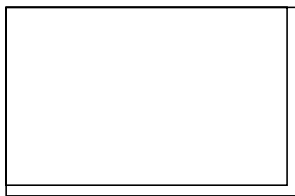
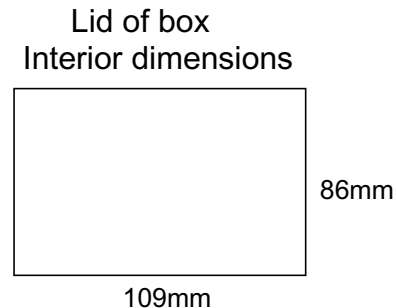
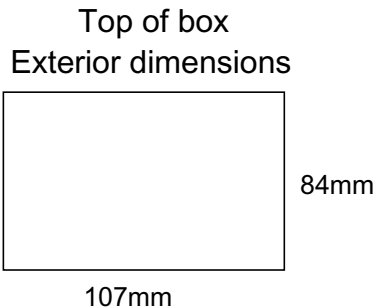


# Imprecision of Measurement

L.7

- 1) Boxes and their lids are made to these dimensions, correct to the nearest mm.



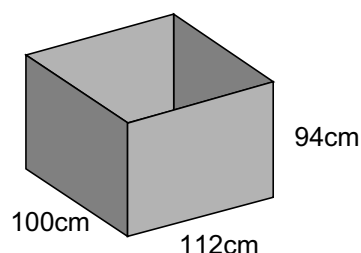
When the lid is put on the box there is a gap between them, as shown on the left.

- What is the maximum gap between lid and box?
- What is the minimum gap between lid and box?

- 2) The timetable says that the buses arrive at the bus stop every 10 minutes, at 8:00, 8:10, 8:20, 8:30 and so on. The bus company says that they are always on time to the nearest minute.

Jan arrives at the bus stop just as a bus is leaving.

- What is the maximum time she will have to wait for the next bus?
  - What is the minimum time she will have to wait for the next bus?
- 3) At an athletics meeting, the javelin throws are measured to the nearest centimetre. The winning throw was 37.31 metres, equalling the record. Explain why this throw could have been the new record.
- 4) At the same athletics meeting the 400 metres relay race was won in a time of 58.3 seconds, correct to the nearest  $\frac{1}{10}$  th of a second. Between what two values does the actual time lie?
- 5) Water tanks are made in the shape of open cuboids. They are made 94cm tall, 100cm wide and 112cm long. Each dimension is measured to the nearest centimetre.



The makers advertise them as capable of holding up to 1068 litres.

Is this a good estimate?

Explain your answer.

# Compound Measure

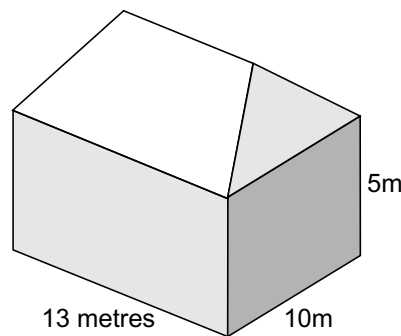
L.7

- 1) A small car has an average fuel consumption of 48 miles per gallon. A large car has a fuel consumption of 23 miles per gallon.

Jaspal calculates that he travels 9,500 miles each year.

- How many gallons of petrol would he use in a year if he bought the small car?
- How many gallons of petrol would he use in a year if he bought the large car?
- A third car is medium sized and the fuel consumption is 10 kilometres per litre. How many gallons of petrol would he use in a year if he bought this car?

- 2) The outside walls of a house are to be painted. The plan of the house is a rectangle measuring 13 metres by 10 metres. The walls are 5 metres tall.



- Calculate the total area of the four walls.  
The house has 12 windows in it and 2 doors. Four of the windows measure 130cm by 250cm and six others measure 130cm by 150cm. The remaining two windows measure 130cm by 60cm. The doors measure 90cm by 2m.
  - Calculate the total area of the windows and doors in  $\text{m}^2$ .
  - What is the total area of wall needing to be painted?
  - Paint is bought in cans containing 10 litres and 1 litre is sufficient to cover  $8.5\text{m}^2$ . How many cans of paint are needed?
- 3) The distance from the bus terminus to Ama's house is 3.5 kilometres. The journey takes 8 minutes. Calculate the average speed of the bus in kilometres per hour.
- 4) The velocity of sound through air is approximately 760 miles per hour. If the noise of thunder takes 8 seconds to reach the listener approximately how far away will it be in metres?
- 5) A hosepipe feeds water into a tank of height 2 metres and internal diameter of 1.6m.
- Calculate the volume of water in the tank when it is full.  
The hosepipe has an internal diameter of 2.5cm.
  - Calculate the volume of 1 metre of water in the pipe.  
The tank takes 30 minutes to fill up.
  - How much water enters the tank in 1 second?
  - Calculate the speed of the water in the pipe in metres per second.

# Currency

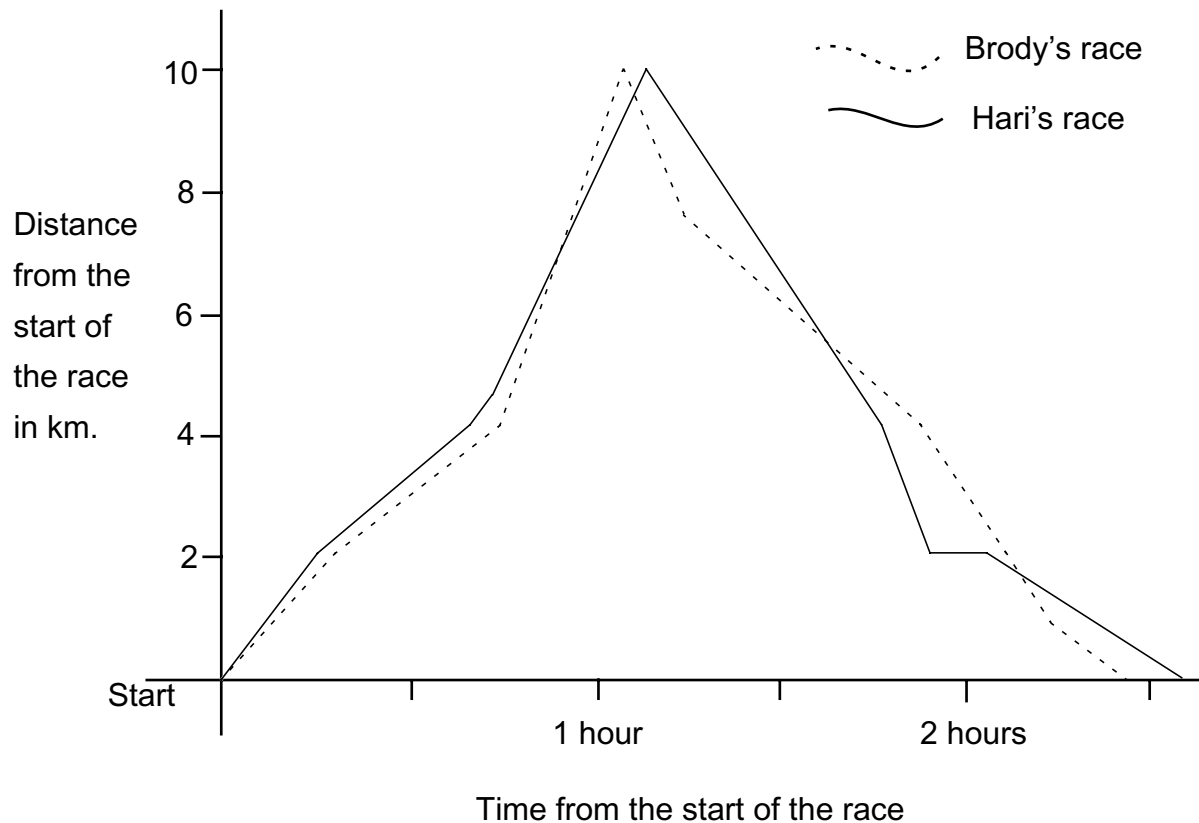
L.7

- 1) Donna goes to Florida on a holiday. She takes 600 dollars with her to spend. She buys this money at a rate of \$1.37 for £1.00. Calculate how much it costs, to the nearest penny.  
She buys the money from a travel agent who adds on another 2.5% commission. What is her total bill?
  
- 2) On the back of a book the price is written in three ways.  
£5.99 in UK  
\$7.99 in USA  
\$14.99 in Australia.  
If the rate of exchange is 1.37 US dollars to a pound and 2.67 Australian dollars to a pound. In which country will the book cost most and in which will it cost least?
  
- 3) Dan travels to Canada for a holiday. He changes £400 into Canadian dollars before he goes at a rate of \$2.11 for £1.00. He spends a week in Vancouver then travels on to the USA. He decides to change 200 of his Canadian dollars into American dollars. He knows that in the UK he can get 1.37 American dollars for £1.00. How many US dollars does he expect to get?
  
- 4) The exchange rate between the UK pound and the Turkish lira is £1.00 equals 1,877 lira.  
Donna goes on a holiday to Turkey. How many lira can she buy for £250?  
When Donna gets to Turkey she finds that the exchange rate has changed to 1,936 lira to a pound. How many more lira could she have gained if she had changed her money in Turkey?
  
- 5) The car Mrs Lee wants to buy costs £7,890 in her town. She finds that in Europe the same car costs 9,400 euros. If 1 euro is worth 66p, how much money does Mrs Lee save by buying it in Europe?
  
- 6) Rik wants to go on a travelling holiday to New Zealand. It costs £450 to travel from the UK to New Zealand or £790 return. However, he is told that the one way fare from New Zealand back to the UK is \$1000. If £1.00 buys 3.29 New Zealand dollars, is it more economical to buy a return fare or two one way fares?
  
- 7) In 2001 Erol bought a pair of sandals in Portugal for 5,500 escudos. On the bottom of his receipt it says '205 escudos = 1 euro'. Erol knows that 1 euro is worth 69p. What is the cost of his shoes in pounds?

# Road Race

L.7

Two friends, Brody and Hari run a 20 kilometre race from Ambridge to Blaconsfield and back. The diagram below shows a rough sketch of their journeys.



- Which of the two friends first takes the lead?
- Along the journey they encounter a hill. Approximately how far from Ambridge is the beginning of the hill?
- At what time did the lead first change?
- How many times did they pass each other?
- How many times did the lead change?
- Who was in the lead at the 1 hour point?
- Who was running the fastest just after the half way point?
- Why did their speed increase between the 1hr 45min and 2hr points?
- Who won the race and by what time interval?
- What was Brody's approximate average speed for the whole race?
- Give an explanation of the dramatic events at the 18km point.

# Mean

L.7

- 1) Joe grows plants in his greenhouse. After one week he measures the heights of them. These are the results he gets, correct to the nearest cm.

| Height of plant cms | Number of plants |
|---------------------|------------------|
| 45                  | 5                |
| 46                  | 8                |
| 47                  | 19               |
| 48                  | 23               |
| 49                  | 12               |
| 50                  | 3                |

- Calculate the mean height of the plants, correct to the nearest millimetre.
- What is the modal height of the plants?
- What is the median height of the plants?
- What is the range of their heights?

- 2) The table below shows the sales of two books in 50 stores throughout the country.

| Number of books sold | Number of shops selling book A | Number of shops selling book B |
|----------------------|--------------------------------|--------------------------------|
| 0                    | 3                              | 7                              |
| 1                    | 10                             | 6                              |
| 2                    | 7                              | 5                              |
| 3                    | 7                              | 5                              |
| 4                    | 8                              | 7                              |
| 5                    | 7                              | 5                              |
| 6                    | 4                              | 6                              |
| 7                    | 1                              | 5                              |
| 8                    | 0                              | 2                              |
| 9                    | 3                              | 2                              |

For example, 3 shops sold no book A's and 7 shops sold no book B's.

- For each of the two books, calculate the mean number sold at the stores.
- For each book, how many shops sold less than the mean?

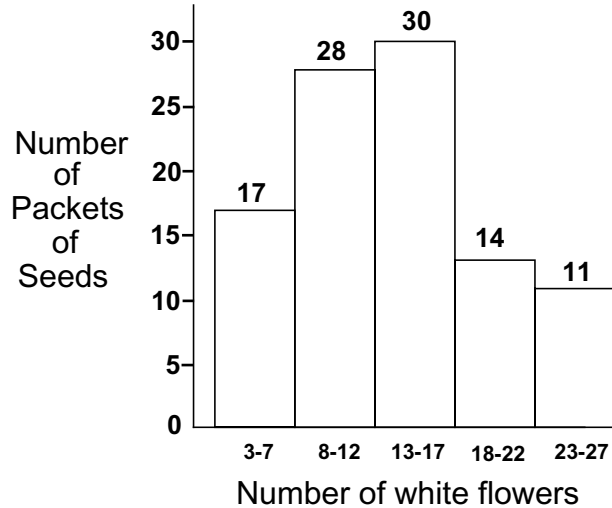
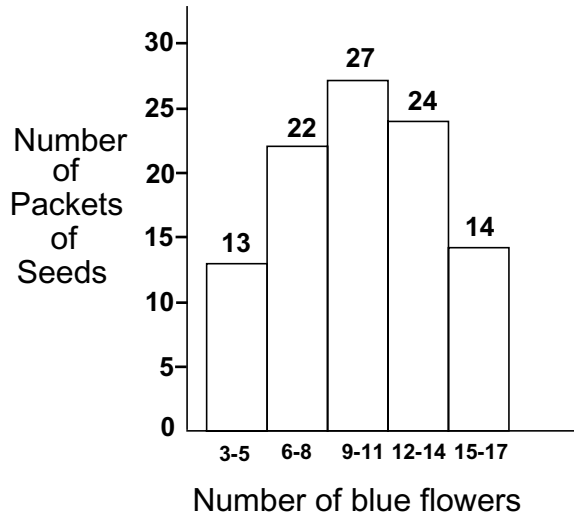
These stores are part of a larger group of 210 stores.

- For each book, calculate the approximate number of books the company sold in all its stores.

# Flower Seeds

L.7

A company produce packets of seeds that will grow into a mixture of blue and white flowers. 100 packets were sown and the resulting colour of the flowers were recorded. The table below shows the results.



a) Complete the table below and estimate the mean number of blue flowers a packet of seeds will produce.

| Number of blue flowers | Mid point of bar ( $x$ ) | Number of packets ( $f$ ) | $xf$ |
|------------------------|--------------------------|---------------------------|------|
| 3-5                    | 4                        | 13                        | 52   |
| 6-8                    | 7                        | 22                        |      |
| 9-11                   | 10                       |                           |      |
| 12-14                  |                          |                           |      |
| 15-17                  |                          |                           |      |
|                        |                          |                           |      |

- b) Draw a similar table and estimate the mean number of white flowers a packet of seeds will produce.
- c) Each year the company produces 15,000 packets of these seeds. Approximately how many blue and white flowers will the packets produce?
- d) Approximately how many packets produce more than 14 white flowers?
- e) Which of the two charts shows a greater range? Explain your answer.
- f) Fill in the blanks in this sentence 'A packet of seeds usually has more ..... seeds in it than ..... seeds'.

# Relative Frequency

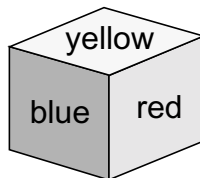
L.7

- 1) A die is rolled 100 times and the number of sixes recorded. How many times would you expect the 6 to occur?
- 2) A bag contains 9 discs, all similar to the touch. Some of the discs are blue, some are green and some are red. Abi takes a disc from the bag and records the colour. She then replaces the disc. She does this 100 times recording all the results in the table below.

|      |       |     |
|------|-------|-----|
| Blue | Green | Red |
| 45   | 34    | 21  |

How many discs of each colour do you think are in the bag?

- 3) A small cube has 2 red sides, two blue sides and 2 yellow sides.



Some friends do an experiment to decide whether this cube is biased. They each roll the cube and record the colour of the top face. These are the results they get.

| Name    | Number of Throws | Results |      |        |
|---------|------------------|---------|------|--------|
|         |                  | Red     | Blue | Yellow |
| Emma    | 100              | 45      | 34   | 21     |
| Liam    | 160              | 87      | 40   | 33     |
| Harriet | 60               | 28      | 23   | 9      |
| Jude    | 80               | 46      | 20   | 14     |

- a) Whose data are more likely to give the most accurate estimate of the probability of getting each result? Explain your answer.
- b) Is the cube biased? Explain your answer.
- The friends combine their results.

| Number of Throws | Results |      |        |
|------------------|---------|------|--------|
|                  | Red     | Blue | Yellow |
| 400              | 206     | 117  | 77     |

- c) Use these results to calculate the probability of getting a yellow.
- d) Use these results to calculate the probability of getting a red.

# Powers

Do not use a calculator

L.8

1) This table shows the powers of 4

$$\begin{aligned}4^0 &= 1 \\4^1 &= 4 \\4^2 &= 16 \\4^3 &= 64 \\4^4 &= 256 \\4^5 &= 1024 \\4^6 &= 4096 \\4^7 &= 16384 \\4^8 &= 65536 \\4^9 &= 262144 \\4^{10} &= 1048576 \\4^{11} &= 4194304 \\4^{12} &= 16777216\end{aligned}$$

- a) Explain how the table shows that  $256 \times 1024 = 262144$
- b) Explain how the table shows that  $64 \times 262144 = 16777216$
- c) Explain how the table shows that  $1048576 \div 16384 = 64$
- d) Explain how the table shows that  $16777216 \div 1048576 = 16$
- e) Use the table to work out  $\frac{4194304}{16384}$
- f) Use the table to work out  $\frac{16777216}{1048576}$

2)  $8^6 = 262144$ . Use this information to write down the following.

- a) What is the units digit of  $8^{12}$ ?
- b) What is the units digit of  $18^{12}$ ?
- c) What could the units digit of  $8^3$  be?
- d) What could the units digit of  $18^3$  be?

3) Which of the following are true? Give the correct answer when they are not, or explain why.

- |                              |                                     |                              |
|------------------------------|-------------------------------------|------------------------------|
| a) $12^1 \div 6^0 = 6^1$     | b) $2^{10} \div 4^5 = 1$            | c) $3^9 \times 3^2 = 6^{18}$ |
| d) $7^6 \times 7^3 = 7^9$    | e) $16^4 \div 8^2 = 8^2$            | f) $4^2 \times 2^4 = 8^6$    |
| g) $2^7 \times 3^3 = 6^{10}$ | h) $4^{10} \div 2^4 = 4^8$          | i) $8^6 \div 8^1 = 8^6$      |
| j) $12^3 \div 6^3 = 2^3$     | k) $3^{12} \times 3^{12} = 3^{144}$ | l) $8^0 \times 8^0 = 0$      |

## Question in Standard Form

L.8

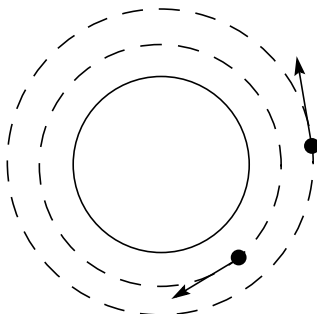
1) The approximate distances of the planets from the Sun are given in the table below.

| Planet  | Distance from the Sun in km | Distance compared to Earth |
|---------|-----------------------------|----------------------------|
| Mercury | $5.8 \times 10^7$           | 0.39                       |
| Venus   | $1.1 \times 10^8$           |                            |
| Earth   | $1.5 \times 10^8$           | 1                          |
| Mars    | $2.3 \times 10^8$           |                            |
| Jupiter | $7.8 \times 10^8$           |                            |
| Saturn  | $1.4 \times 10^9$           |                            |
| Uranus  | $2.9 \times 10^9$           |                            |
| Neptune | $4.5 \times 10^9$           |                            |
| Pluto   | $5.9 \times 10^9$           | 39.3                       |

The final column compares the distance of the earth from the Sun with the distances of the other planets from the Sun.

- a) Complete the table.
- b) The speed of light is approximately  $3 \times 10^8$  metres per second. Use the values above to calculate how long it takes for light to travel from the Sun to the Earth.
- c) How long will it take for light to travel from the Sun to Pluto?

2) The diameter of Mars is  $6.79 \times 10^6$  metres. Two man made satellites circle the planet at different altitudes and at different velocities.



The satellites are circling at heights of 150km and 260 km above the surface of Mars.

- a) What is the maximum possible distance between the satellites?
- b) What is the minimum possible distance between the two satellites?

3) If 1cm is approximately equal to 0.395 inches, how many cubic centimetres are there in 1 cubic foot? Give your answer in standard form.

## Repeated Proportional Change

L.8

- 1) The population of a village at the end of 1998 was 1,450. At the end of the next year it was found to have risen by 10%. At the end of the next year it rose by a further 8%. What was the population at the end of 2000?
- 2) Arlan puts £1000 into a bank account. He plans to leave it there for three years. He is told when he puts the money in that it will grow by 5% each year. Arlan says 'After 3 years I will have £1150 in the bank'
- a) Explain why Arlan is wrong.
- b) Calculate the true amount of money Arlan will have in the bank after 3 years.
- 3) A car costs £8,000. At the end of the first year its value depreciates by 12%.
- a) Which of the following calculations will work out its new value?  
 $8000 \times 1.12$        $8000 \times 0.12$        $8000 \times 0.88$        $8000 \times 1.08$
- b) The next year it will depreciate in value by a further 9%. What calculation must be carried out in order to find its new value?
- c) What is its value at the end of the second year?
- 4) A business employed 2000 people at the end of 1995. The table below shows the number of employees at the end of subsequent years.

|             |          |
|-------------|----------|
| End of 1995 | 2000     |
| End of 1996 | 10% more |
| End of 1997 | 10% more |
| End of 1998 | 10% more |

- a) Which of the following is used to calculate the number of employees in the company at the end of 1998?  
 $2000 \times 0.3$        $2000 \times 1.3$        $(2000 \times 1.1)^3$        $2000 \times 1.1^3$        $2000 \times 3.3$
- b) Calculate the number of people employed by the company at the end of 1998.
- 5) Two people go to a restaurant. The food costs £60. To that is added a service charge of 10%. To the new total a tax (VAT) of  $17\frac{1}{2}\%$  added.
- a) Which of the following calculations will work out their final bill?  
 $60 \times 2.275$        $60 \times 1.2925$        $60 \times 1.275$        $60 \times 2.2925$
- b) Explain how this calculation is arrived at.

# Proportion

L.8

- 1) The table below shows the population of two towns, Greystock and Thrusham in 1980 and 2000.

|           | 1980   | 2000   |
|-----------|--------|--------|
| Greystock | 43,520 |        |
| Thrusham  | 27,840 | 36,480 |

- a) In Greystock the population fell by 15.4% between 1980 and 2000.  
What was the population in Greystock in 2000?
- b) In Thrusham the population increased between 1980 and 2000.  
Calculate the percentage increase to 1 decimal place.
- c) Between 1980 and 2000 the population of two other towns, Kinster and Flockborough increased by the same amount. The percentage increase in Kinster was greater than the percentage increase in Flockborough.  
Which of the following statements below is true?  
'In 1980 the population in Kinster was higher than in Flockborough'  
'In 1980 the population in Kinster was lower than in Flockborough'  
'In 1980 the population in Kinster was the same as that in Flockborough'  
'From the information given you cannot say whether Kinster or Flockborough had the higher population'

- 2) A company makes laptop computers and mobile phones. The table below shows the value of their sales in thousands of pounds for 1994 and 2000.

|                  | 1994   | 2000   |
|------------------|--------|--------|
| Laptop Computers | 11,200 | 14,300 |
| Mobile Phones    | 1,400  |        |

- a) What was the percentage increase in the value of the company's laptop computer sales between 1994 and 2000?
- b) The company's sales of mobile phones increased by 2400% between 1994 and 2000. What was the value of their sales in 2000?
- c) What proportion of their 1994 sales were mobile phones?
- d) What proportion of their 2000 sales were mobile phones?

## Letters and %

L.8

- 1) A length of string is  $x$ cm. Another piece measures  $x + 5$ cm. If the second piece is 20% longer than the first, calculate the value of  $x$ .
  
- 2) In 1998 the cost of a bus fare was  $x$  pence. In 1999 it increased by 10%.
  - a) What was its price in 1999 in terms of  $x$ ?In 2000 the price increased by a further 8%.
  - b) What was the new price in terms of  $x$ ?
  - c) If a bus ticket cost £1.50 in 1998, how much did it cost in 2000? (correct to the nearest penny)
  
- 3) A length of string measuring  $y$  centimetres is cut in half. One of the pieces is discarded and the other is cut into thirds. Two of these pieces are discarded and the remaining one is cut in half.
  - a) What is the length of one of these pieces in terms of  $y$ ?
  - b) If the original length of string was 600cms, what were the lengths of each of the two final pieces of string?
  
- 4) The length of a rectangular piece of wood is  $x$ cm and its width is  $y$ cm.

The rectangle is made smaller by cutting 20% off its length and 10% from its width.

  - a) By what percentage does its area decrease?Another piece of wood with the same dimensions has 10% cut from its length and 20% cut from its width.
  - b) By what percent does its area decrease?
  - c) If the original length was 150cm and its width was 40cm, calculate their final areas in each case.
  
- 5) The population of a town in 1998 was  $n$  people. During 1999 the population increased by 8%. During 2000 the population decreased by 2%.

What was the population of the town at the end of 2000 as a percentage of  $n$ ?
  
- 6) A rectangle has a length of  $x$ cm and a width of  $y$ cm.
  - a) What is its area in terms of  $x$  and  $y$ ?Another rectangle has the same area, but its width is 10% greater.
  - b) By what percentage is its length smaller?A rectangle measures 110cm by 100cm.
  - c) What are the dimensions of a rectangle having the same area with one side 10% greater?