

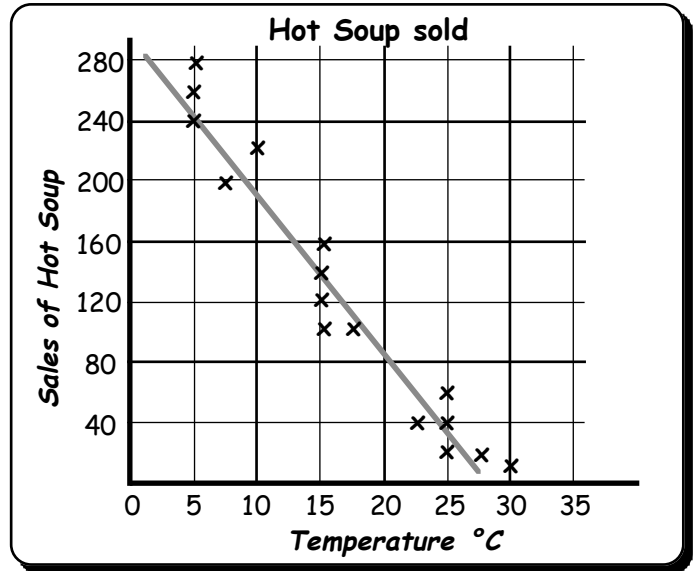
4. This scattergraph shows the sales of cups of hot soup at a football ground.

This would be called a strong **negative correlation** since all the points lie roughly on a straight line going downwards from left to right.

The line is called a **line of best fit**.

Use the line of best fit to estimate :-

- the sales at 20°C.
- the temperature when the sales were approximately 240 cups.

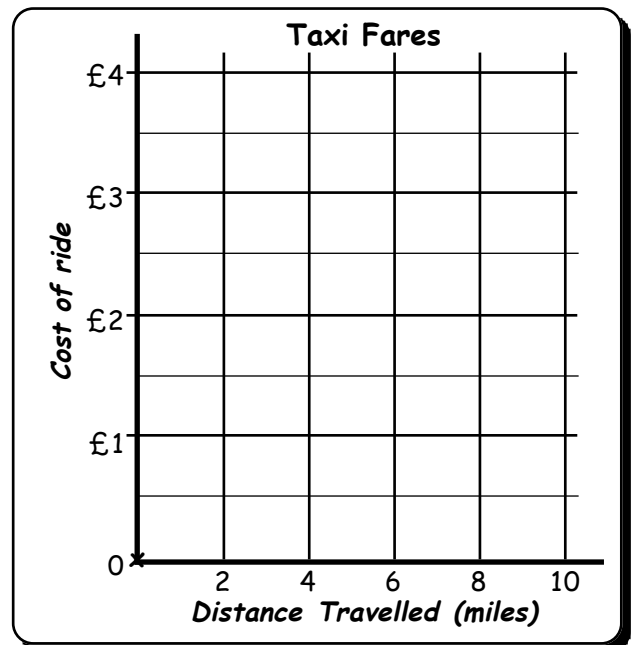


5. This graph represents the cost of different taxi fares and the distances travelled.

- Copy the graph.
- Use the table below to plot the points on the graph.



Distance (km)	Cost (£)
2	1.50
3	2.50
2	1.75
5	3.25
5	3.50
6	4.00



- Does this graph show a strong negative or positive correlation?
- Draw a best line of fit on your graph.
- Estimate how much a 4 kilometre journey would cost.



6. For each data set below, construct a scattergraph and show a best line of fit.

(a)

Age (years)	0	1	1	2	3	3	3	4	4	5	6	7	8	8	9	9	10	10
Car price (£1000)	10	9	8	8	7	6	5	5	4	2	3	3	3	2	2	1	2	1

(b)

Temp. (°C)	0	5	5	5	10	15	20	20	20	25	25	30	30	25	20
No. of People in the park	1	3	5	5	10	15	25	35	20	40	50	60	55	35	30

## Probability

Probability is the likelihood or chance of something happening.

**Examples** What is the probability that :-

if today is Tuesday, then tomorrow will Sunday ?	(impossible)
it will be sunny <b>everyday</b> in December ?	(unlikely)
if I toss a coin, it will land tails ?	(Even chance)
if I toss 10 coins, at least one will be heads ?	(likely)
if I jump into a river, I will get wet ?	(certain)

### Exercise 8 (Oral exercise)

For each statement below, say whether the probability of it happening is :-

Impossible - unlikely - evens (50-50) - likely - certain.

1. If today is Monday, yesterday was Thursday.
2. The next person I see will be male.
3. No trains will be on time tomorrow.
4. There will be snow in January.
5. I will win the jackpot lottery this week.
6. I will have a birthday this year.
7. Christmas will be in November next year.
8. I will blink my eyes today.

## Calculating Probability

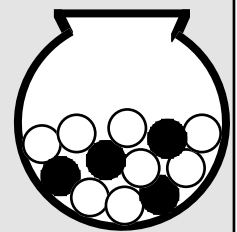
Probability can be thought of as a simple fraction.

$$\text{Probability of an event happening} = \frac{\text{number of favourable outcomes}}{\text{number of possible outcomes.}}$$

**Example** A bowl contains 4 black balls and 8 white balls.

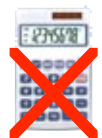
If a ball is picked at random what is the probability that it will be black ?

$$P(\text{black}) = \frac{4 \text{ (black balls)}}{12 \text{ (balls altogether)}} = \frac{4}{12} = \frac{1}{3}$$



### Exercise 9

1. A bag contains 6 black balls and 12 white balls.  
If a ball is picked at random, what is the probability that it will be black ?  
(Use the notation :-  $P(\text{black}) = \dots$ )
2. A bag has 3 red sweets, 6 green sweets and 9 blue sweets.  
If a sweet is picked at random, what is the probability that the sweet will be :-  
(a) red (b) green (c) blue (d) orange ?



3. A dice numbered from 1 to 6, is rolled.

(a) What is the probability that it will show a 2 ? ( $P(2) = \dots$ )

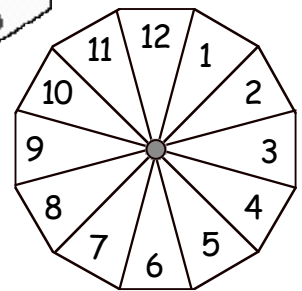
(b) Find :- (i)  $P(3)$  (ii)  $P(\text{odd})$  (iii)  $P(8)$



4. A duo-decagon (12 sides) spinner is spun and its number is noted.

Find :- (a)  $P(\text{less than } 4)$  (b)  $P(\text{multiple of } 3)$

(c)  $P(\text{prime})$  (d)  $P(\text{factor of } 12)$



5. A bag contains 20 raffle tickets.

Four tickets win a cuddly toy, two tickets win £10 and the rest are losing tickets.

Find :- (a)  $P(\text{win a toy})$  (b)  $P(\text{losing ticket})$

(c)  $P(\text{win } \pounds 10)$  (d)  $P(\text{not win } \pounds 10)$ .



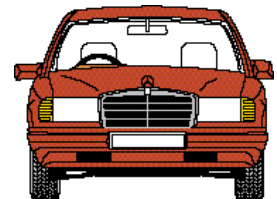
6. A garage forecourt has the following coloured cars :-

12 blue, 8 green, 6 silver, 4 white, 3 black, 2 red, 1 yellow.

Find:- (a)  $P(\text{blue})$  (b)  $P(\text{green})$  (c)  $P(\text{silver})$

(d)  $P(\text{white})$  (e)  $P(\text{black})$  (f)  $P(\text{red})$

(g)  $P(\text{yellow})$  (h)  $P(\text{red or blue})$  (i)  $P(\text{not red or blue})$



7. In a word game, letters are chosen at random from the word :-



Find :- (a)  $P(A)$  (b)  $P(R)$  (c)  $P(\text{vowel})$  (d)  $P(\text{consonant})$

8. The probability of an event happening is said to be  $\frac{3}{7}$ .

What is the probability of the event **not** happening ?

9. Three coins are tossed at the same time.

(a) List all the possible outcomes. (HHH, HHT, etc....).

(b) Find:- (i)  $P(\text{all heads})$  (ii)  $P(2 \text{ tails})$ .



10.  One dart is thrown at this dart board, numbered 1 - 20.

If the dart actually lands on the board, find :-

(a)  $P(16)$  (b)  $P(\text{over } 12)$  (c)  $P(\text{even})$  (d)  $P(\text{prime})$ .

11. Look at the two bags shown.

How many **more** black balls do I have to put into bag 2 so that each bag has the same probability of picking, at random, a black ball ?



Bag 1



Bag 2

When setting up a survey, preparation is very important.

Have you avoided bias in your survey ? (What is bias ?)

Will you use a tally box or a questionnaire ?

Will you use discrete (countable) or continuous (measurable) data.

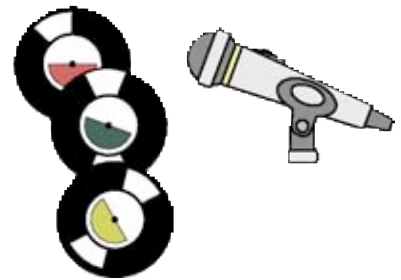
What form will the final information take?

### Exercise 10

1. Jason is to conduct a survey asking whether or not a local weekend disco should be closed down.

Explain why he should **not** ask the following groups :-

- (a) The staff of the disco.
- (b) People leaving the disco at 3 a.m. on Saturday morning.
- (c) The old folks home across the road.



2. Construct a questionnaire to allow several responses to the following surveys :-

- (a) How much would you spend each week on magazines ?
- (b) On average, how many hours sleep do you get each weekend ?
- (c) Approximately how many kilometres do you travel each day ?



3. Describe each sentence below using either the words discrete or continuous.

- (a) The number of pets each person has in a class.
- (b) The distances pupils walk to school.
- (c) The temperatures at noon everyday for a week.
- (d) Time taken by runners in a 100 metre race.



4. Conduct a survey by asking the class how many pets they have.

Use in your final results three separate methods of displaying the information.

5. Conduct a survey of your choosing, using a group of 50 people.

Use three separate methods of displaying your information.

Explain why you chose your subject matter and any other relevant details.

# Statistics



- Find the mean, median, mode and range of each data set below :-  
 (a) 5, 6, 2, 2, 1, 7, 8, 3, 4                      (b) 2.3, 2.7, 2.5, 1.9, 2.5, 3, 2.9, 2
- The mean age of a group of eight girls was 15.  
One more girl joined the group and the mean age became 14.  
How old was the ninth girl ?



- The number of pupils in each classroom in a school is shown below.  
 5 14 28 21 16 17 32 35 27 30 7 0 12 18 10  
 22 34 24 15 19 14 11 9 29 25 29 33 4 12 16

Show this information on a frequency table.  
(Use class intervals of 0 - 4, 5 - 9, 10 - 14, etc).

- Construct a frequency table using the data below :-

137	142	153	164	111	123	157	145	161	120	127	139
131	164	145	124	105	112	160	160	149	114	161	123
140	108	166	164	152	159	100	131	153	122	160	164

- The frequency table shows the maximum temperature each day in February.

- Copy the frequency table and add a third column to help you find the mean temperature.
- Copy the table again, but this time add a cumulative frequency column and use it to determine the median.

Max Temp (°C)	
Freq	
(x)	(f)
5	7
6	8
7	5
8	2

- (a) Copy and complete the table showing a class's favourite pet.

Type of Pet	Number	Fraction	Angle
Dog	10	$\frac{10}{30}$	$\frac{10}{30} \times 360 = \dots^\circ$
Cat	15		$\dots \times 360 = \dots^\circ$
Fish	4		$\dots \times 360 = \dots^\circ$
Other	1		$\dots \times 360 = \dots^\circ$
<b>TOTAL</b>	<b>30</b>		<b>360°</b>



- Construct an accurate pie chart showing this information.

7. The stem and leaf graph show the ages of people at a family 50th birthday party.
- Write a key for this stem and leaf graph.
  - How many people were at the party?
  - List the ages of the people at the party.
  - Find the modal age.
  - Find the median.

**People's Ages**

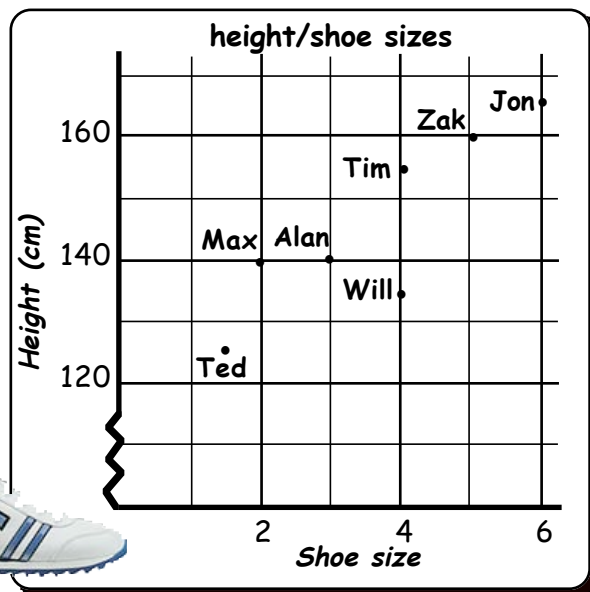
1	9
2	0 2 7
3	2 2 4 7 8
4	0 0 0 4 7 9
5	0 3

8. Construct a stem and leaf graph from the data set below.

27	32	43	54	61	12	57	65	63	14	37	19
11	24	35	54	25	32	40	60	39	54	51	23

9. The scattergraph shows the shoe size and heights of several pupils.

- Write down the shoe size and height of :-
  - Max
  - Alan
  - Zak
  - Tim
  - Will
  - Jon
- Is there a positive or negative correlation.
- Estimate the shoe size of Tom who is 150 centimetres tall.



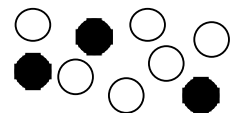
10. (a) Construct a scattergraph for the set of data below :-

Height (cm)	140	150	160	110	155	170	160	155	130	120
Weight (kg)	30	45	60	25	45	60	55	50	35	15

- Draw a line of best fit for your scattergraph.
- From your line of best fit, estimate the height of a girl who weighs 20 kilograms.

11. A bag contains 3 black balls and 6 white balls.

What is the probability of randomly picking a white ball from the bag?



12. A lucky dip contains ticket numbers from 1 up to 50. Calculate the following probabilities :-

- |                                |                                     |                                     |
|--------------------------------|-------------------------------------|-------------------------------------|
| (a) $P(23)$                    | (b) $P(\text{odd})$                 | (c) $P(\text{single digit number})$ |
| (d) $P(\text{multiple of } 4)$ | (e) $P(\text{factor of } 64)$       | (f) $P(\text{square number})$       |
| (g) $P(\text{prime})$          | (h) $P(\text{prime factor of } 30)$ |                                     |