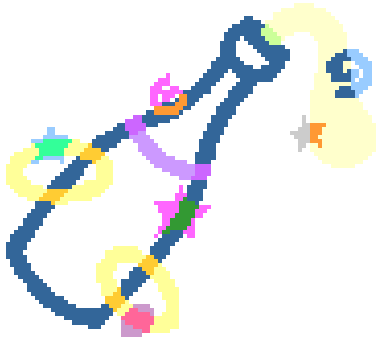
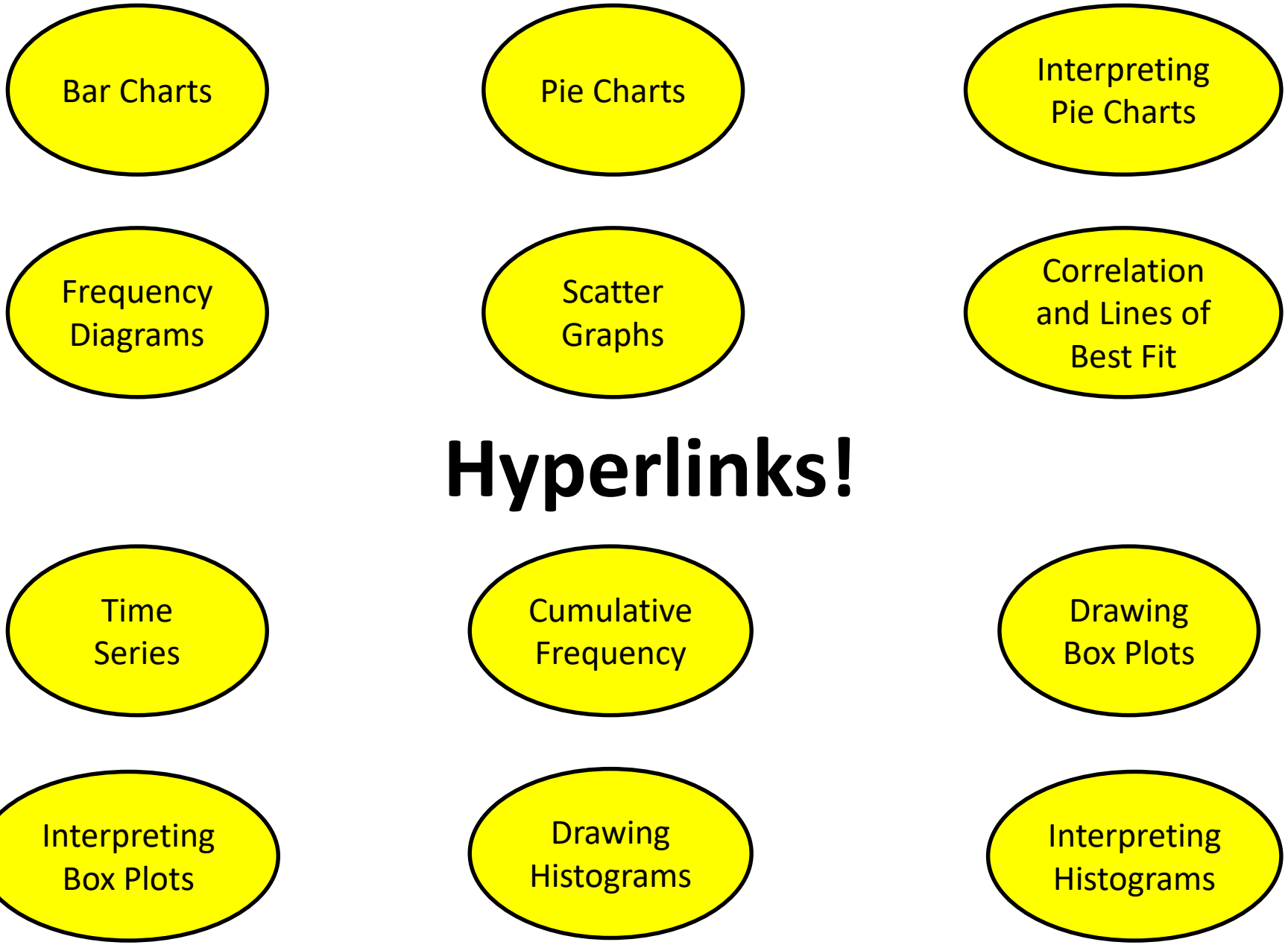
Data Handling – Displaying Data

Grades F to A




Bar Charts
Pie Charts
Interpreting Pie Charts
Frequency Diagrams
Scatter Graphs
Correlation and Lines of Best Fit
Hyperlinks!
Time Series
Cumulative Frequency
Drawing Box Plots
Interpreting Box Plots
Drawing Histograms
Interpreting Histograms

SUCCESS CRITERIA: WHERE ARE WE NOW?

Level	Learning outcomes:	R	A	G
F2	I can read and draw bar charts.			
E2	I can read and draw pie charts.			
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B2	I can use box plots to compare two sets of results.			
A2	I can draw a histogram from a set of grouped data.			
A1	I can interpret a histogram and compare sets of data using them.			

Bar charts

<u>Lesson Objective:</u>

Can I draw and read a bar charts correctly?

Grade F

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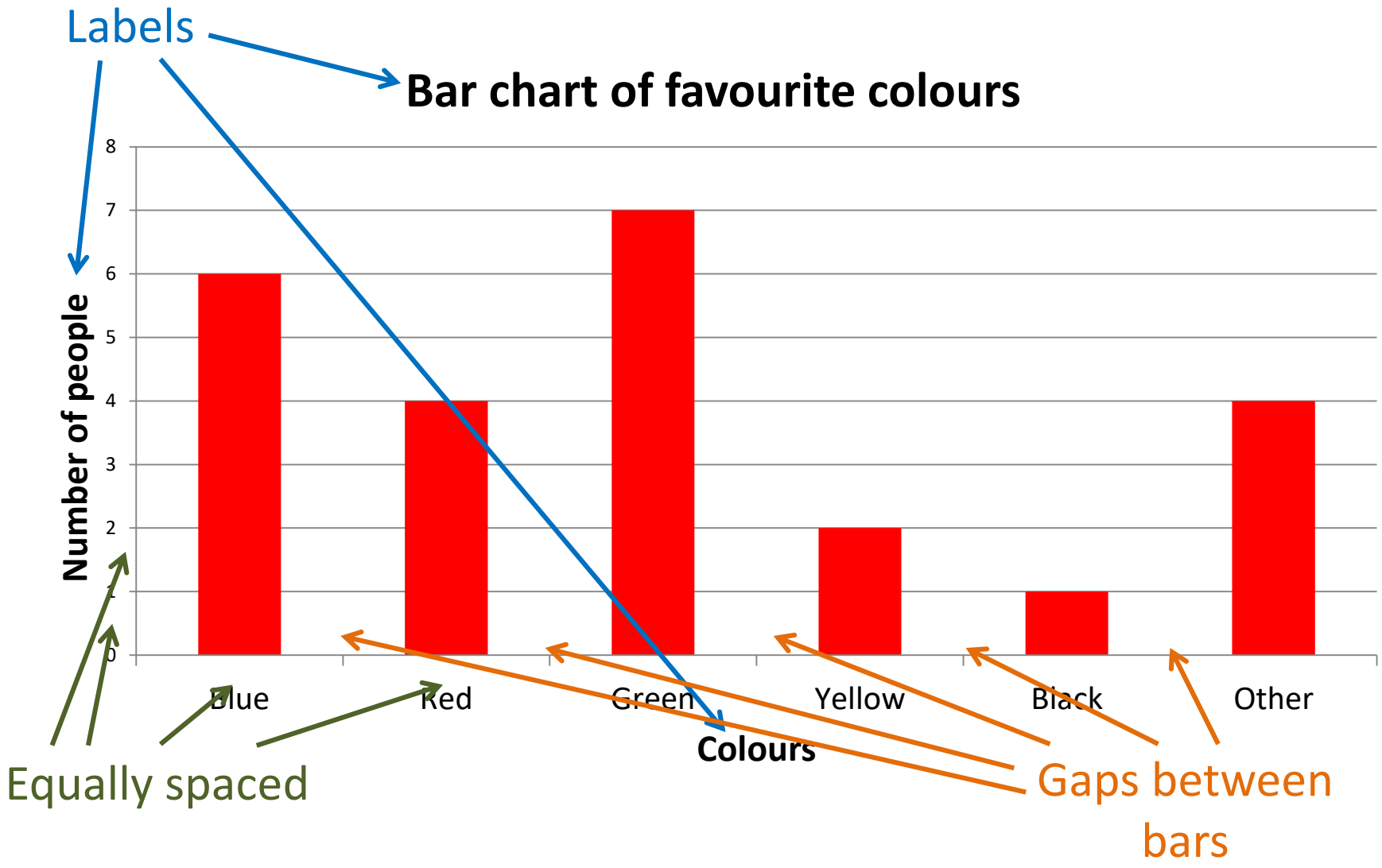
Bar chart rules!

A bar chart must have labels on each axis saying what it is showing – the y-axis (the vertical one) is “frequency” or “number of…”.

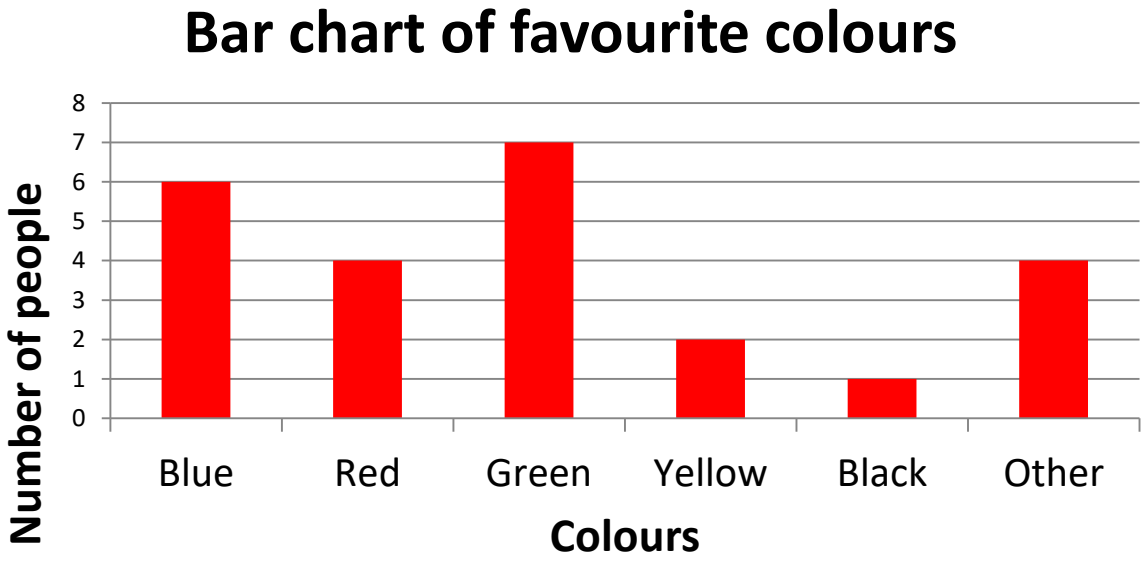
There must be gaps between the bars.

The numbers/gaps must be the same size each time.

How bar charts should look:

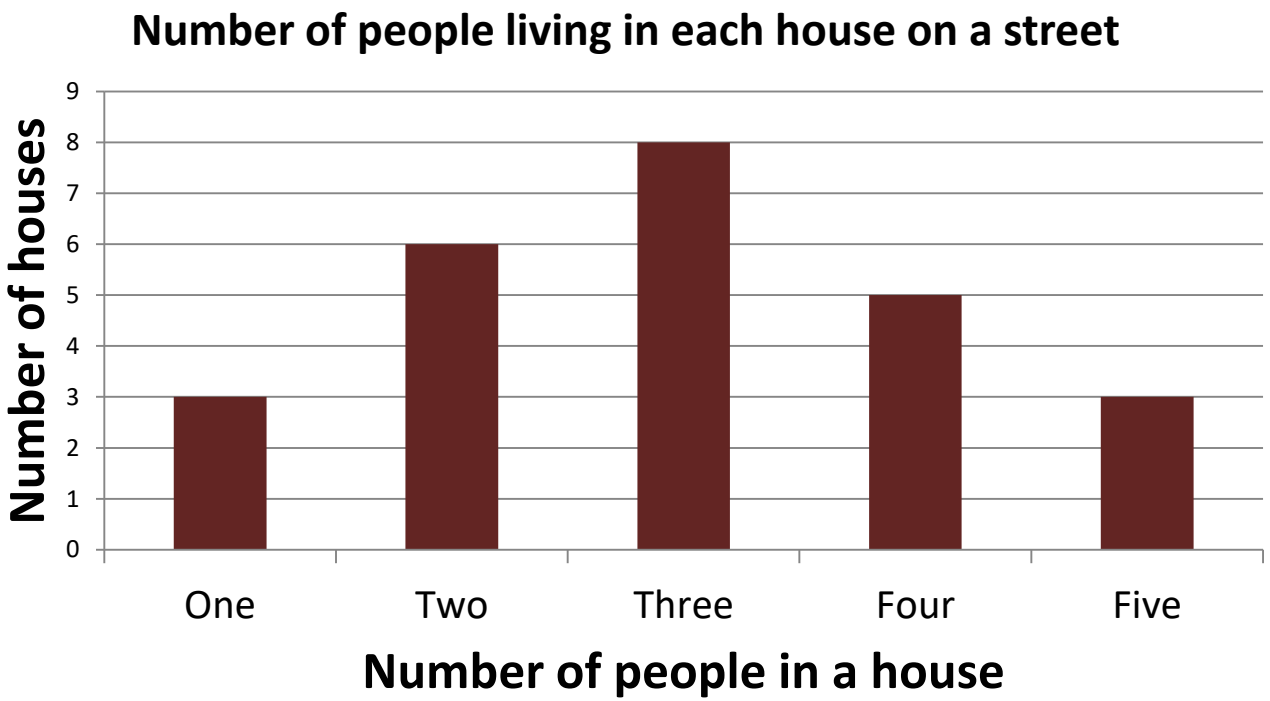


What is this bar chart showing?



1. Which was the most popular colour? **Green**
2. How many people chose red as their favourite? **5**
3. How many people were asked? **24**

One for you to try:



1. How many houses have two people living in them? **6**
2. How many houses have more than 3 people living in them? **8**
3. What is the modal number of people living in a house? **3**
4. How many houses are there on the street? **25**

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Pie charts

<u>Lesson Objective:</u>

Can I draw a pie chart correctly by calculating the angles of each sector?

Grade E

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What is a pie chart?

A pie chart represents data by showing each group as a sector or slice of a circle.

The whole circle must be used.

The key is to work out how many degrees of the pie chart each piece of data is worth.

A pie chart example:

Favourite football team	Frequency	Degrees
Brighton and Hove Albion	7	140º
Manchester United	3	60º
Chelsea	4	80º
Arsenal	2	40º
Other	2	40º
Total	18	360º

To calculate the number of degrees for each:

$$\frac{360°}{Total\ frequency} = \frac{360°}{18} = \mathbf{20°}$$

The pie chart:

A Pie Chart of Favourite Football Teams

Don’t forget to label each sector!

Put this data into a pie chart:

24 people were asked what they would have for lunch given the five choices listed.

Favourite meal	Frequency
Pizza	5
Pasta	7
Fish and Chips	2
Salad	4
Sandwich	6
Total	**24**

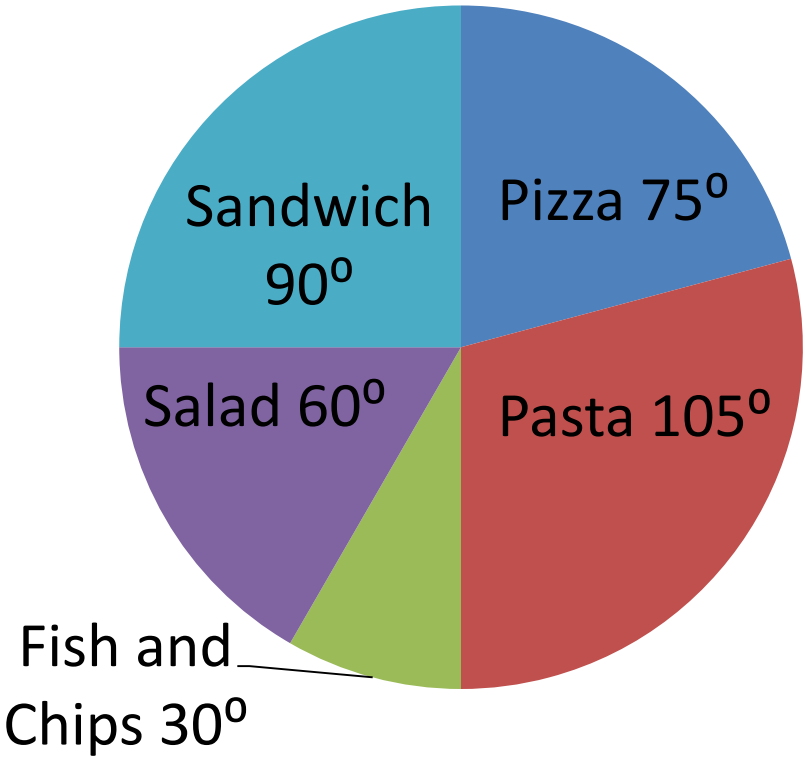
Answers:

Favourite meal	Frequency	Degrees
Pizza	5	75^o
Pasta	7	105^o
Fish and Chips	2	30^o
Salad	4	60^o
Sandwich	6	90^o
Total	**24**	**360^o**

Degrees per person = $\frac{360°}{24} = \mathbf{15°}$

The pie chart:

Pie chart showing meal choices



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Interpreting pie charts

<u>Lesson Objective:</u>

Can I read and interpret a pie chart correctly?

Grade D

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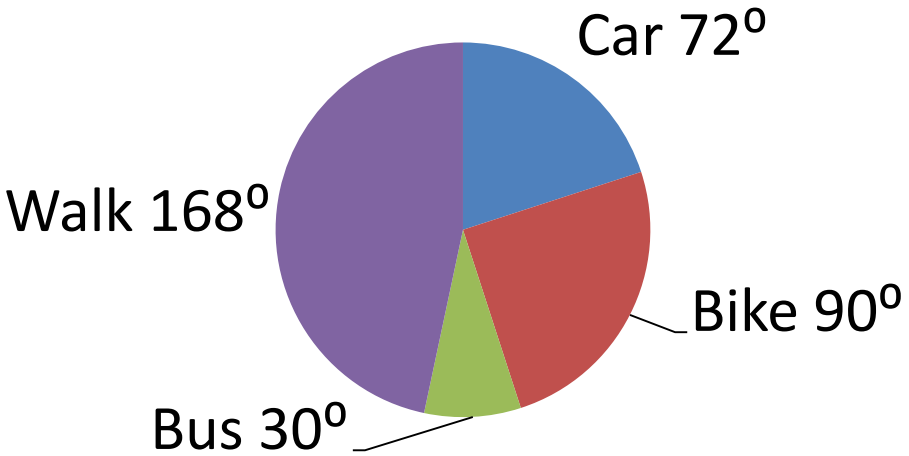
What do you mean?

What information can you read from a pie chart?

Can we make comments on data using pie charts?

Can you answer these questions?

Pie chart showing how pupils get to school



1. What is the most popular way for pupils to get to school?
2. If 15 people ride their bike, how many are driven by car?
3. How many people were surveyed?

Answering the questions:

1. What is the most popular way for pupils to get to school?

Most popular = largest section = **Walk**

2. If 15 people ride their bike, how many are driven by car?

15 people = 90^{o} so each person is 6^{o}.

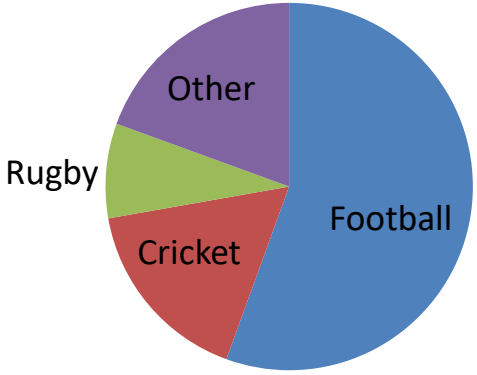
$72^{o} \div 6 =$ **12 people**

3. How many people were surveyed?

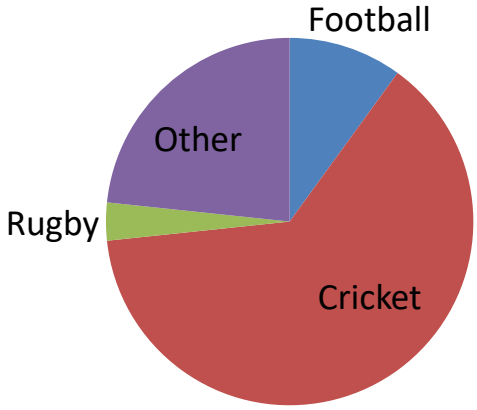
$360^{o} \div 6 =$ **60 people**

Can you compare these two pie charts?

Favourite sports in the UK



Favourite sports in India



1. In which country was cricket the most popular sport? **India**
2. Which country had the most people who prefer football? **You can't tell – no total given**

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Frequency diagrams

<u>Lesson Objective:</u>

Can I draw a frequency diagram given a set of data?

Grade C

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What are frequency diagrams?

These are ways of displaying continuous data.

There are a couple of types you will see:

A histogram – basically a bar chart with continuous data (no gaps between the bars). At this point all the groups/bars will be the same width.

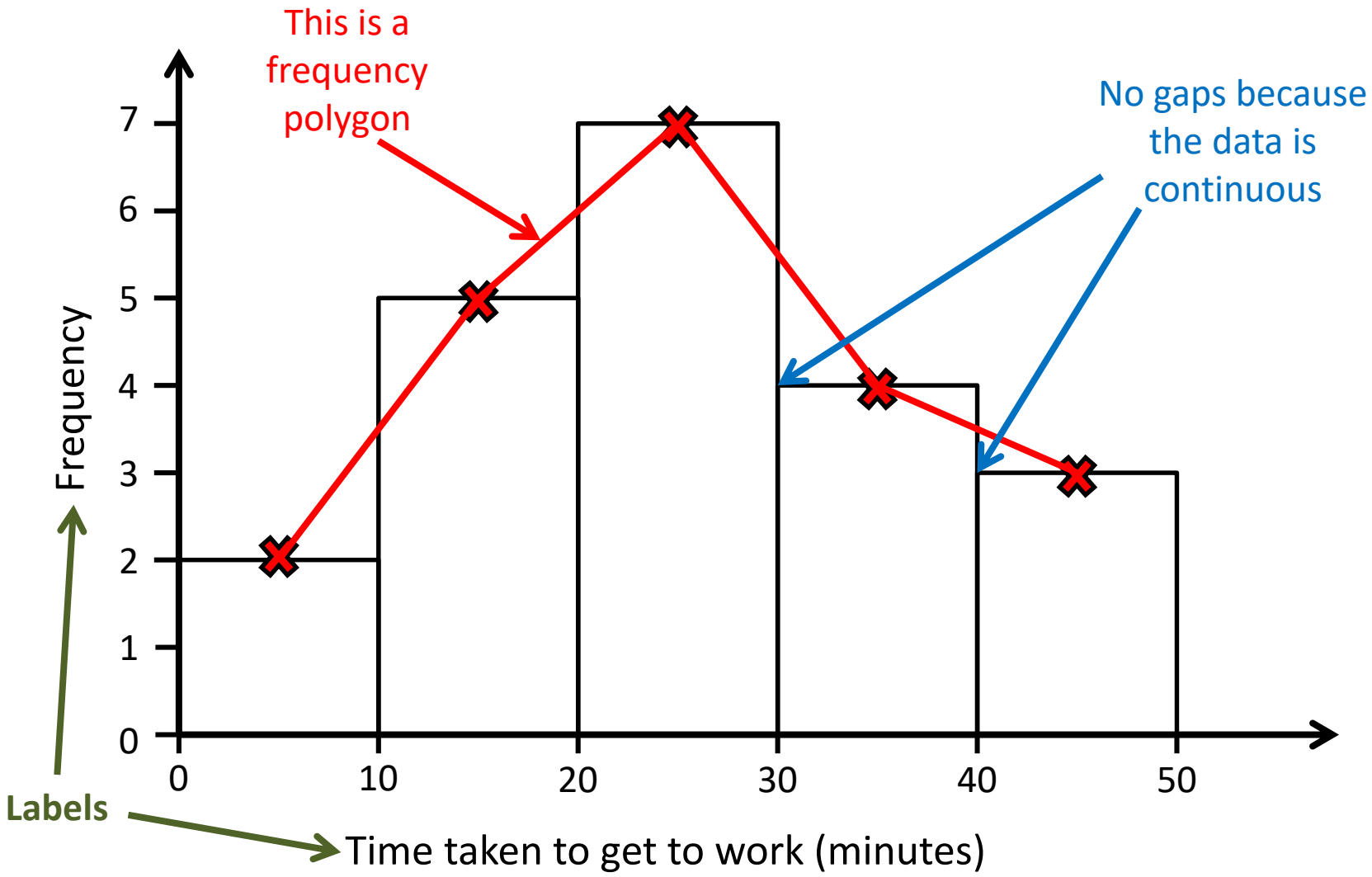
A frequency polygon – a line between crosses in the middle of each group at the frequency height.

Data for a frequency diagram:

Time taken to get to work (t minutes)	Frequency
$0 \leq t < 10$	2
$10 \leq t < 20$	5
$20 \leq t < 30$	7
$30 \leq t < 40$	4
$40 \leq t < 50$	3

Time is continuous data

A frequency diagram:



Draw a frequency diagram for this data:

Length of foot (f cm)	Frequency
$5 \leq f < 10$	1
$10 \leq f < 15$	3
$15 \leq f < 20$	7
$20 \leq f < 25$	9
$25 \leq f < 30$	8
$30 \leq f < 35$	4
$35 \leq f < 40$	2

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Scatter graphs

<u>Lesson Objective:</u>

Can I plot points on a scatter graph?

Grade C

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What does a scatter graph show?

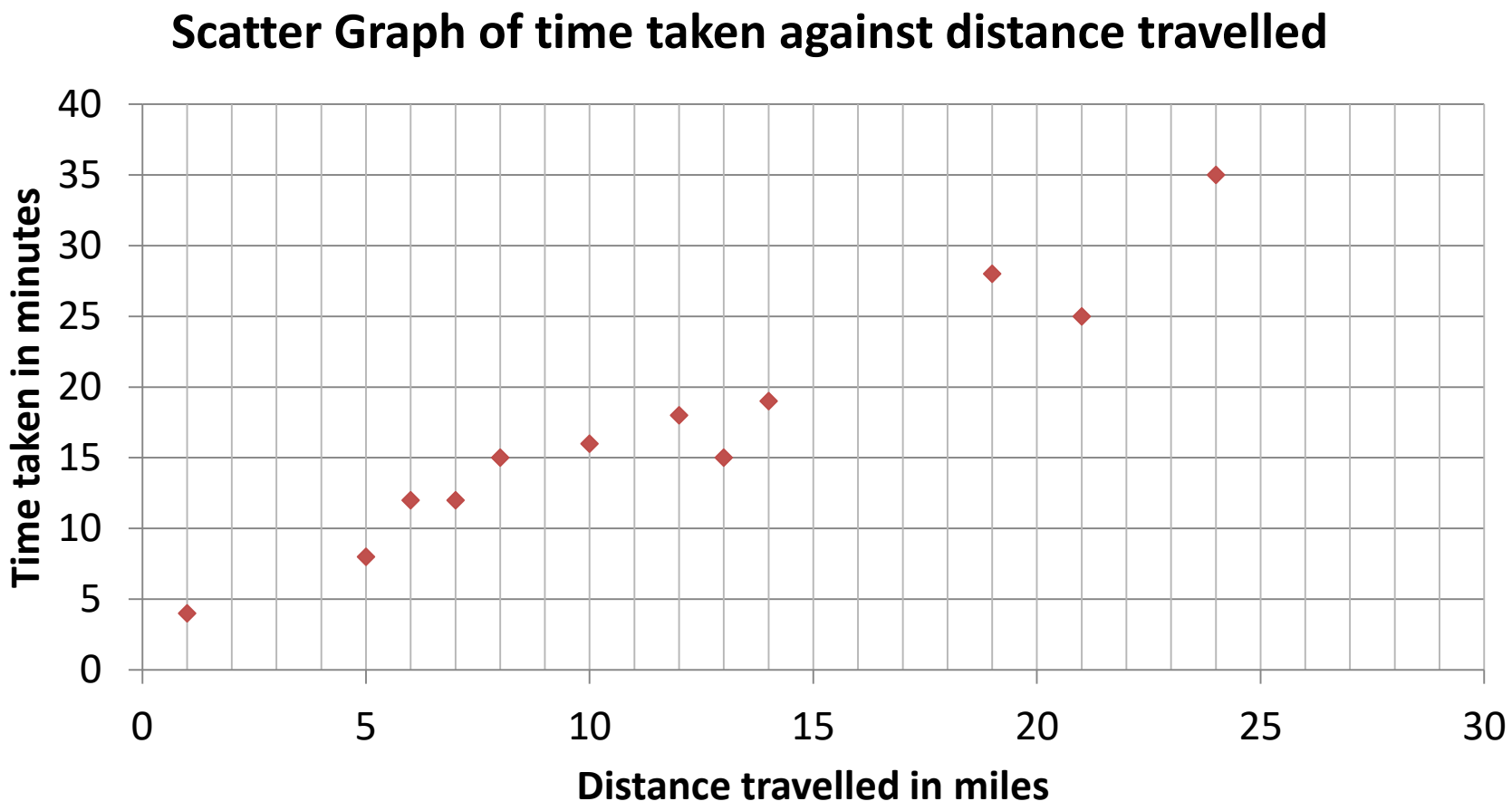
They show whether there's a relationship between two sets of results.

Points are plotted like co-ordinates.

Data for a scatter graph:

Distance travelled in miles	Time taken in minutes
7	12
10	16
24	35
1	4
12	18
14	19
21	25
6	12
8	15
19	28
13	15
5	8

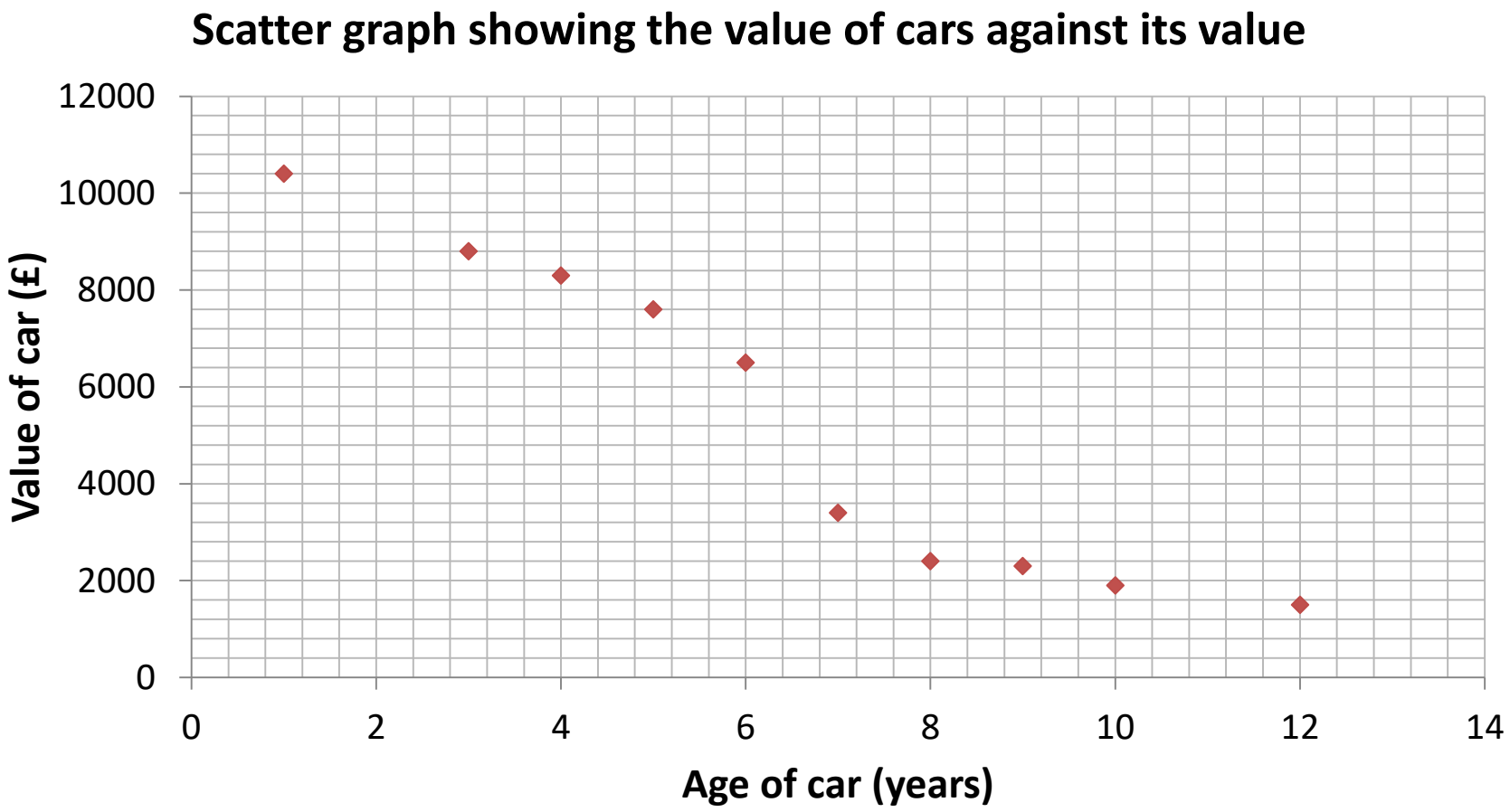
The scatter graph:



Draw a scatter graph of this data:

Age of car (years)	Value of car (£)
4	8300
8	2400
5	7600
10	1900
12	1500
1	10400
6	6500
3	8800
9	2300
7	3400

How the scatter graph should look:



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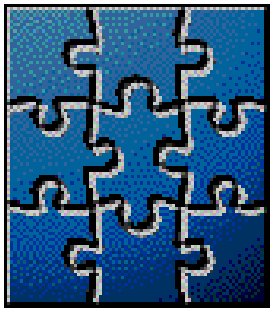
Correlation and lines of best fit with scatter graphs

<u>Lesson Objective:</u>

Can I describe correlation and use a line of best fit to estimate an answer?

Grade C



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What is correlation and a line of best fit?

Correlation describes the relationship between the data.

There are 3 types of correlation:

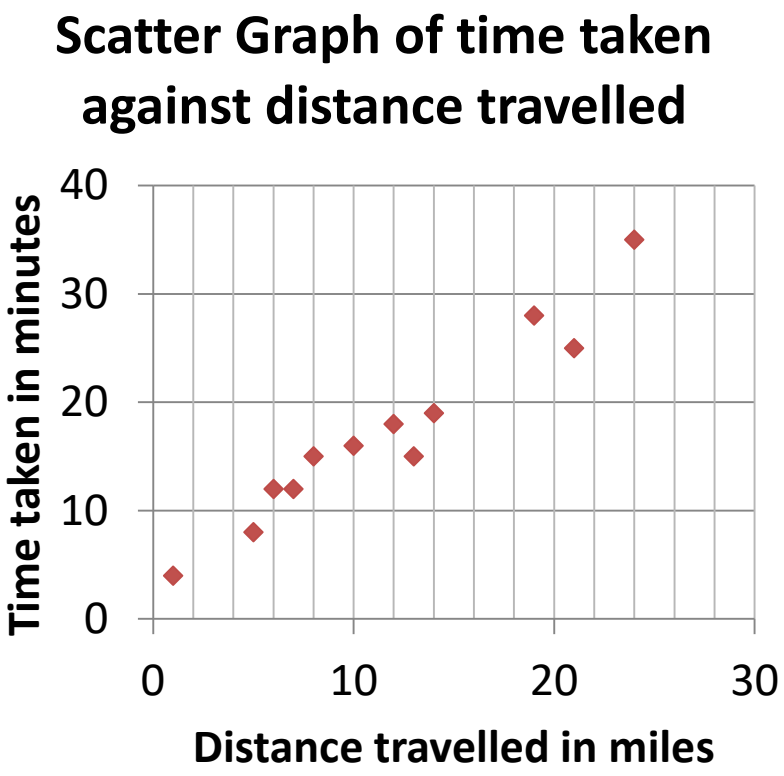
Positive, Negative and No Correlation

A line of best fit is a straight line through the middle of all the points as best you can.

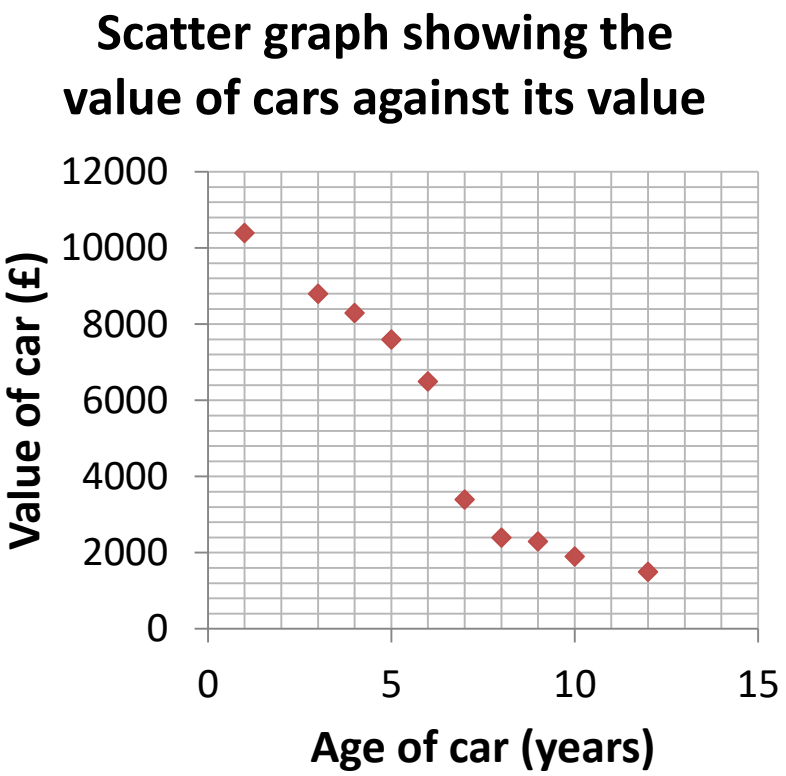
The line of best fit does not have to go through the origin!

What correlation looks like:

Positive correlation:



Negative correlation:



No correlation: the points are spread randomly around the grid.

Correlation in words:

Positive correlation: As one set of data increases, so does the other.

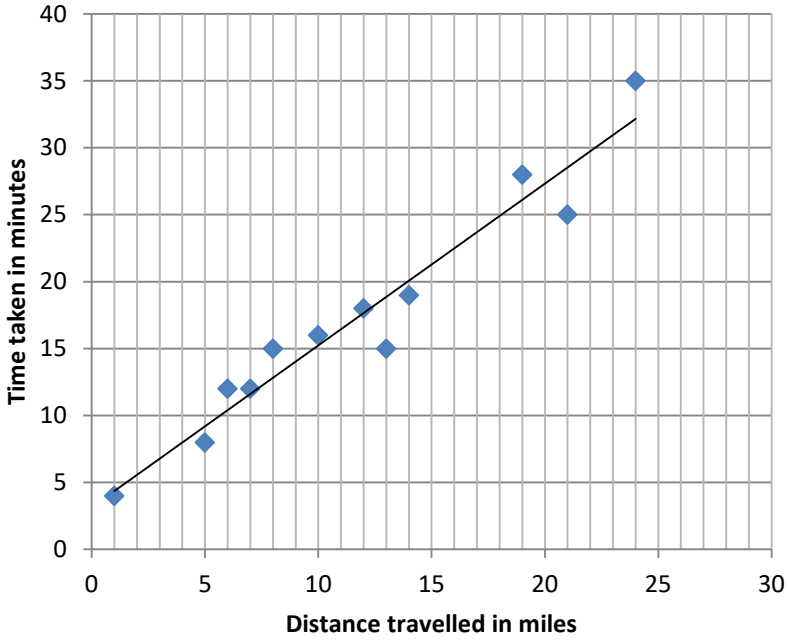
Negative correlation: As one set of data increases, the other decreases.

No correlation: The data is not related in any way.

What a line of best fit looks like:

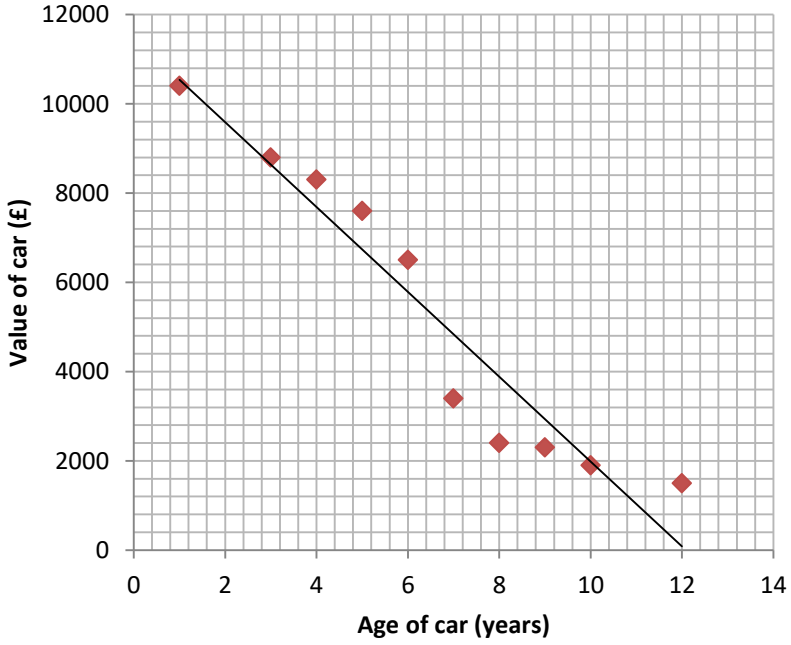
Positive correlation:

Scatter Graph of time taken against distance travelled



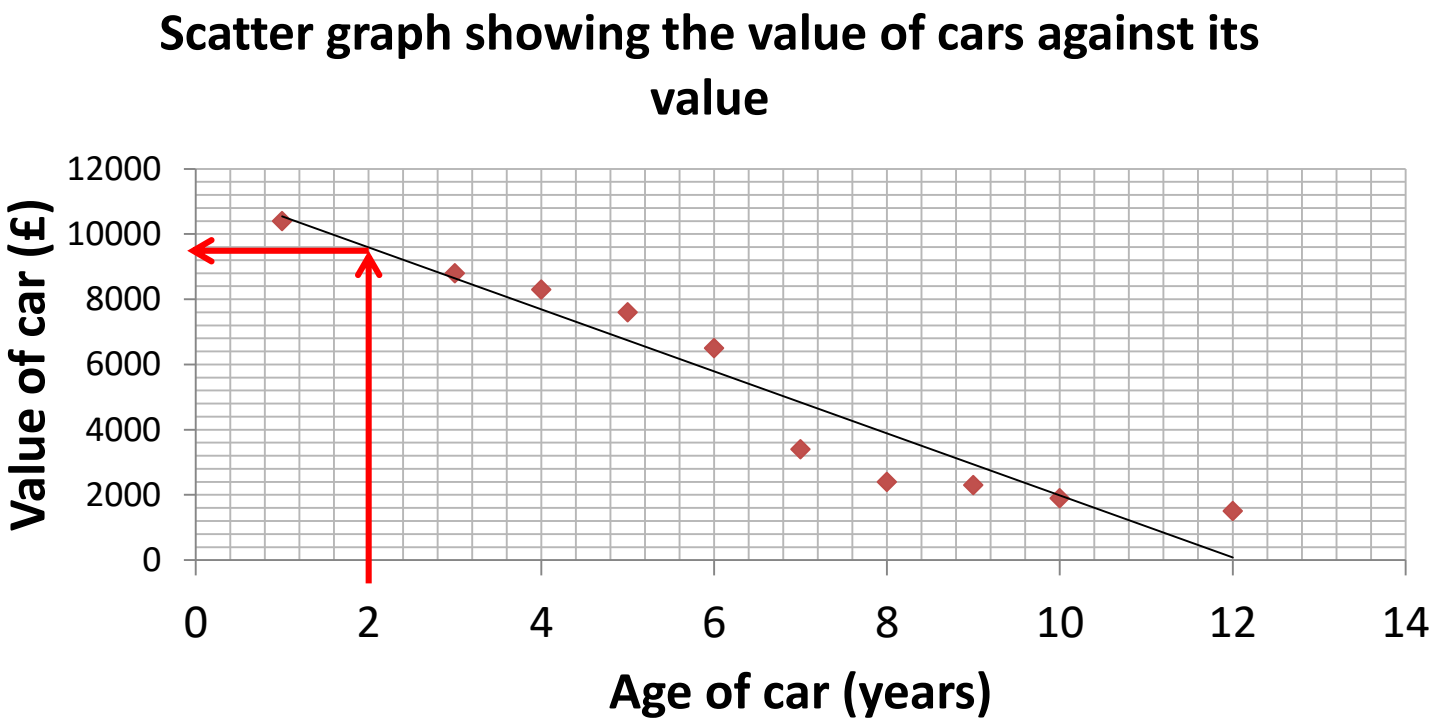
Negative correlation:

Scatter graph showing the value of cars against its value



No correlation: you can't draw a line of best fit.

Using a line of best fit:



How much would you expect a car that is 2 years old to be worth?

£9500

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Time series

<u>Lesson Objective:</u>

Can I draw and use a time series graph to predict a result?

Grade C

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What are time series?

Time series show trend.

They plot results over periods of time – hence the name.

They are used to predict what could happen in the future.

How do you draw them?

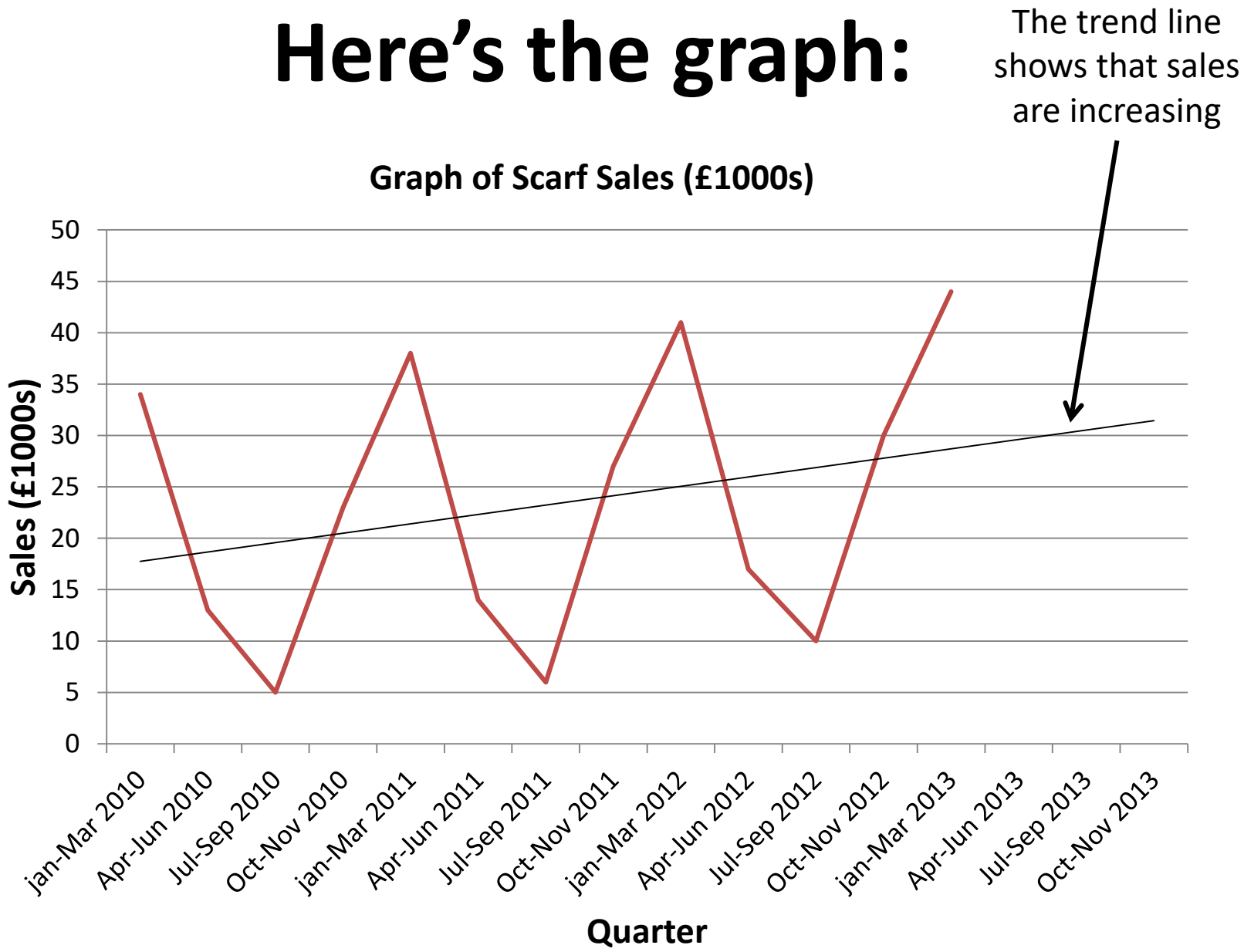
Below is a table showing the sales made by a small scarf company:

Quarter	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Mar 2011	Apr-Jun 2011	Jul-Sep 2011	Oct-Dec 2011
Sales (£1000s)	34	13	5	23	38	14	6	27
Quarter	**Jan-Mar 2012**	**Apr-Jun 2012**	**Jul-Sep 2012**	**Oct-Dec 2012**	**Jan-Mar 2013**	**Apr-Jun 2013**	**Jul-Sep 2013**	**Oct-Dec 2013**
Sales (£1000s)	41	17	10	30	44	?	?	?

Are sales on the increase?

It's difficult to tell, but a time series graph should show the sales' trend.

Here's the graph:

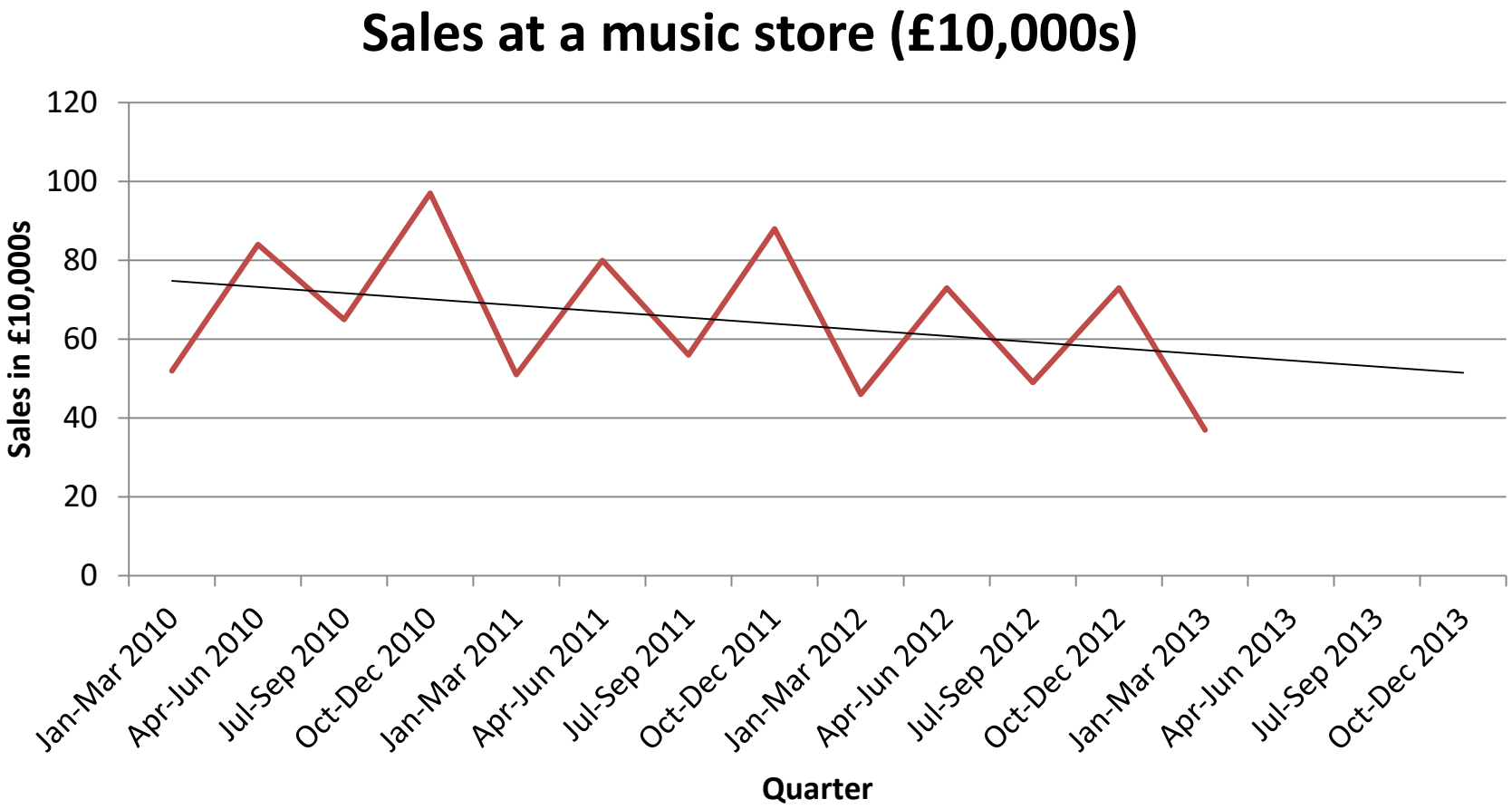


Can you draw a time series graph for this data and describe what's happening?

Below is a table showing the sales made by at a music store:

Quarter	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Mar 2011	Apr-Jun 2011	Jul-Sep 2011	Oct-Dec 2011
Sales (£10,000s)	52	84	65	97	51	80	56	88
Quarter	**Jan-Mar 2012**	**Apr-Jun 2012**	**Jul-Sep 2012**	**Oct-Dec 2012**	**Jan-Mar 2013**	**Apr-Jun 2013**	**Jul-Sep 2013**	**Oct-Dec 2013**
Sales (£10,000s)	46	73	49	73	37	?	?	?

Answer:


Sales at a music store (£10,000s)
Sales in £10,000s
120
100
80
60
40
20
0
Jan-Mar 2010
Apr-Jun 2010
Jul-Sep 2010
Oct-Dec 2010
Jan-Mar 2011
Apr-Jun 2011
Jul-Sep 2011
Oct-Dec 2011
Jan-Mar 2012
Apr-Jun 2012
Jul-Sep 2012
Oct-Dec 2012
Jan-Mar 2013
Apr-Jun 2013
Jul-Sep 2013
Oct-Dec 2013
Quarter

SUCCESS CRITERIA: WHERE ARE WE NOW?

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F2	I can read and draw bar charts.			
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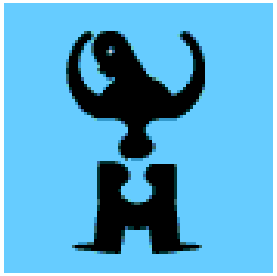
C3	I can plot a graph of a time series.			
B3	I can draw and read a cumulative frequency diagram.			
B3	I can draw and interpret a box-and-whisker plot.			
B2	I can use box plots to compare two sets of results.			
A2	I can draw a histogram from a set of grouped data.			
A1	I can interpret a histogram and compare sets of data using them.			

Cumulative frequency

<u>Lesson Objective:</u>

Can I draw a cumulative frequency graph?

Grade B



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A1	I can interpret a histogram and compare sets of data using them.			

What does cumulative mean?

“Cumulative” means to “add up as you go”.

It gives a total up to a certain point.

Cumulative frequency adds up the frequency as you move up through the groups.

Cumulative frequency can’t go down!

A cumulative frequency table:

Age group (x years)	Frequency	Cumulative Frequency
$0 \leq x < 10$	6	6
$10 \leq x < 20$	13	19
$20 \leq x < 30$	17	36
$30 \leq x < 40$	12	48
$40 \leq x < 50$	8	56
$50 \leq x < 60$	4	60

We add up the frequency as we go (up to the red line each time)…

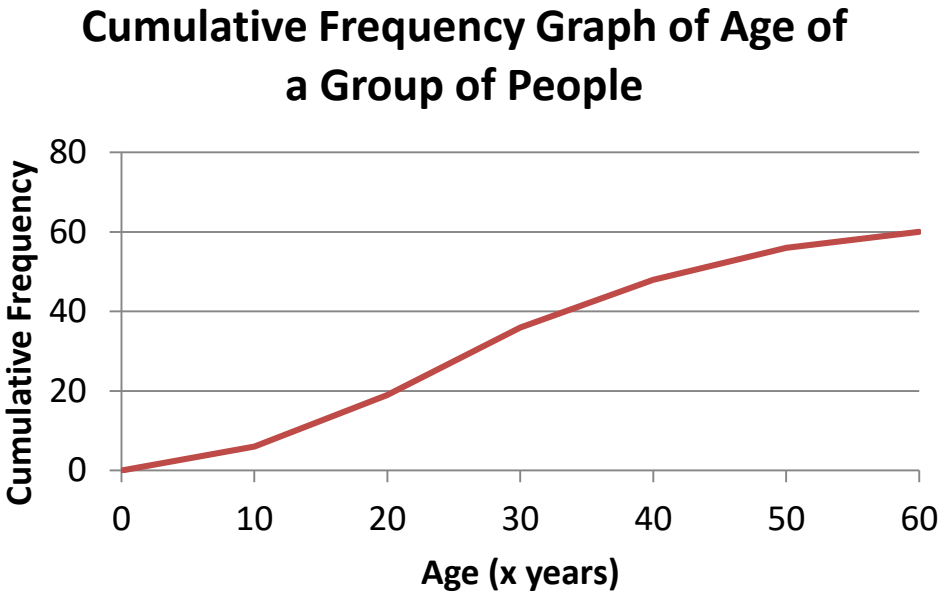
What happens next?

Once we've done the cumulative frequency we plot it on a graph.

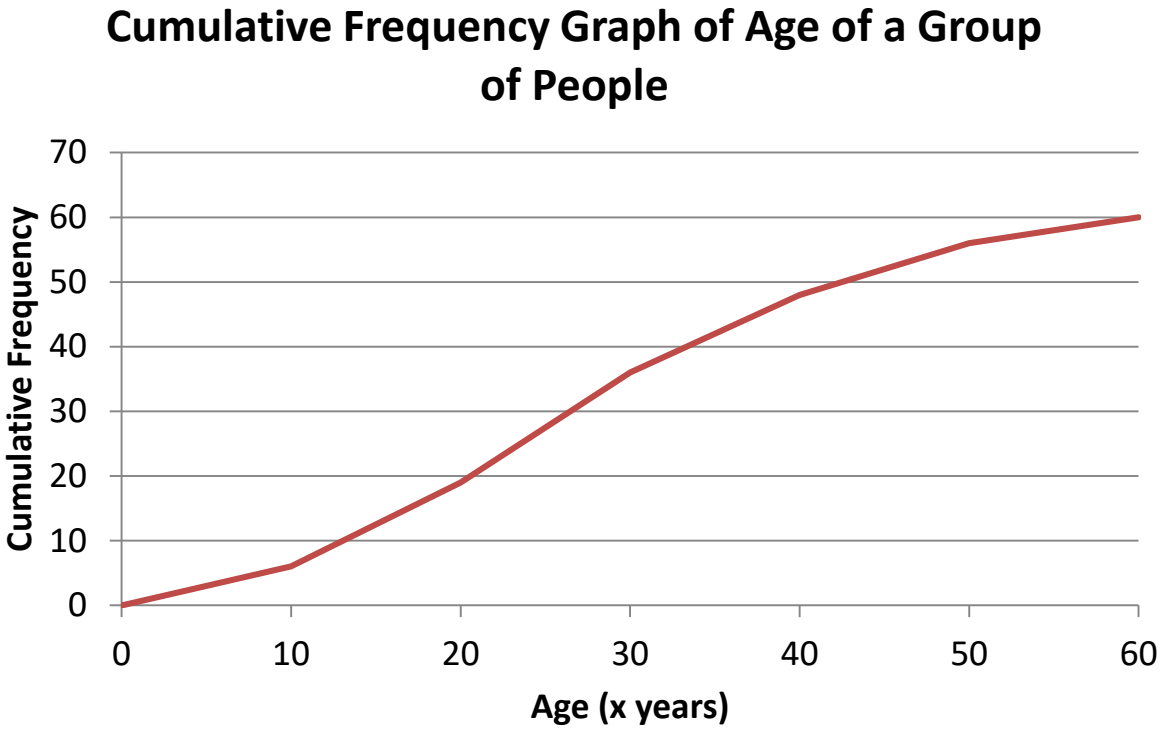
You must plot at the top of each group because it's showing the frequency up to that point.

A cumulative frequency graph:

Age Group (x years)	Frequency	Cumulative Frequency
$0 \le x < 10$	6	6
$10 \le x < 20$	13	19
$20 \le x < 30$	17	36
$30 \le x < 40$	12	48
$40 \le x < 50$	8	56
$50 \le x < 60$	4	60



Calculations from the graph:



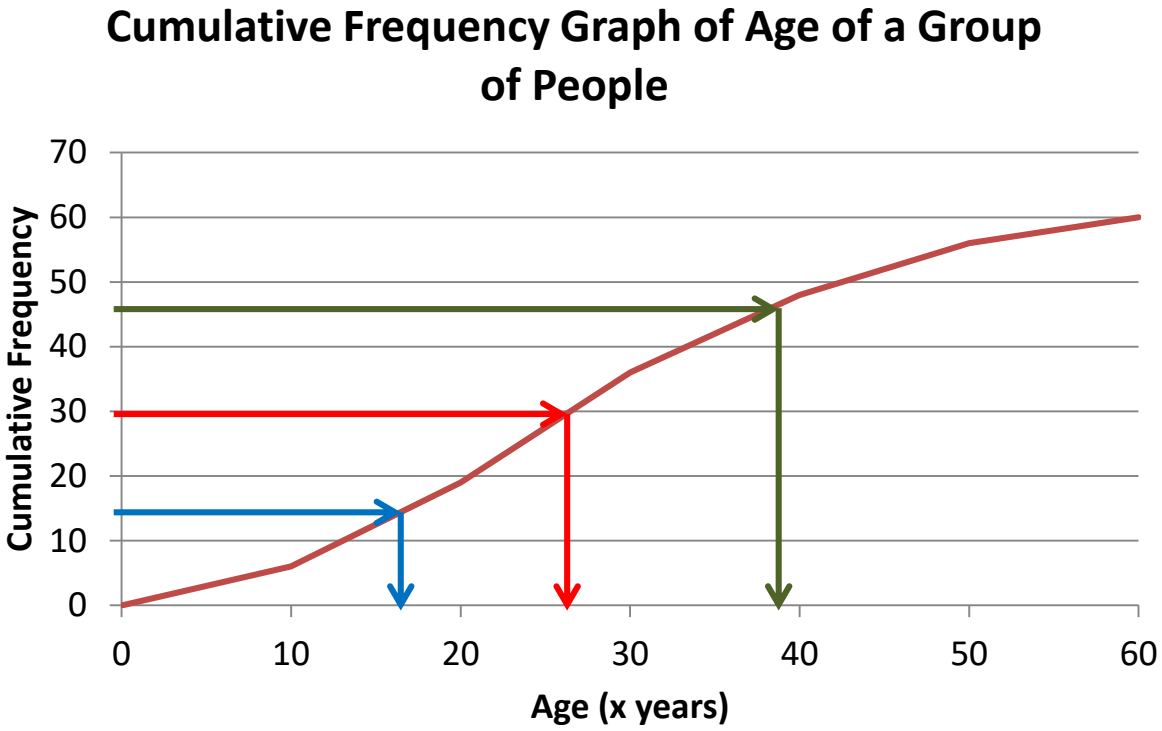
We can now calculate the median, the lower and upper quartiles and the inter-quartile range from the graph.

Calculations from the graph:

Upper quartile is a three quarters of the way

Median is halfway

Lower quartile is a quarter of the way



Median: **27**

Lower Quartile: **17**

Upper Quartile: **39**

Inter-quartile range: **39 - 17 = 22**

One for you to do:

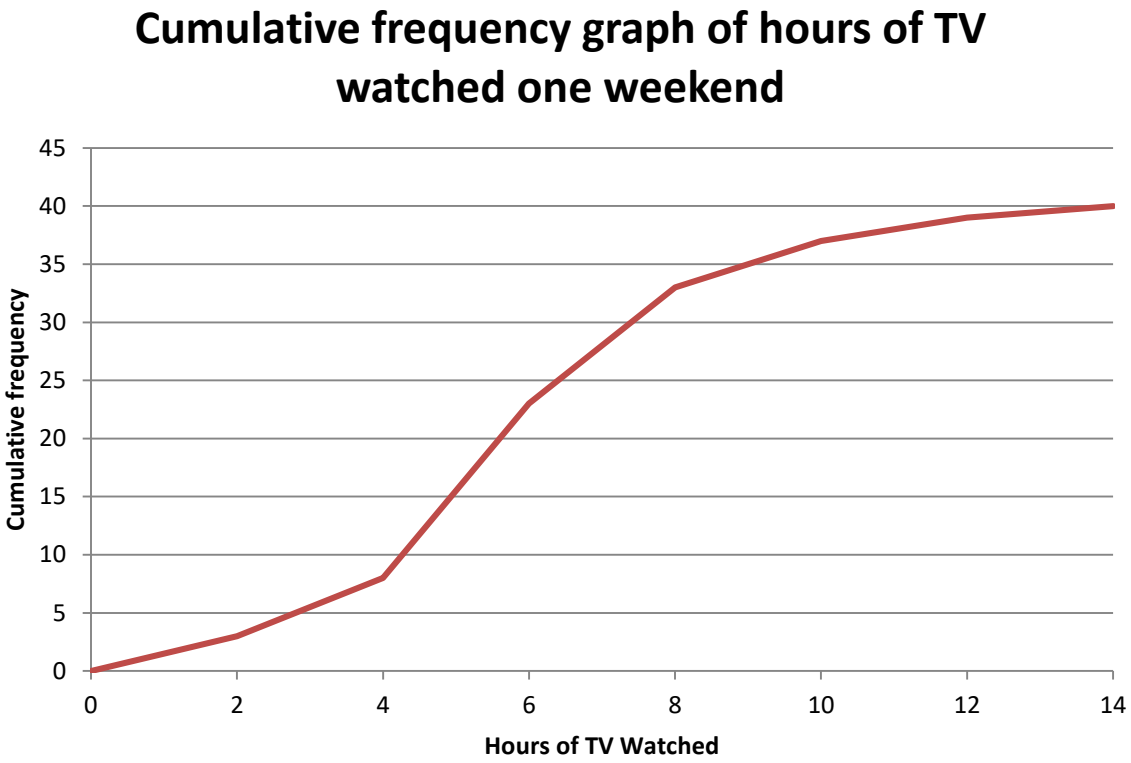
Hours spent watching TV last weekend (h hours)	Frequency
$0 \leq h < 2$	3
$2 \leq h < 4$	5
$4 \leq h < 6$	15
$6 \leq h < 8$	10
$8 \leq h < 10$	4
$10 \leq h < 12$	2
$12 \leq h < 14$	1

Draw a cumulative frequency graph for this data and then calculate the median and inter-quartile range.

Answers:

Hours spent watching TV last weekend (h hours)	Frequency	Cumulative Frequency
$0 \leq h < 2$	3	**3**
$2 \leq h < 4$	5	**8**
$4 \leq h < 6$	15	**23**
$6 \leq h < 8$	10	**33**
$8 \leq h < 10$	4	**37**
$10 \leq h < 12$	2	**39**
$12 \leq h < 14$	1	**40**

Answers:



Median: **5.5 hours**

Inter-quartile range: **7.5 – 4.2 = 3.3 hours**

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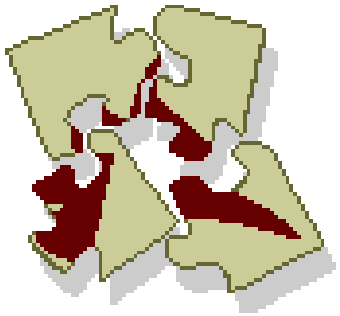
Drawing box plots

<u>Lesson Objective:</u>

Can I draw a box plot given the correct data?

Grade B



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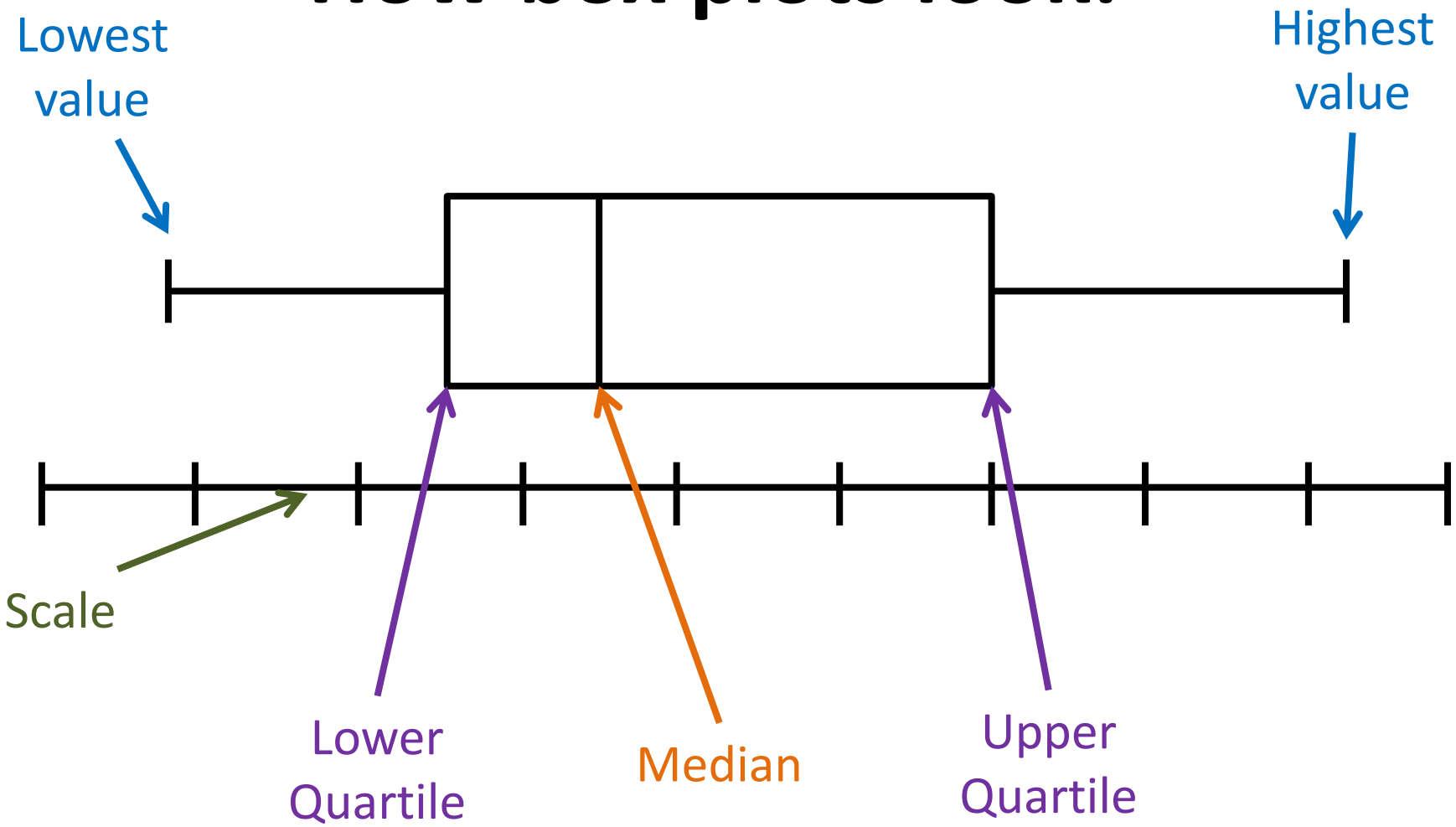
What is a box plot?

These are sometimes called “box and whisker” diagrams.

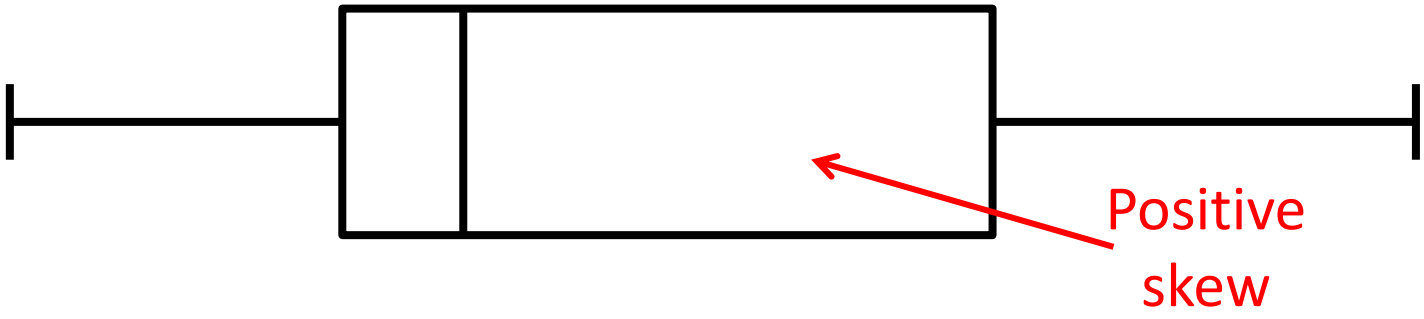
The “box” shows the inter-quartile range and has a line within the box representing the median.

The “whiskers” are lines that show below the lower quartile and above the upper quartile.

How box plots look:



Skewness: determined by the position of the median.



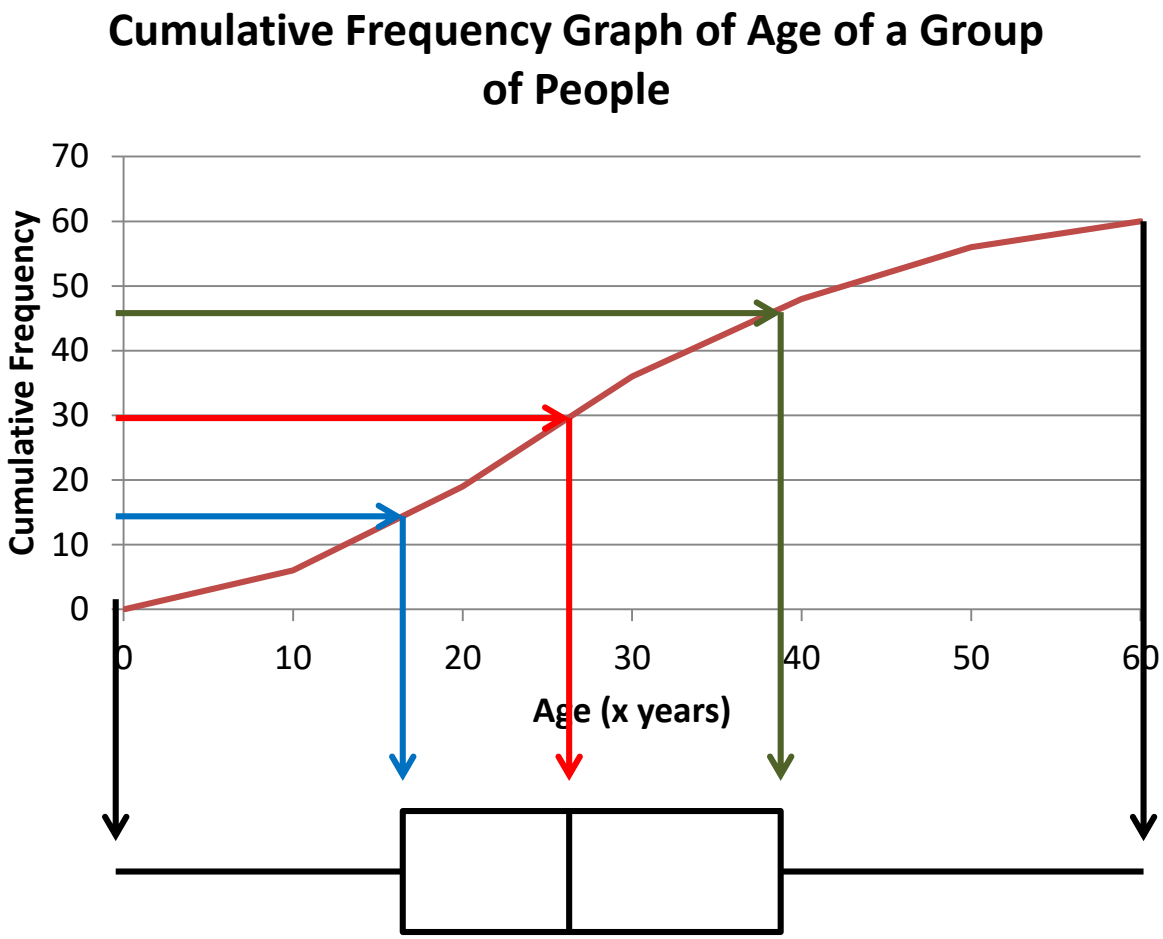
Box plots and cumulative frequency graphs:

Box plots are often used alongside cumulative frequency graphs.

You must compare medians and the inter-quartile range.

Each question will ask for two comparisons one for each of the above.

Calculations from the graph:

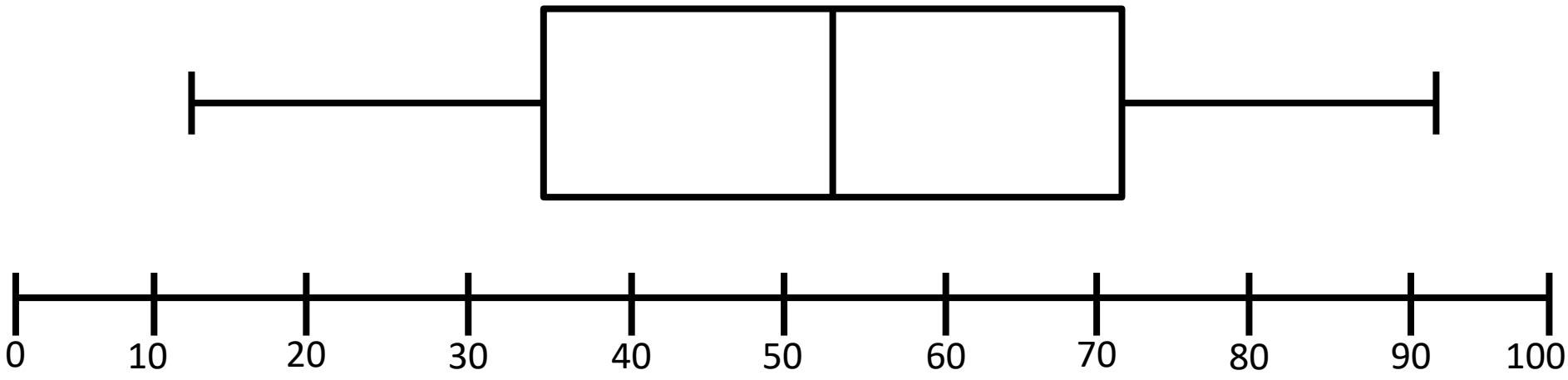


Draw a box plot for these exam marks:

Here are 15 test marks out of 100:

53, 72, 34, 48, 92, 55, 12, 43

82, 19, 27, 43, 58, 66, 73



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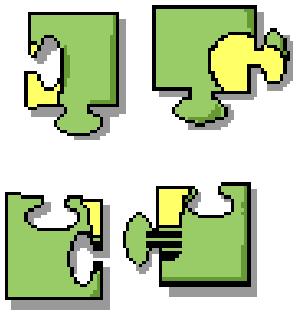
Interpreting box plots

<u>Lesson Objective:</u>

Can I compare sets of data using box plots?

Grade B



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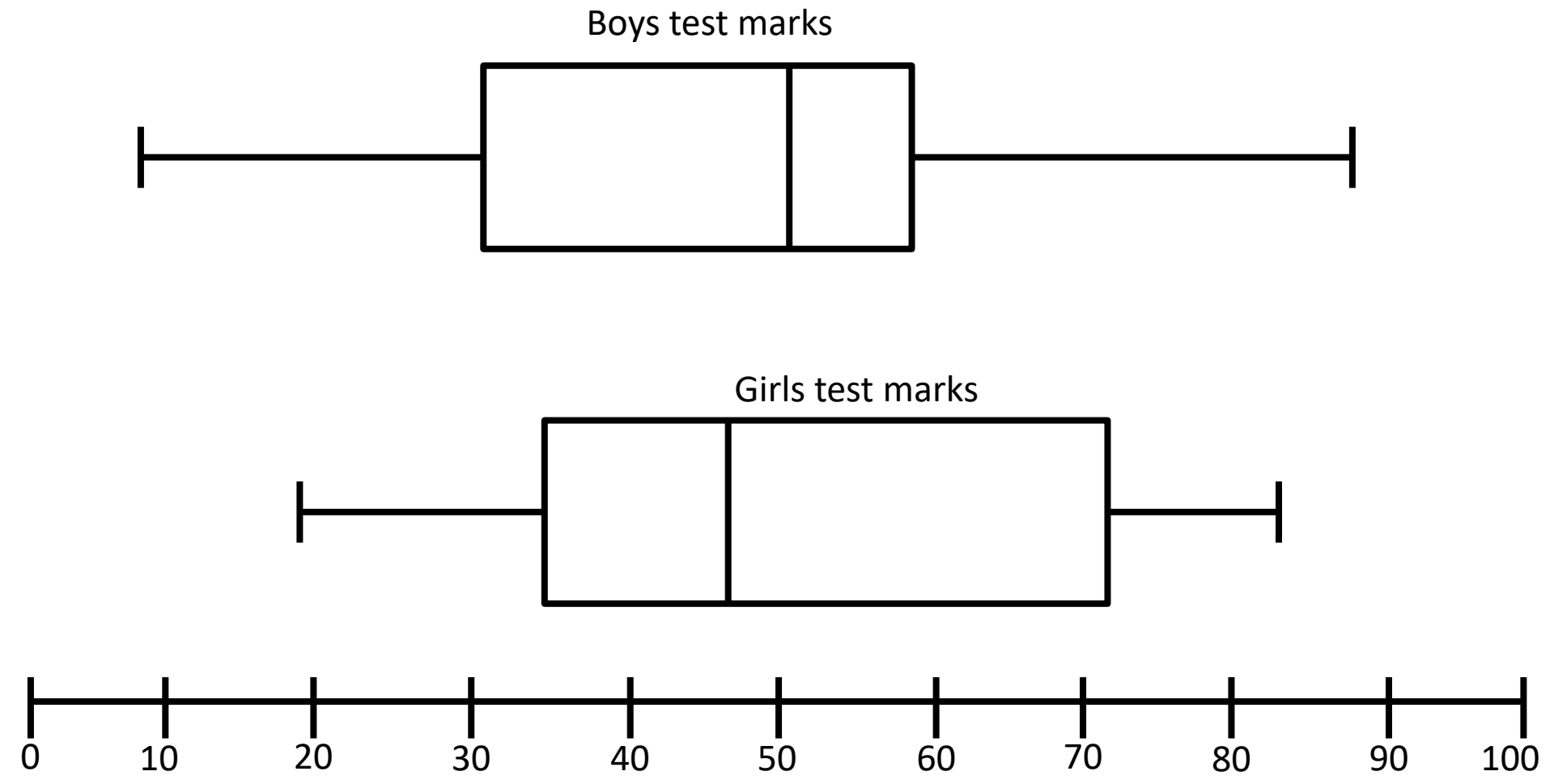
What does this mean?

This will normally involve you comparing two box plots.

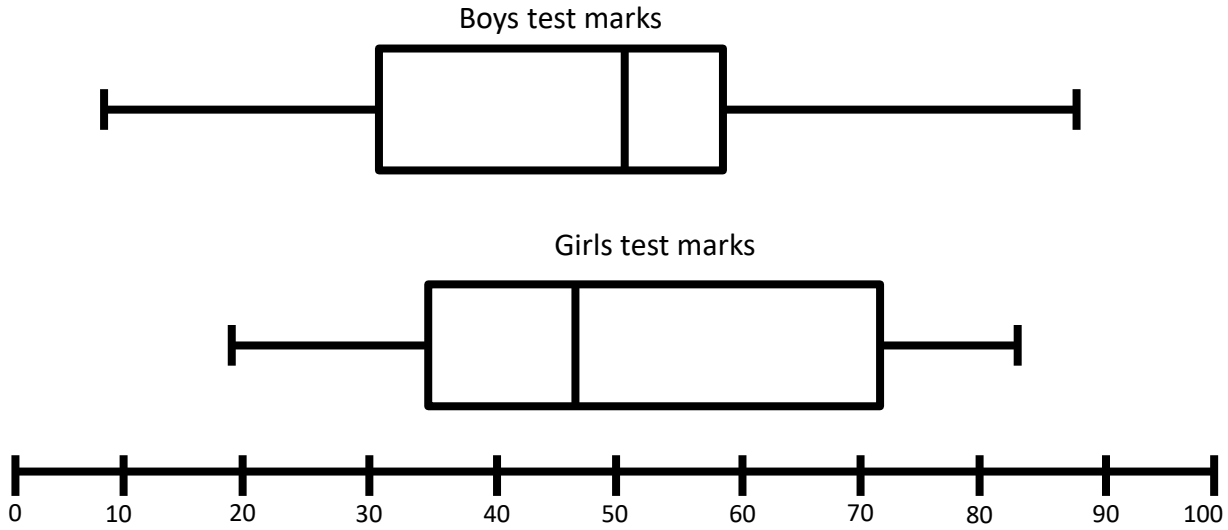
You would be expected to make a couple of comparisons.

Compare average and range (or inter-quartile range).

Make two comments about this data:



Possible comments about this data:

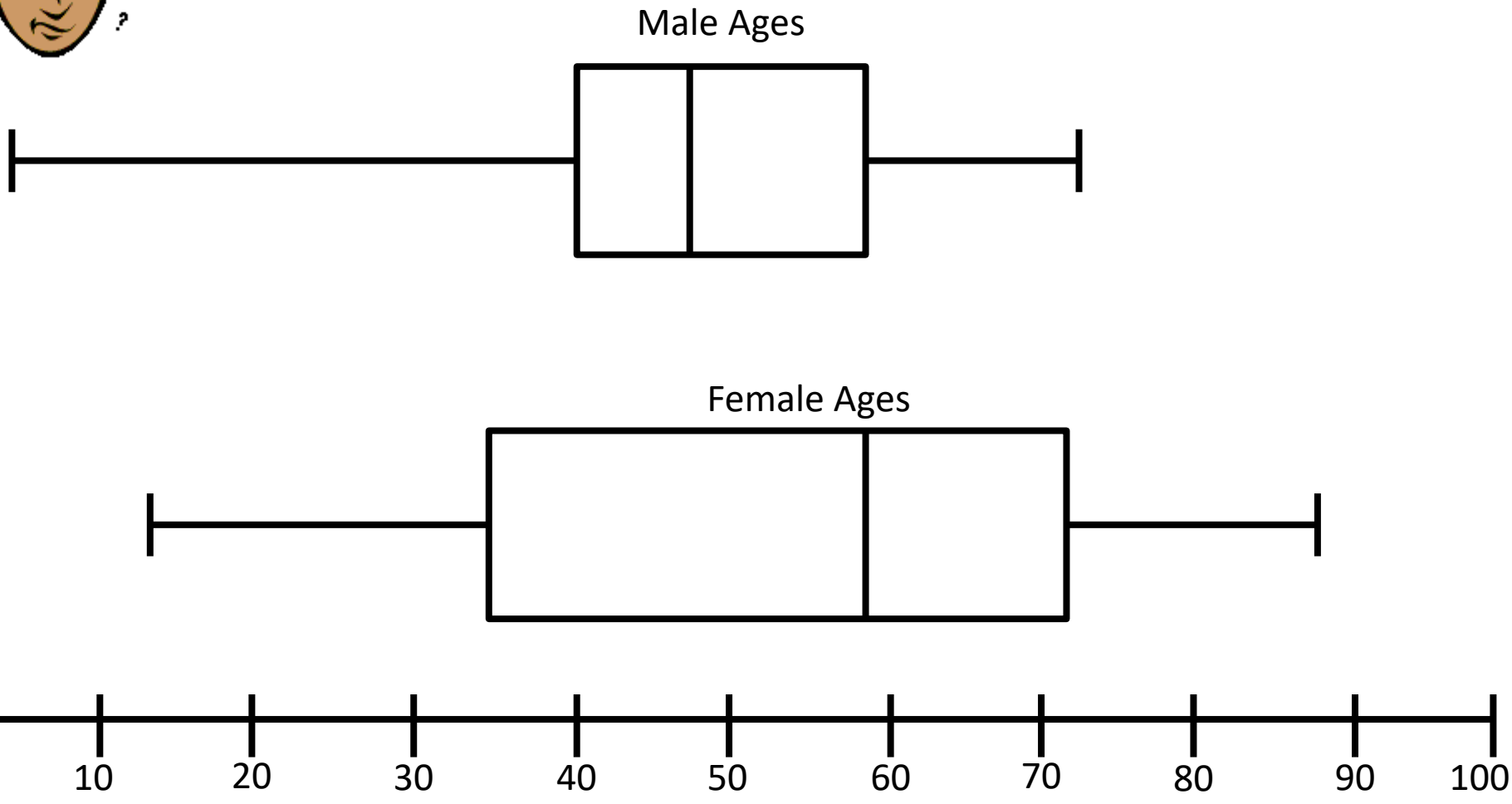


Boys had a higher median/average mark than girls. The boys' median was 50 and the girls' median was 47.

Boys had a larger range than the girls. The boys' range was 79 and the girls' range was 64.

Girls had a larger inter-quartile range than the boys. The girls' IQR was 37 whereas the boys' IQR was 29.

Make two comments about this data from a group of club members:



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Drawing histograms

<u>Lesson Objective:</u>

Can I draw a histogram where the groups are different widths?

Grade A

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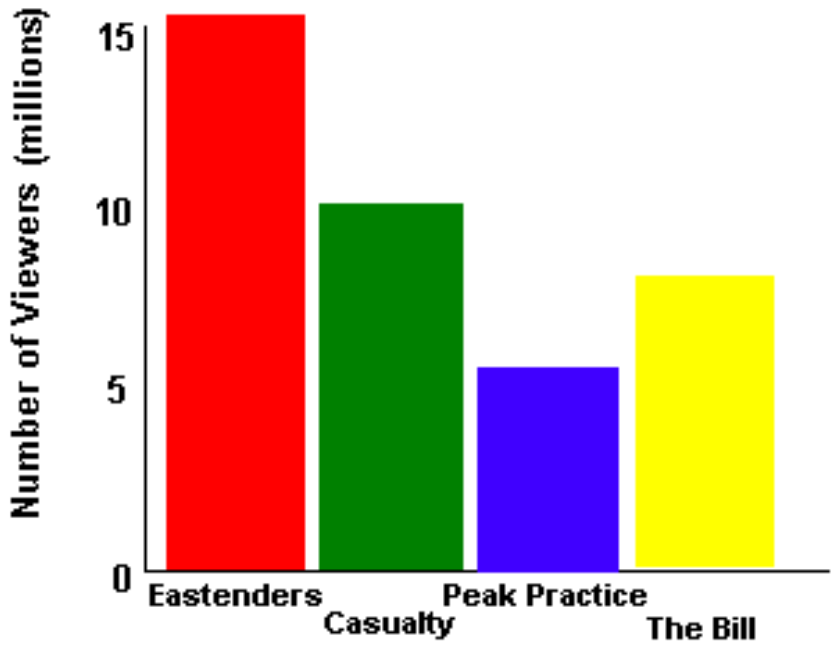
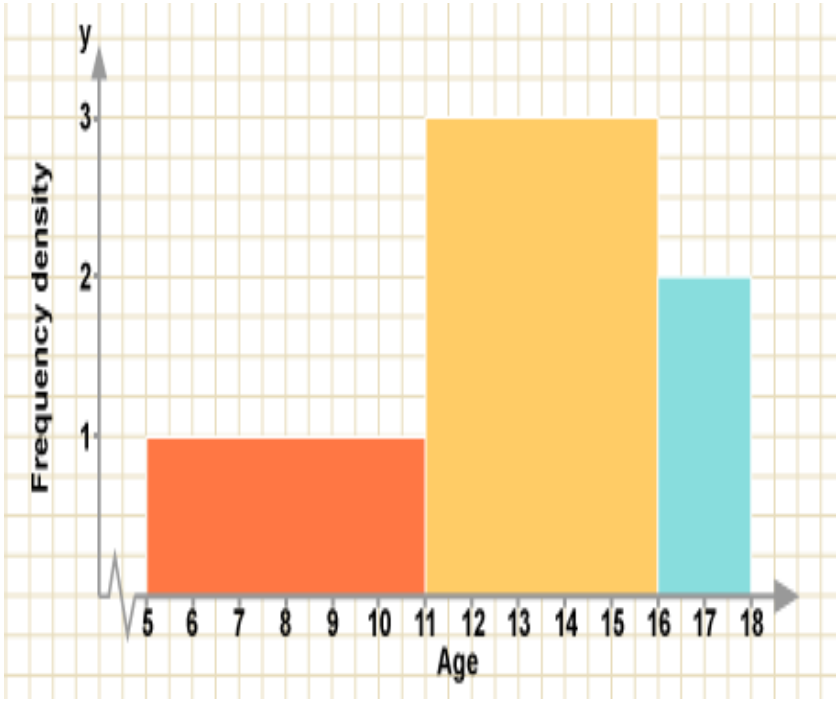
Spot The Difference

Bar Chart



Histogram



Write down any differences you notice between the two graphs, including the bars, the axes and note down anything you aren't sure about.

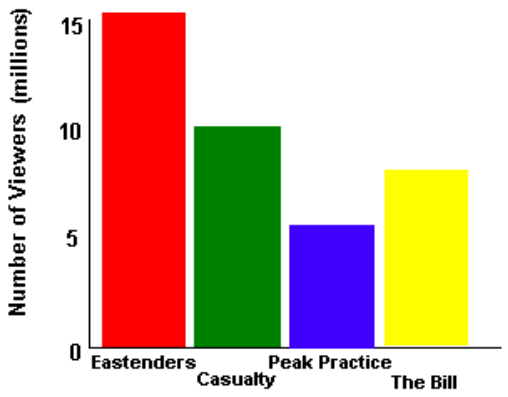
The Differences

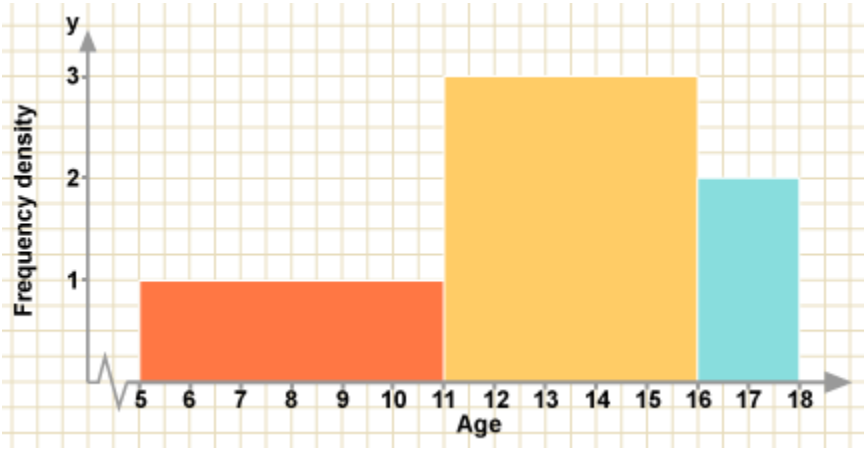
Bar Chart

Category	Property
Bars	
X-Axis	
Y-Axis	

Histogram

Category	Property
Bars	
X-Axis	
Y-Axis	

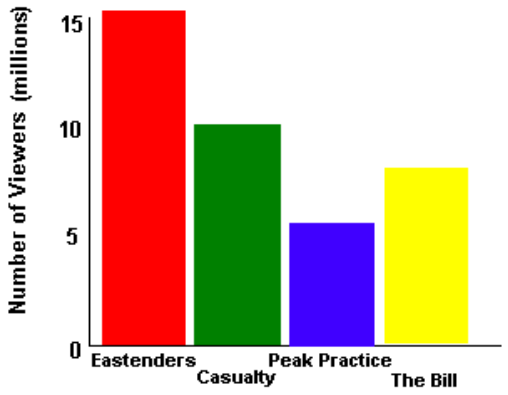




The Differences

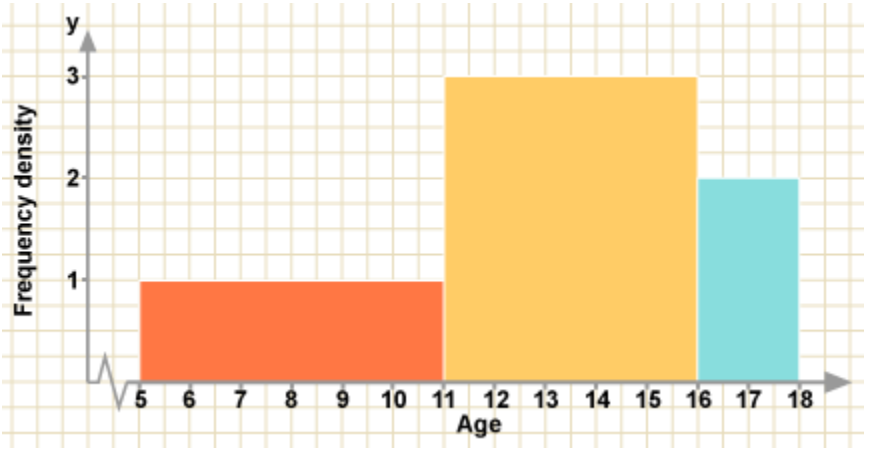
Bar Chart

Category	Property
Bars	There are gaps between the bars.
X-Axis	Words or categories. (Discrete)
Y-Axis	Number of people or frequency.



Histogram

Category	Property
Bars	There are no gaps between the bars and they are different widths.
X-Axis	Numbers. (Continuous)
Y-Axis	Frequency density – what's that?



What are histograms?

Histograms are like frequency diagrams but the groups are different widths.

Since the groups are different widths we can't plot the frequency, we plot what's known as the "frequency density".

$$Frequency\ density = \frac{Frequency}{Group\ width}$$

Example Of How To Draw A Histogram:

A survey has been conducted on how many hours of TV some children watched last week. Draw a histogram for this data.

Hours (h) spent watching TV last week	Frequency
$0 \leq h < 2$	3
$2 \leq h < 5$	6
$5 \leq h < 10$	10
$10 \leq h < 20$	25
$20 \leq h < 40$	10

Why can't we just plot the frequency?

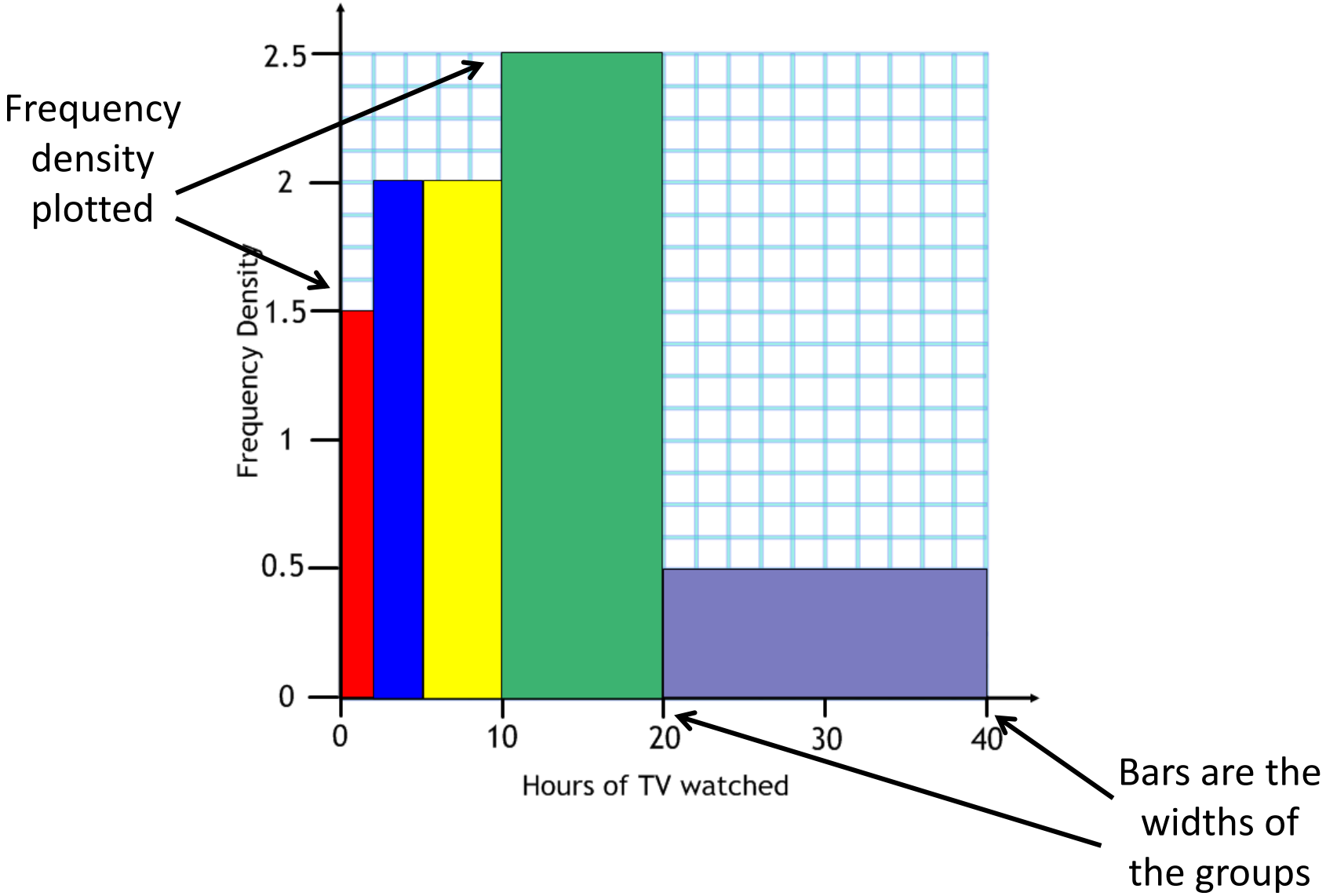
How To Draw A Histogram:

A survey has been conducted on how many hours of TV some children watched last week. Draw a histogram for this data.

Hours (h) spent watching TV last week	Frequency	Frequency Density (Frequency ÷ Group Width)
$0 \leq h < 2$	3	$3 \div 2 =$ **1.5**
$2 \leq h < 5$	6	$6 \div 3 =$ **2**
$5 \leq h < 10$	10	$10 \div 5 =$ **2**
$10 \leq h < 20$	25	$25 \div 10 =$ **2.5**
$20 \leq h < 40$	10	$10 \div 20 =$ **0.5**

Since the groups are all different widths we need to calculate the frequency density by dividing the frequency by the group width.

The histogram:



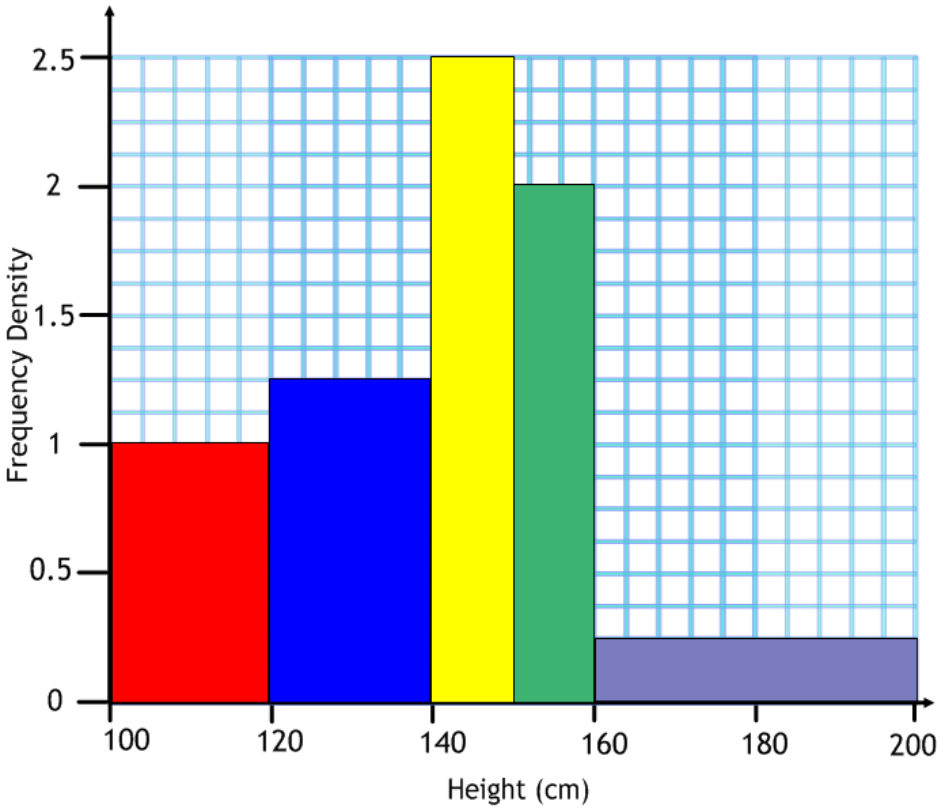
Histogram question:

A survey of the heights of 100 Year 11 students was conducted with the results in the table below. Draw a histogram of this data.

Height (x cm)	Frequency
$100 < x \leq 120$	20
$120 < x \leq 140$	25
$140 < x \leq 150$	25
$150 < x \leq 160$	20
$160 < x \leq 200$	10

Answer:

Height (cm)	Frequency	Frequency Density
$100 < x \leq 120$	20	1
$120 < x \leq 140$	25	1.25
$140 < x \leq 150$	25	2.5
$150 < x \leq 160$	20	2
$160 < x \leq 200$	10	0.25



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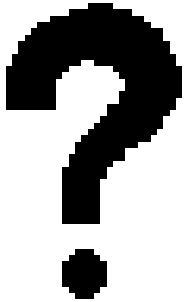
Interpreting histograms

<u>Lesson Objective:</u>

Can I read a histogram in order to interpret results?

Grade A



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What sort of things can we interpret?

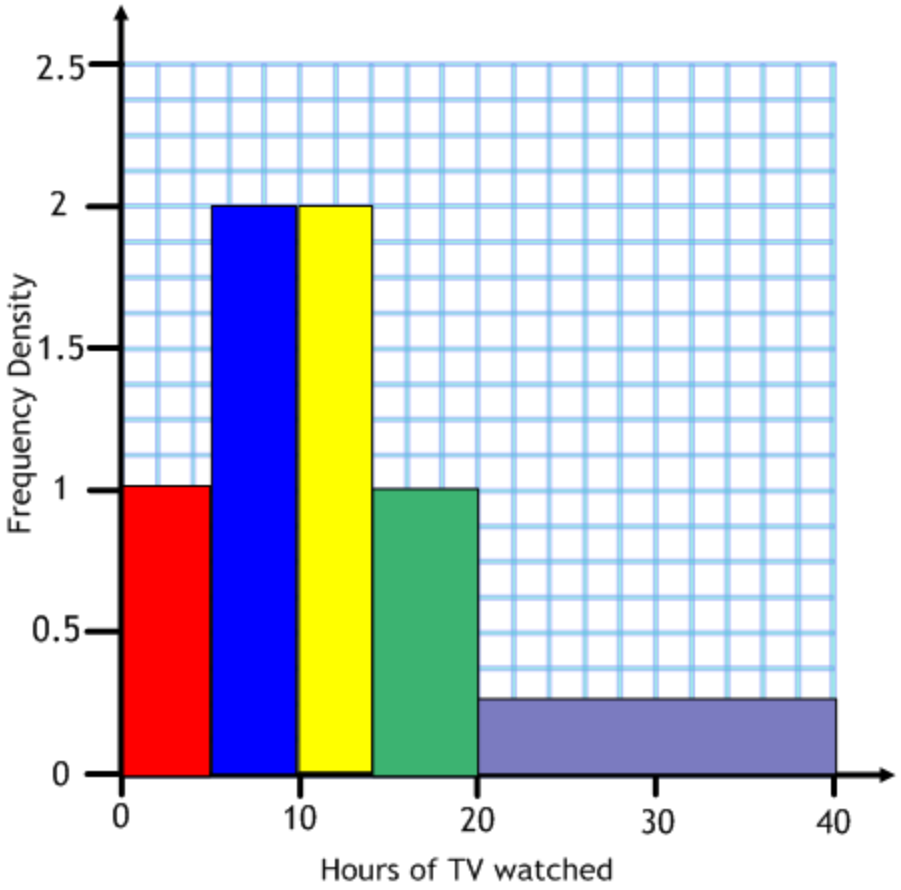
This is basically working backwards regarding histograms.

You have the frequency densities, and want to find the frequencies.

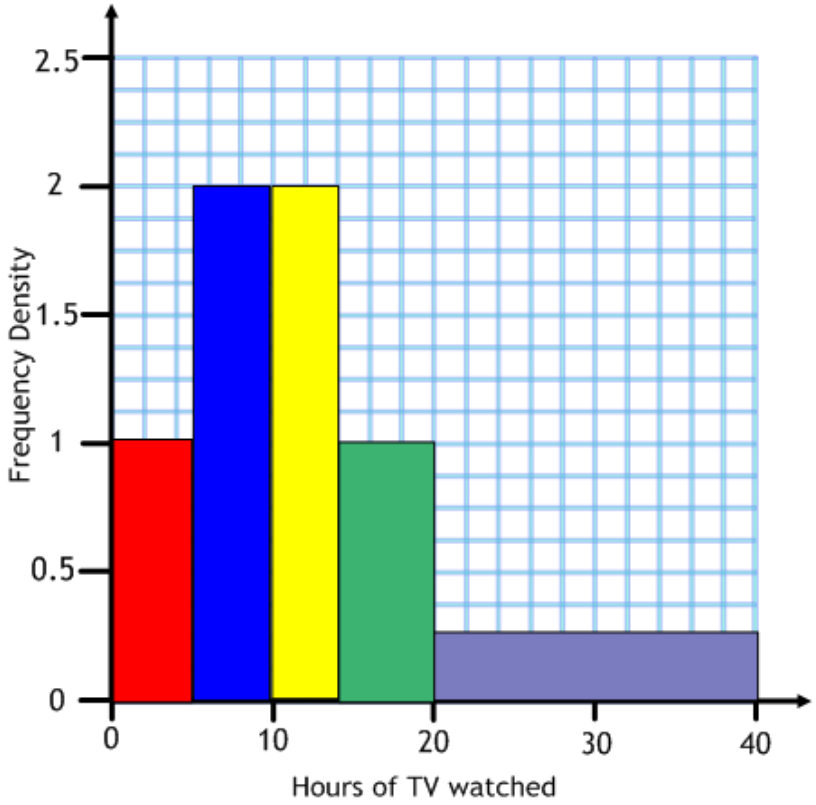
Read the question carefully!

Reading A Histogram

This is a histogram of how many hours of TV some adults watched last week. How many adults were asked in total?



Draw yourself a table

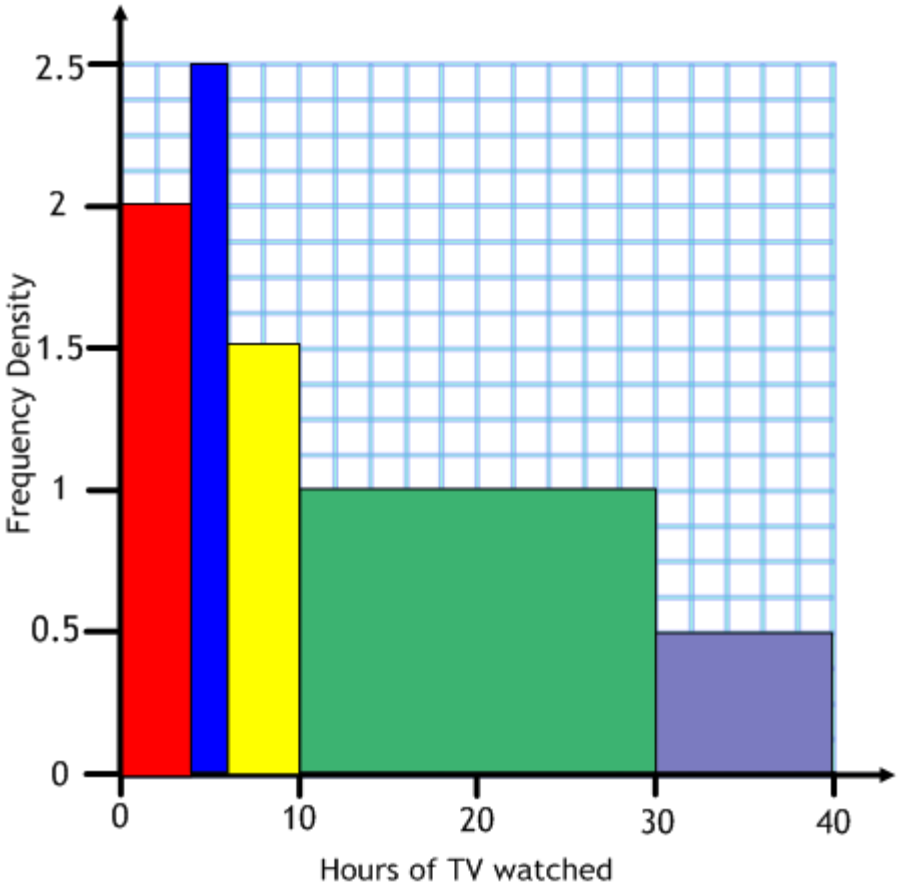


Answer: 34

Hours (h) of TV watched	Frequency Density	Frequency
0≤h<5	1	5
5≤h<10	2	10
10≤h<14	2	8
14≤h<20	1	6
20≤h<40	0.25	5
Width of each bar	*Height of each bar*	*Width × Height*

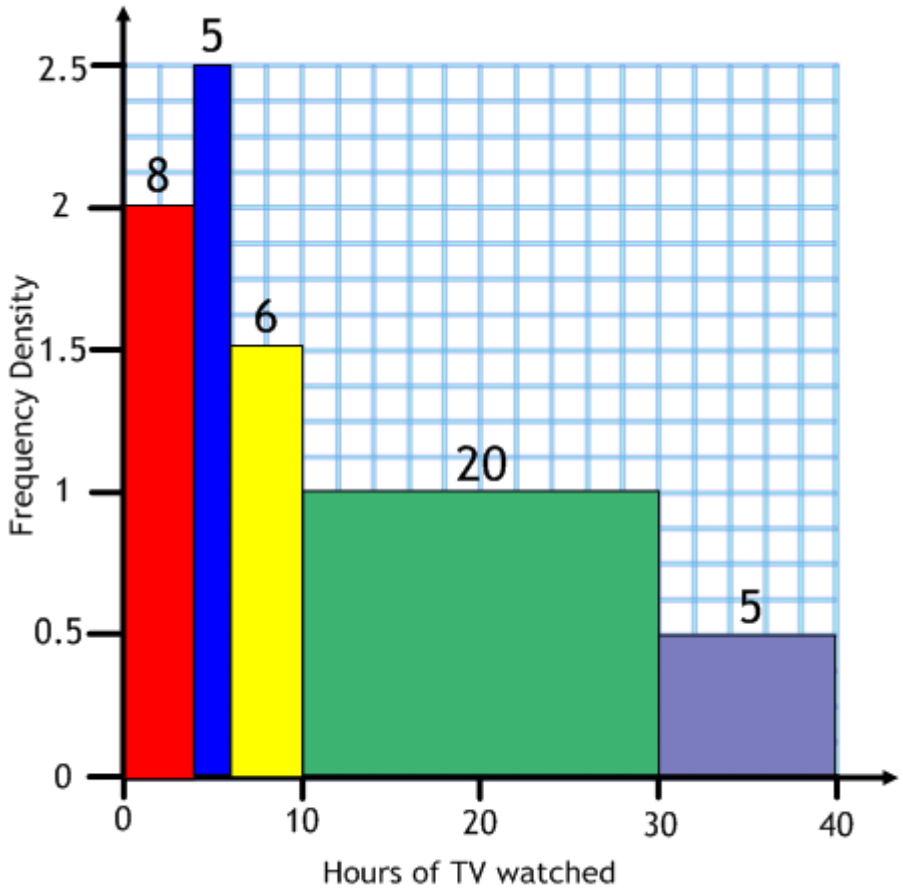
A question for you:

What percentage of people in the survey below watched 20 hours or more of TV?



Answer:

$$\frac{\text{Half the green bar + the purple bar}}{\text{Total number of people surveyed}} \times 100$$



Answer:

$$\frac{15}{44} \times 100 = 34\%$$

SUCCESS CRITERIA: WHERE ARE WE NOW?

Level	Learning outcomes:	R	A	G
F2	I can read and draw bar charts.			
E2	I can read and draw pie charts.			
D3	I can interpret pie charts and compare sets of results.			
C1	I can draw and read a frequency diagram.			
C2	I can draw a scatter graph given two sets of data and describe correlation.			
C1	I can draw a line of best fit and use it to estimate results.			
C3	I can plot a graph of a time series.			
B3	I can draw and read a cumulative frequency diagram.			
B3	I can draw and interpret a box-and-whisker plot.			
B2	I can use box plots to compare two sets of results.			
A2	I can draw a histogram from a set of grouped data.			
A1	I can interpret a histogram and compare sets of data using them.			