Lesson - Pie charts, line graphs and the mean

Year: Year 6

Charts and averages help us understand data. In this lesson you will read and draw pie charts and line graphs, and find the mean.

Starter activity

Mr Jones asks the 30 pupils in his class "What is your favourite pet?" He wants to show the answers on a poster, so everyone can see them at once. He also wants to know the typical height of a pupil in the class. In this chapter you will see how to display data in pie charts and line graphs, and how to calculate the mean as a typical value.

Pie charts

Definition: pie chart

A **pie chart** is a circle cut into slices called **sectors**. It shows how a whole amount is shared between groups. The whole circle is 360°, so the sectors add up to 360°.

Key fact: pie chart facts

Half of the pie is 180° and a quarter is 90°. A bigger sector means a bigger share.

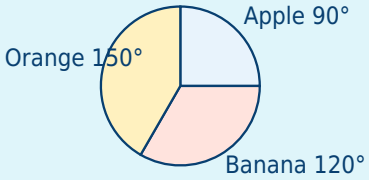
Reading a pie chart

Method: reading a pie chart

1. Check that the angles add up to 360°.
2. Write each sector as a fraction of 360.
3. Find that fraction of the total.

Example 1

The pie chart shows the favourite fruit of 72 people: apple 90°, banana 120° and orange 150°. How many chose each fruit?



Check: 90 + 120 + 150 = 360. Apple: $\frac{90}{360} = \frac{1}{4}$ of 72 = 18. Banana: $\frac{1}{3}$ of 72 = 24. Orange: 72 − 18 − 24 = 30. Check: 18 + 24 + 30 = 72.

Note

Another way: 360 ÷ 72 = 5°, so each person is 5°. Then 90° is 90 ÷ 5 = 18 people.

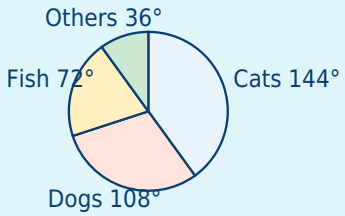
Drawing a pie chart

Method: drawing a pie chart

1. Add up the numbers to find the total.
2. Divide 360 by the total to find the angle for one item.
3. Multiply the angle for one item by each number.
4. Check that the angles add up to 360°.
5. Draw a circle, then use a protractor to draw each sector, and label them.

Example 2

30 pupils chose a favourite pet: cats 12, dogs 9, fish 6 and others 3. Find the angles.



One pupil is 360 ÷ 30 = 12°. Cats: 12 × 12 = 144°. Dogs: 9 × 12 = 108°. Fish: 6 × 12 = 72°. Others: 3 × 12 = 36°. Check: 144 + 108 + 72 + 36 = 360.

Watch out

The angles of a pie chart add up to 360°, not 100. Always check the total.

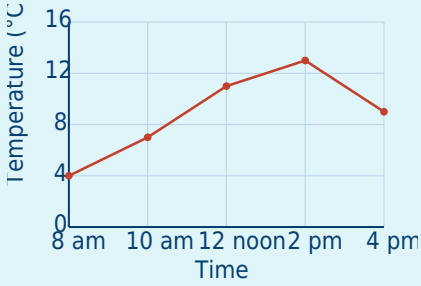
Line graphs

Definition: line graph

A **line graph** shows how something changes, usually over time. Time goes along the horizontal axis and the measurement goes up the vertical axis.

Example 3

The temperature was 4°C at 8 am, 7°C at 10 am, 11°C at 12 noon, 13°C at 2 pm and 9°C at 4 pm. Describe the changes.



The highest temperature is 13°C at 2 pm. From 8 am to 2 pm it rose by $13 - 4 = 9$ degrees. From 2 pm to 4 pm it fell by $13 - 9 = 4$ degrees.

Note

A line graph lets you estimate between points. At 11 am the line is halfway between 7 and 11, so the temperature is about 9°C. It is an estimate because it was not measured. The steepest part shows the fastest change.

The mean

Definition: mean

The **mean** is an average. It is what each value would be if the total were shared equally.

Rule: calculating the mean

Mean = total of the values ÷ number of values. So total = mean × number of values.

Example 4

Find the mean of 4, 7, 9 and 12.

$4 + 7 + 9 + 12 = 32$. There are 4 values, so $32 \div 4 = 8$.

Example 5

The mean of four numbers is 7. Three of them are 5, 8 and 6. Find the fourth.

The total is $4 \times 7 = 28$. The three known numbers add to 19. The missing number is $28 - 19 = 9$.

Watch out

When finding the mean, divide by how many values there are, not by the largest number.

More about charts and the mean

Method: drawing a pie chart

1. Add up the numbers to find the total.
2. Divide 360° by the total to find the angle for one item.
3. Multiply the angle for one item by each frequency.
4. Check that all the angles add up to 360°, then draw each sector with a protractor.

Example 6

20 pupils choose their favourite colour: red 8, blue 6, green 4, yellow 2. Find the angles.

$360 \div 20 = 18°$ for each pupil. Red: $8 \times 18° = 144°$. Blue: $6 \times 18° = 108°$. Green: $4 \times 18° = 72°$. Yellow: $2 \times 18° = 36°$. The total is $144 + 108 + 72 + 36 = 360°$, so the angles are correct.

Example 7

A pie chart is drawn for 48 children. The sector for swimming has an angle of 60°. How many children chose swimming?

60° out of 360° is $\frac{60}{360} = \frac{1}{6}$. One sixth of 48 is $48 \div 6 =$ **8 children**.

Example 8

A bus is full of 20 children. The mean age is 9. Two children aged 7 and 11 get off. What is the mean age of the 18 children left?

The total age of the 20 children is $20 \times 9 = 180$ years. The two children who get off have a total age of $7 + 11 = 18$ years. The 18 children left have a total age of $180 - 18 = 162$ years. The mean age is $162 \div 18 =$ **9**.

Watch out: common mistakes

A pie chart shows the *fraction* of the whole, not the number. Two pie charts with the same angle can stand for different numbers of people if the totals are different. Also, when you use a line graph to read between two points, say "about" or "estimate": no one measured the value you are reading. For the mean, divide by the number of values, not by the biggest value.

Range, and why the mean matters

The **range** is the biggest value minus the smallest value. It shows how spread out the data is. The mean shows a typical value. Two sets of data can have the same mean but different ranges. For example 5, 5, 5 and 1, 5, 9 both have a mean of 5, but the ranges are 0 and 8.

Did you know?

Florence Nightingale, the famous nurse, was also a clever mathematician. About 170 years ago she used a type of pie chart to show that more soldiers were dying from disease than from wounds. Her charts persuaded the government to improve hospitals, and they saved many lives.

Otto's tip

For pie charts, first work out how many degrees stand for one item. After that, it is just multiplying or dividing!