# Stanground Academy

## Mathematics Department

## Year 10 Home Learning Booklet

Student's Name:.................................................................

Teacher:..............................................................

# Averages Matching Pairs

Find the mode, median and mean for each frequency table and reunite each set of data with its correct statement

| 1 | | | | |
|---|---|---|---|---|
| | 0 | 5 | | |
| | 1 | 4 | | |
| | 2 | 5 | | |
| | 3 | 6 | | |
| | Total | 20 | | |

**A**

My modal and median values are equal.

| 2 | | | | |
|---|---|---|---|---|
| | 0 | 6 | | |
| | 1 | 2 | | |
| | 2 | 4 | | |
| | 3 | 8 | | |
| | Total | 20 | | |

**B**

My modal and median class are the same.

| 3 | | | | |
|---|---|---|---|---|
| | 2 | 10 | | |
| | 3 | 14 | | |
| | 4 | 5 | | |
| | 5 | 1 | | |
| | Total | 30 | | |

**C**

My mode is 3 and my mean is 1.6

| 4 | | | | |
|---|---|---|---|---|
| | $0 < x \le 10$ | 3 | | |
| | $10 < x \le 20$ | 5 | | |
| | $20 < x \le 30$ | 7 | | |
| | $30 < x \le 40$ | 5 | | |
| | Total | 20 | | |

**D**

My estimated mean is less than 20.

| 5 | | | | |
|---|---|---|---|---|
| | $0 < x \le 10$ | 20 | | |
| | $10 < x \le 20$ | 10 | | |
| | $20 < x \le 30$ | 5 | | |
| | $30 < x \le 40$ | 15 | | |
| | Total | 50 | | |

**E**

The difference between my median and mean is 0.3

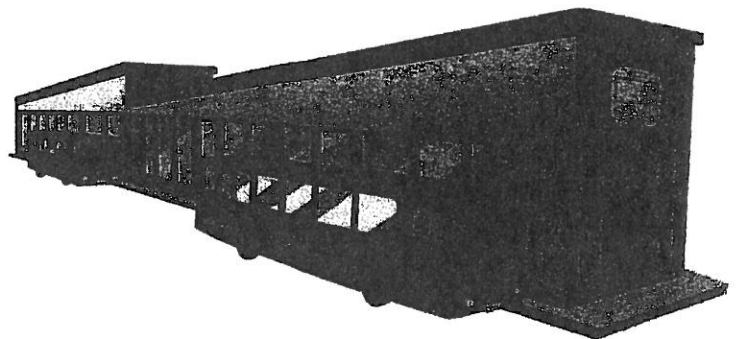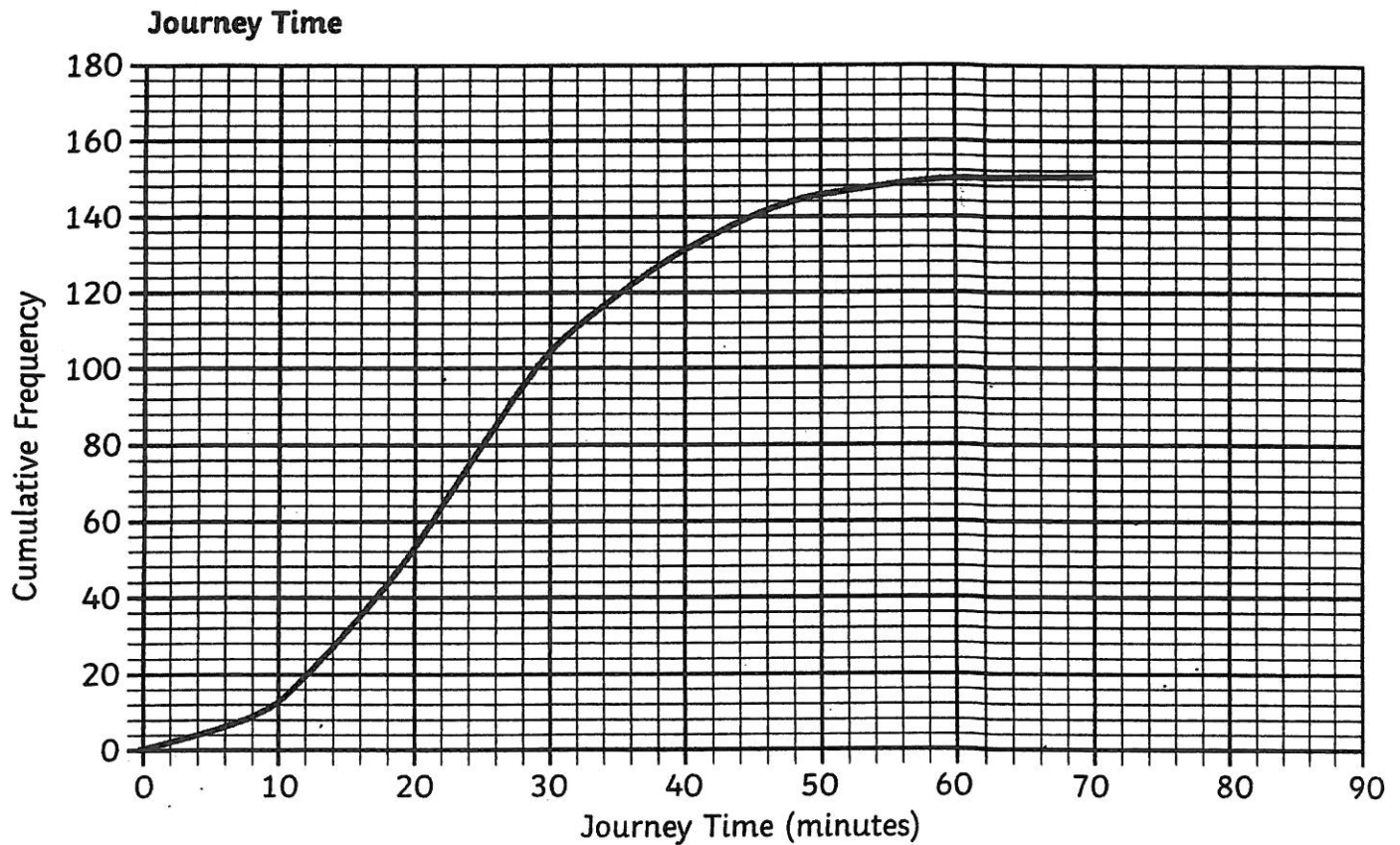**Extension:** Find the mode, mean and median for each frequency table.

# Finding Quartiles

1.  150 people were surveyed about how long it takes them to travel to work. The cumulative frequency diagram below gives information about the results.

    Estimate the median, upper and lower quartiles and the interquartile range.
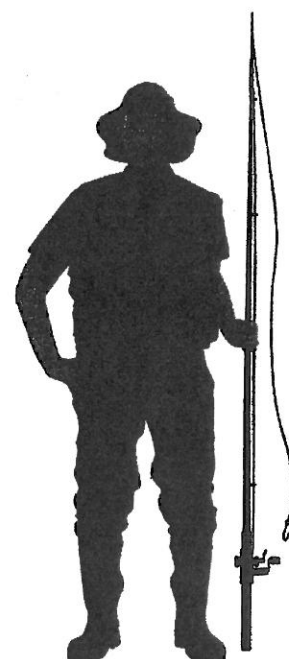
**Journey Time**

2. In a fishing competition each of the fish caught was weighed before being thrown back.

Using the cumulative frequency diagram, estimate the median and the interquartile range o the results.

**Weight of Fish**
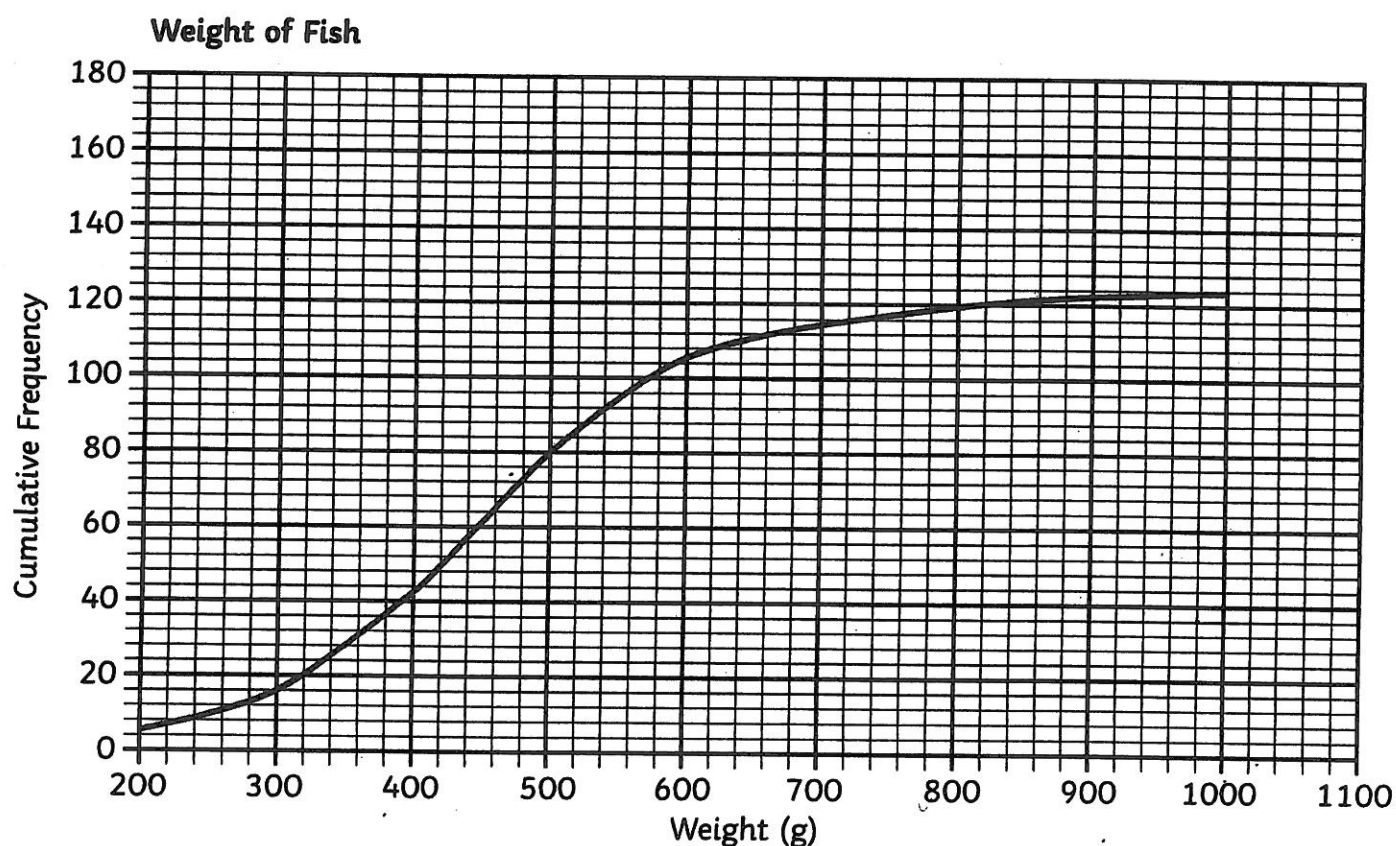


Estimate the probability that a fish caught weighs more than 700g.
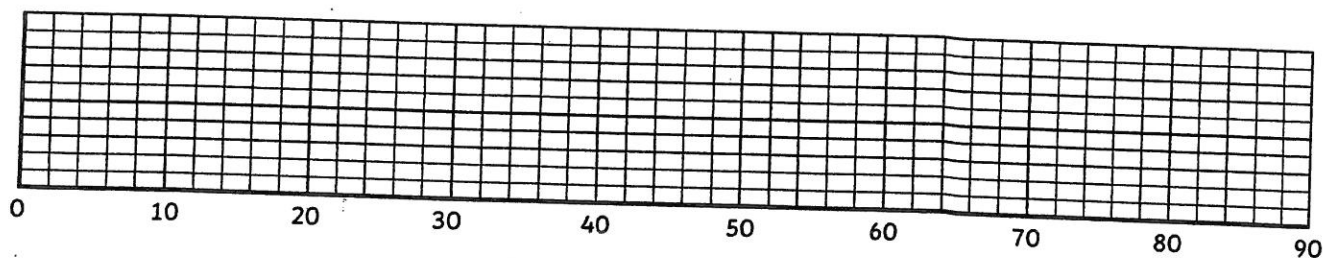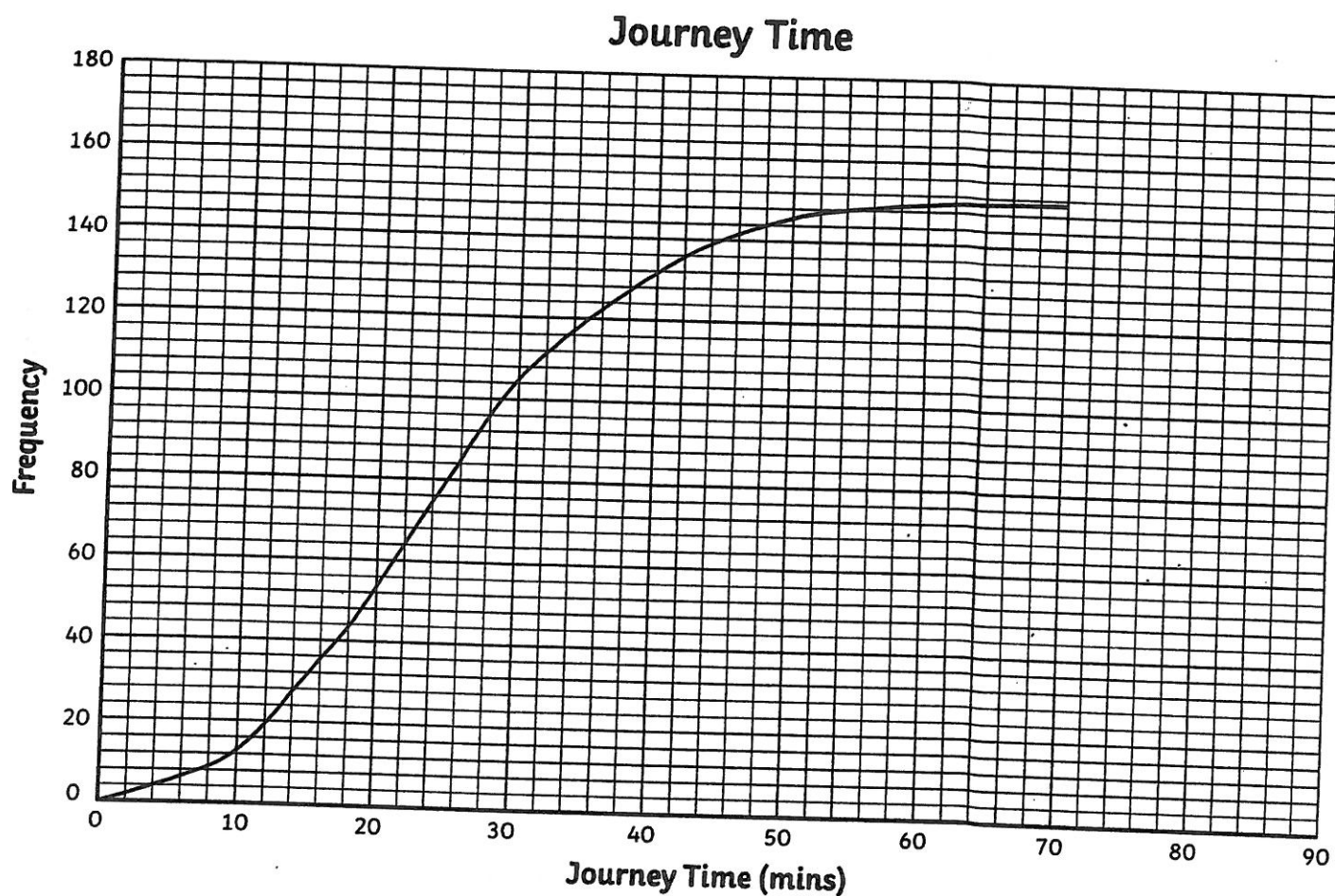
_____

_____

# Drawing Box Plots

You can assume that the lowest and highest values are the lower and upper bounds shown on the x-axis. The median and quartiles will be estimates only.
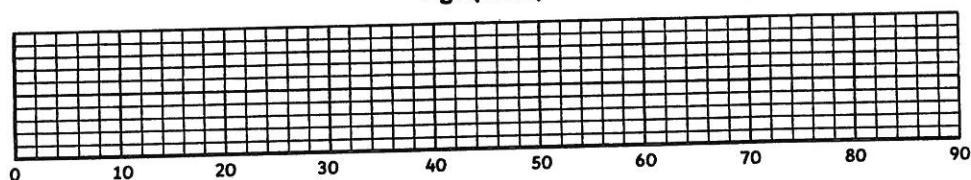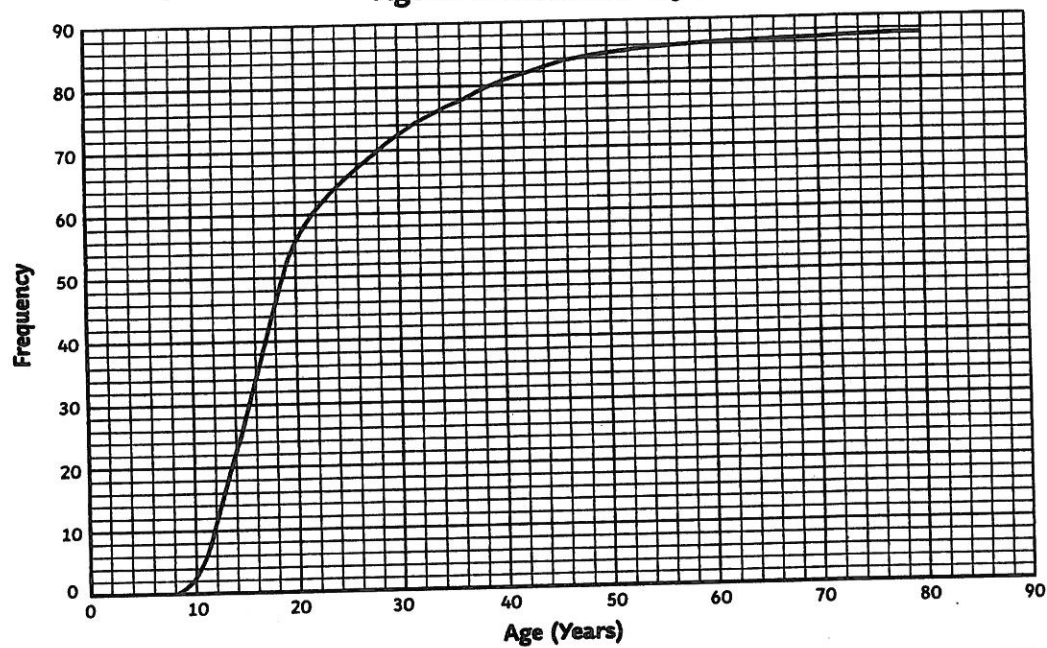
1. This cumulative frequency diagram shows information about 150 people's journey times when travelling to work.
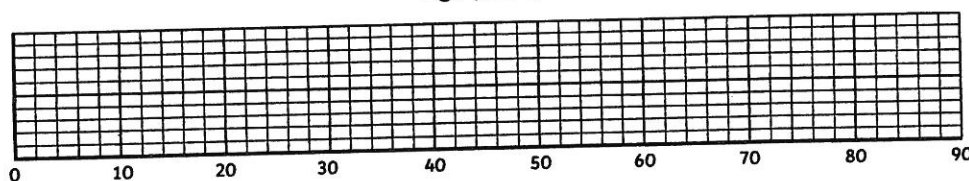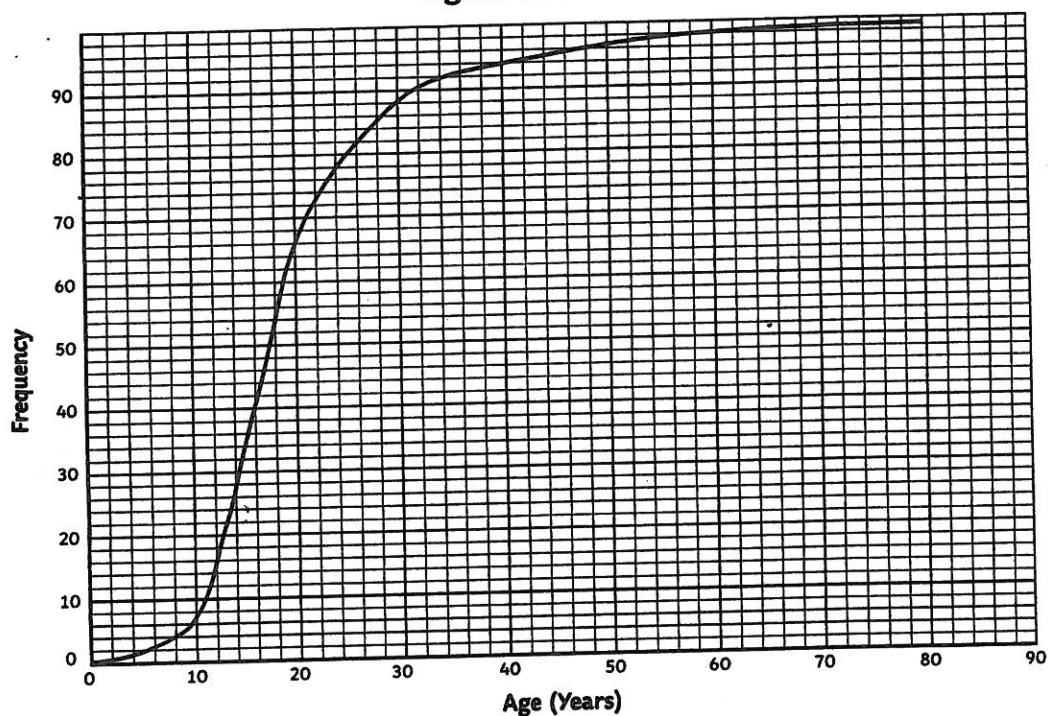
   Complete the box plot for this data.

## Journey Time

Secondary

2. Three sports clubs surveyed their members.
   Complete the box plot for this data.

### Age of Basketball Players



### Age of Footballers

# Increasing or Decreasing a Quantity by a Given Percentage

1. Ellen works part time and earns £112 per week. Her employer agrees to raise her weekly wages by 3%. What is Ellen's new weekly wage?

   _____

   _____

   _____

2. Matthew buys a t-shirt in a sale. Its original cost was £35 but in the sale, there is 30% off this price. How much does Matthew pay for his t-shirt?

   _____

   _____

   _____

3. Write the decimal multiplier you can use to work out the value after an increase of 67%.

   _____

   _____

   _____

4. Increase 280 by 150%

   _____

   _____

   _____

5. Write the decimal multiplier you can use to work out the value after a decrease of 2%.

   _____

   _____

   _____

6. The cost of sending a parcel increases by 15%. A 1kg parcel costs £2.80 to send. Work out the new price to send the parcel.

   _____

   _____

# Interesting Earnings

Since the year 2000 Lego sets have been a better investment than either stocks or shares or gold, with the value of sets increasing on average 12%. The best performing set – The Ultimate Collector's Millennium Falcon – has increased in value from £342.49 to £2712.

You could try to find out:

- about different ways people invest money;
- how interest works;
- which other toys have become collector's items;
- what the most expensive Lego set ever made is.

If you have a savings account with a bank and deposit money, the bank will pay you extra money for saving with them. Similarly, if you need to borrow money from a bank the bank will expect you to pay back more than you borrowed from them in the first place! How much depends on the interest rate set by the bank.

You have won £1,000,000 in the Lottery! Choose one of the ten investment schemes below and see how your money will grow over ten years. Was the one you chose the best investment? How can you check?

| Property Investment | High Risk Investment | Savings Account |
|---|---|---|
| Your money doubles every 2 and a half years. | Toss a coin for the end of each of the 10 years – if it is heads double your money. If it is tails, lose half of it. | Earn 5% each year in interest. |
| Start a Business<br><br>Choose how much to invest and then roll a dice.<br><br>1 = double your investment<br>2 = lose it all<br>3 = triple your investment<br>4 = get your money back<br>5 = get half your money back<br>6 = get your money back plus 50% | Stock Market Investment<br><br>For 5 years earn nothing, for the other 5 years earn 10%. This can happen in any order you like! | Hide Your Money Under Your Mattress<br><br>Amount doesn't change! |

# Percentage Change Activity Sheet
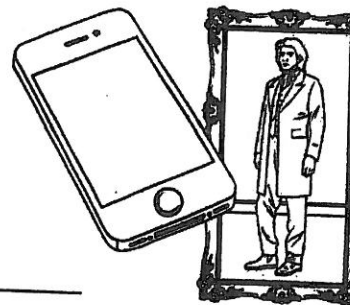
1. In January, a mobile phone shop sold 100 phones. In February, they sold 92 phones. Represent this difference as a percentage change.

_____

_____

_____

2. A piece is cut from a 130cm length of wood so that the remaining length is 104cm. What percentage of the wood has been cut off?

_____

_____

_____

3. There are now 30 boys in a class that originally had 24 boys in it. What was the percentage increase in the number of boys in the class?

_____

_____

_____

4. Last year, there were 300 students in Year 7. This year there are 315 students. Show that this is a 5% increase.

_____

_____

_____

5. A piece of art was bought for £600. Six months later, it was sold for £675. What percentage profit did the seller make?

_____

_____

_____

Secondary

# Finding the Original Value

1. A shop offers a 25% discount in a sale. A dress has a sale price of £33.75. What was the original price?

_____

_____

_____

2. The price of a laptop is £345 after 20% VAT is added. What was the price before VAT was added?

_____

_____

_____

3. Charlotte works in a local pet shop. She was told to increase all prices by 5%. She increased a price to £42. What was the original price?

_____

_____

_____

4. A car depreciates in value by 20% during its first year. Its value now is £7850. What was its original price?

_____

_____

_____

5. The price of a bike increases by 12% to £168. What was the price of the bike before the increase?

_____

_____

_____

6. The total price for a holiday, including a 15% discount, was £799. What was the price of the holiday before the discount?

_____

_____

_____

# Upper and Lower Bounds Getting to Work

D
S | T
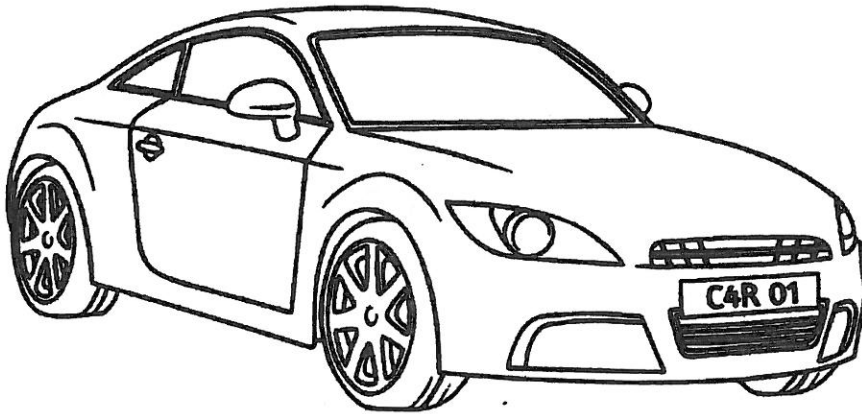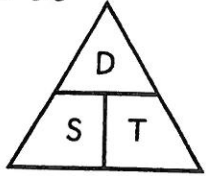
Kelly drives to work at an average speed of 33km/h. It takes 15 minutes.

Speed is correct to the nearest km.
Time is correct to the nearest minute.

Use the upper and lower bounds to calculate minimum and maximum values of Kelly's distance from work.

Martin cycles to his place of work 9km away at an average speed of 40km/h.

Speed is correct to the nearest km.
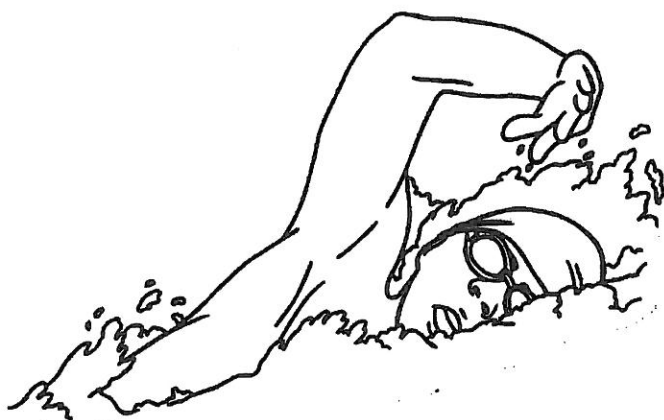Distance is correct to the nearest kilometre.

Use the upper and lower bounds to calculate minimum and maximum values of Martin's time to get to work.

**Maths**

# Upper and Lower Bounds **Getting Fit**
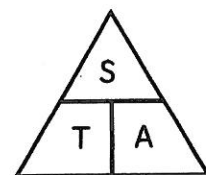
What is their acceleration if...



...Doug reaches a swimming speed
of 1.2ms$^{-1}$ (from stationary) in 4 seconds?



...Maggie's average jogging speed changes
from 2.1ms$^{-1}$ to 3.4ms$^{-1}$ in 6 seconds.

Speed is correct to one decimal place.
Time is correct to the nearest second.

Use the upper and lower bounds to calculate minimum
and maximum values of Doug and Maggie's acceleration.

Don't forget S means change in speed
in this formula!

# Standard Form

1. Write the following in standard form:

   a. 70 000 _____

   b. 100 000 _____

   c. 99 000 000 _____

   d. 458 000 _____

   e. 372 000 000 _____

   f. 21 300 _____

   g. 23.72 _____

   h. 0.0005 _____

   i. 0.034 _____

   j. 0.0079 _____

2. Write the following as ordinary numbers:

   a. $5 \times 10^3$ _____

   b. $6.2 \times 10^4$ _____

   c. $2.55 \times 10^2$ _____

   d. $9.99 \times 10^5$ _____

   e. $1.01 \times 10^8$ _____

   f. $7.13 \times 10^1$ _____

   g. $4 \times 10^{-2}$ _____

   h. $3.2 \times 10^{-4}$ _____

   i. $9.75 \times 10^{-3}$ _____

   j. $8.1 \times 10^{-5}$ _____

3. Write the following, correctly, in standard form

   a. $90 \times 10^5$ _____

   b. $88 \times 10^6$ _____

   c. $790 \times 10^{-3}$ _____

   d. $21.2 \times 10^3$ _____

   e. $101.1 \times 10^2$ _____

   f. $0.1 \times 10^2$ _____

   g. $0.54 \times 10^4$ _____

   h. $34 \times 10^{-3}$ _____

   i. $0.26 \times 10^{-2}$ _____

   j. $0.006 \times 10^{-5}$ _____

4. Calculate the following, leaving your answers in standard form:

   a. $3 \times 10^3 \times 2 \times 10^2$ _____

   b. $5 \times 10^4 \times 3 \times 10^1$ _____

   c. $6 \times 10^4 \times 7 \times 10^3$ _____

   d. $2.1 \times 10^2 \times 3 \times 10^2$ _____

   e. $5.5 \times 10^3 \times 2 \times 10^{-1}$ _____

   f. $4 \times 10^{-2} \times 6 \times 10^{-4}$ _____

   g. $3.1 \times 10^{-5} \times 3 \times 10^{-2}$ _____

   h. $5.5 \times 10^3 \div (2 \times 10^{-1})$ _____

   i. $\dfrac{4 \times 10^5}{2 \times 10^3}$ _____

   j. $\dfrac{12 \times 10^6}{36 \times 10^2}$ Give answer to 2s.f. _____

## Extension

Charlotte inherits £$4.2 \times 10^6$ from her great aunt Flo's estate.
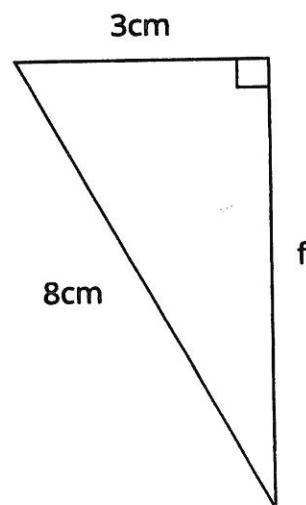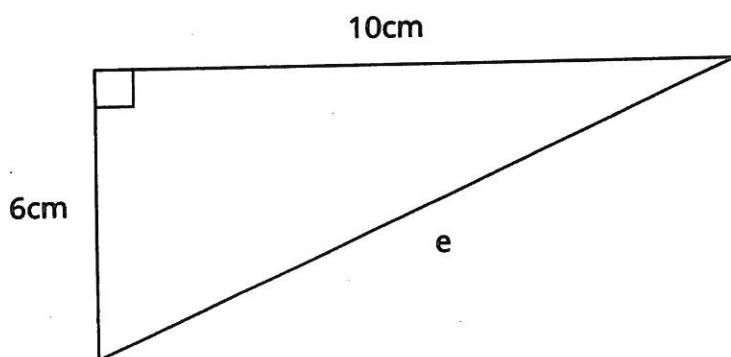
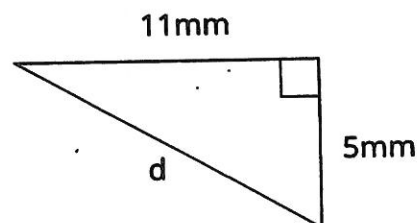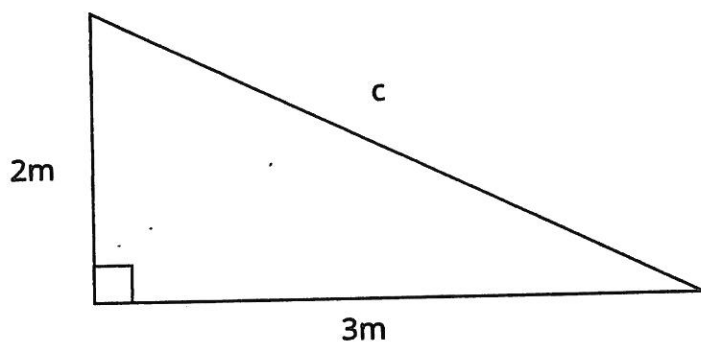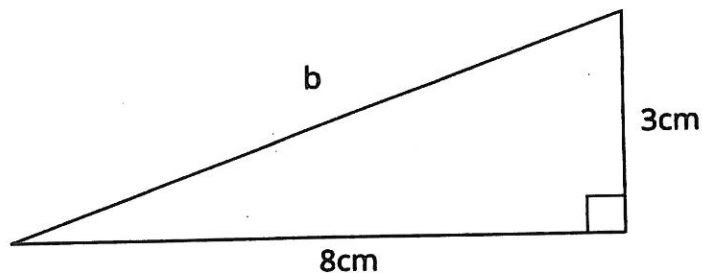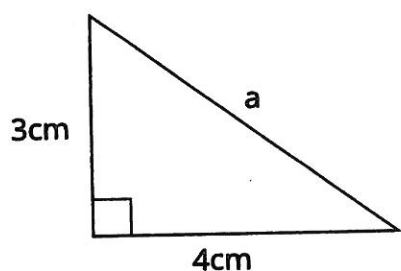   a. How much money is this?

   _____

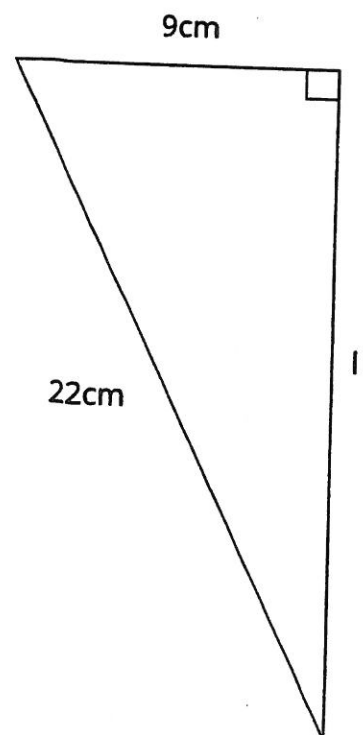   b. She spends 45% on a house and car. How much money does she have left? Write your answer in standard form.

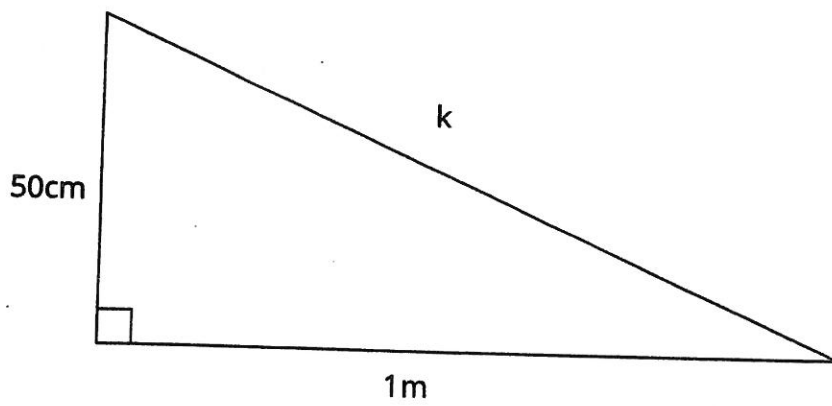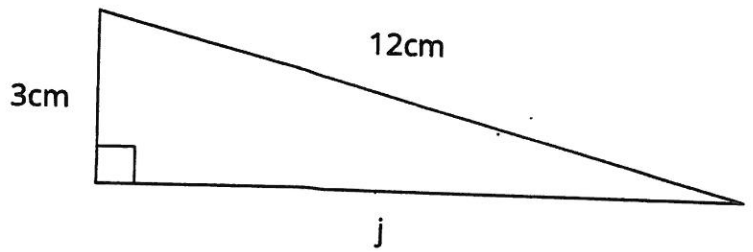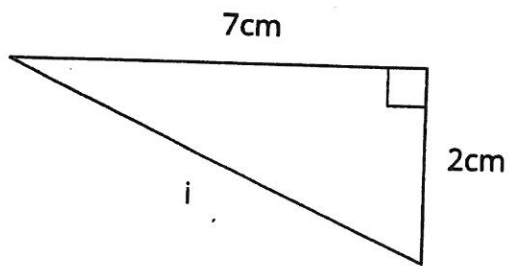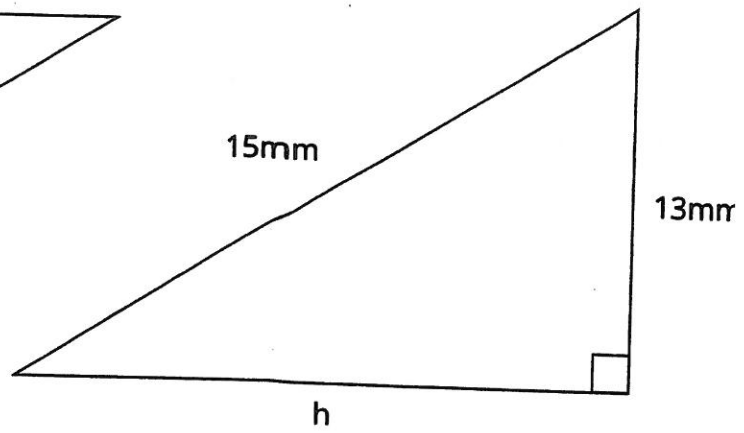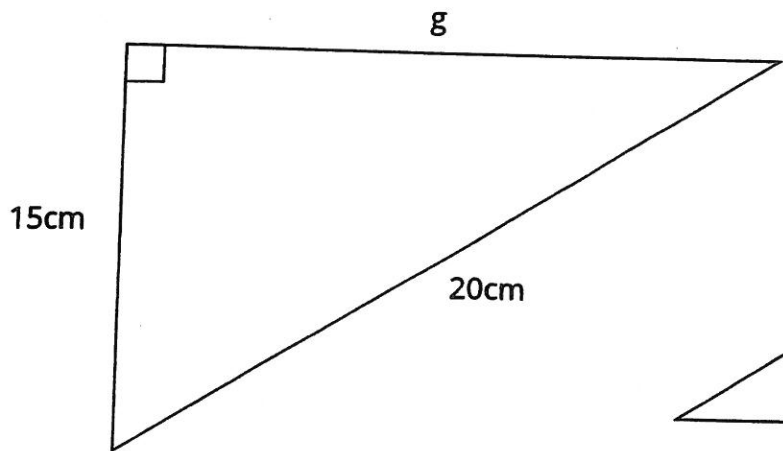   _____

   _____

# Pythagoras' Theorem

**Calculator allowed.** Give your answers correct to 1 decimal place unless otherwise stated.

1. Find the length of the side labelled with a letter.

3cm    a    4cm

b    3cm    8cm

2m    c    3m

11mm    5mm    d

10cm    6cm    e

3cm    8cm    f

g

15cm

20cm

15mm

13mm

h

7cm

2cm

i

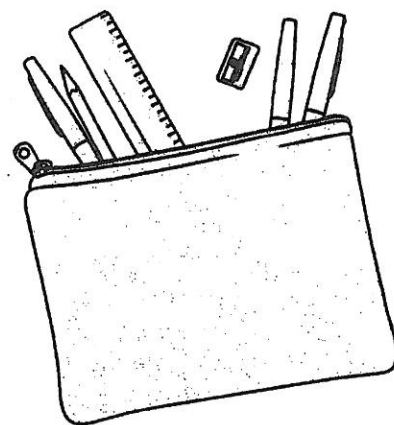12cm

3cm

j

9cm

k

50cm

1m

22cm

l

# Sequences Involving Surds

Which of these are geometric sequences?

1. 4, 8, 16, 32, 64, ... _____

2. 20, 30, 200, 300, 2000, ... _____

3. 5, 8, 11, 14, 17, ... _____

4. 243, 81, 27, 9, 3, ... _____

What is the common ratio for each of these geometric sequences? What are the next 3 terms?

1. 7, 14, 28, 56, ...

_____

2. √3, 5√3, 25√3, 125√3, ...

_____

3. 6, 6√2, 12, 12√2, ...

_____

4. 2, 2√3, 6, 6√3, ...

_____

5. 3√3, 9√5, 45√3, 135√5, ...

_____

6. $\frac{\sqrt{6}}{2}$, $\frac{3}{2}$, $\frac{3\sqrt{6}}{4}$, $\frac{9}{4}$, $\frac{9\sqrt{6}}{4}$, ...

_____

7. 1, $\frac{\sqrt{2}}{2}$, $\frac{1}{2}$, $\frac{\sqrt{2}}{4}$, ...

_____

What is the common ratio for this geometric sequence? What is the next term?

3, (3 + 3√3), (12 + 6√3), ...

_____

_____

# Rationalising the Denominator

**Starter**

Expand the brackets.

1. $5(x + 2) =$

2. $6(2x + 3) =$

3. $a(3a + b) =$

4. $(x + 2)(x - 2) =$

5. $(y - 7)(y + 7) =$

6. $(2c - 5)(2c + 5) =$

## Expanding brackets with surds.

1. $5(3 + \sqrt{2}) =$

2. $3(2\sqrt{5} + 1) =$

3. $(3 + \sqrt{7})(3 - \sqrt{7}) =$

4. $(3 + \sqrt{5})(3 - \sqrt{5}) =$

5. $(7 + \sqrt{2})(7 - \sqrt{2}) =$

6. $(12 + \sqrt{11})(12 - \sqrt{11}) =$

7. $(\sqrt{5} + \sqrt{7})(\sqrt{5} - \sqrt{7}) =$

8. $(3\sqrt{7} + \sqrt{3})(3\sqrt{7} - \sqrt{3}) =$

# Collect a Joke

Begin on the card marked 'Start'. The question at the bottom of each card will lead you to an answer on top of another. Collect the words as you answer each question to spell out a joke

| | | | |
|---|---|---|---|
| START <br> **What** <br> $\frac{1}{\sqrt5}$ | $\frac{20 - 5\sqrt2}{14}$ <br> **Bear** <br> $\frac{3}{\sqrt5 - 1}$ | $2 - \sqrt3$ <br> **A** <br> $\frac{5}{4 + \sqrt2}$ | $4\sqrt2$ <br> **You** <br> $\frac{15}{\sqrt5}$ |
| $\frac{3\sqrt5 + 3}{4}$ <br> **With** <br> $\frac{\sqrt2}{\sqrt2 + 5}$ | $\frac{\sqrt5}{5}$ <br> **Do** <br> $\frac{8}{\sqrt2}$ | $\sqrt3 - 2$ <br> **Pink** <br> $\frac{\sqrt3}{\sqrt2}$ | $\frac{4\sqrt3 + 3}{13}$ <br> **Teeth?** <br> $\frac{1 + \sqrt2}{\sqrt2 - 1}$ |
| $\frac{\sqrt6}{2}$ <br> **Face** <br> $\frac{7}{\sqrt5 + 1}$ | $7 - 3\sqrt3$ <br> **Gummy** <br> $\frac{\sqrt2 + 5}{2 + \sqrt5}$ | $\frac{5\sqrt2 - 2}{23}$ <br> **No** <br> $\frac{\sqrt3}{4 - \sqrt3}$ | $3 + 2\sqrt2$ <br> **A** <br> $\frac{\sqrt3 + 5}{\sqrt3 + 2}$ |
| $3\sqrt5$ <br> **Call** <br> $\frac{1}{2 + \sqrt3}$ | $\frac{7\sqrt5 - 7}{4}$ <br> **Silly** <br> $\frac{9}{\sqrt2}$ | $\sqrt{10} - 2\sqrt2 + 5\sqrt5 - 10$ <br> **Bear!** <br> END | $\frac{9\sqrt2}{2}$ <br> **Oops** <br> END |

**Maths**