

**CALCULATORS ALLOWED****1. Calculations – Using the calculator**

**NB These sizes are fictitious and used only to illustrate the calculations.**

- a) A spider weighs  $19.06 \times 10^{-5}$  kilograms. A humming bird is 18 times heavier.  
Calculate the weight of the humming bird.
- b) A molecule is  $5.6 \times 10^{-11}$  mm in length  
How long would 100,000,000 molecules be. Give your answer in metres in scientific notation.
- c) The nearest galaxy is 4.5 light years away. One light year is  $9.46 \times 10^{12}$  km.  
How far away is the nearest galaxy in km ?
- d) The mass of water on the earth's surface is  $1.41 \times 10^{18}$  tonnes  
The total mass of the earth is  $5.97 \times 10^{21}$  tonnes.  
Express the mass of water on the earth's surface as a percentage of the total mass of the earth.
- 

**2. Percentages, Appreciation, Depreciation.**

- a) A microwave is on sale at £ 149.99 + VAT  
If VAT is 17.5%, how much will you pay for the microwave ?
- b) A photocopier costs £2878.75 **including** VAT at 17.5% What is the cost **without** VAT
- c) A house cost £ 35000 and appreciated by 3% per year.  
What would be the value after 4 years.
- d) A car was bought for £17500. It depreciated by 25% in the first year, 20% in the second year and 15% in the third year. What was it worth at the end of the **third** year.
- e) In January 1999, it was estimated that the number of monkeys in a colony was 5000.  
The number of monkeys is decreasing at the rate of 12% per year.  
How many monkeys are expected to be in the colony in January 2002 ?
- f) On a £500 holiday, a company offers an easy payment scheme.  
£100 is repaid on the 15<sup>th</sup> of each month.  
Interest is charged at the rate of 2.5% per month  
on the amount outstanding **at the end** of each month.  
The first payment is to be made in May.  
Find the amount outstanding at the beginning of August.
- g) In 1999 a house was valued at £90 000 and the contents were valued at £60 000.  
The value of the house **appreciates** by 5% each year.  
The value of the contents **depreciates** by 8% each year.  
What will be the **total** value of the house **and** the contents in 2002 ?
-

### 3. Algebra, Graphs & Trigonometry

- a) Solve the equation  $2x^2 + 3x - 7 = 0$   
Give your answer **correct to 1 decimal place**.

You have not done these yet.

- b) Solve the equation  $x^2 + 3x - 5 = 0$   
Give your answer **correct to 2 significant figures**.

- c) Solve the inequation:  $5(x - 4) + 3 \leq 9$

- d) Solve the inequation:  $2 - 7(2x - 3) \leq 11$

- e) Jenny and Bob each go to McBurger King and buy some burgers and fries to take home to their families.

Jenny buys 3 burgers and 2 lots of fries. She spends £13.45

Bob buys 4 Burgers and 5 lots of fries. Bob spends £20.50

How much is a burger, and how much are fries ?

- f) Andrew and Doreen each book in at the Sleepwell Lodge.

Andrew stays for 3 nights and has breakfast on 2 mornings.  
His bill is £145

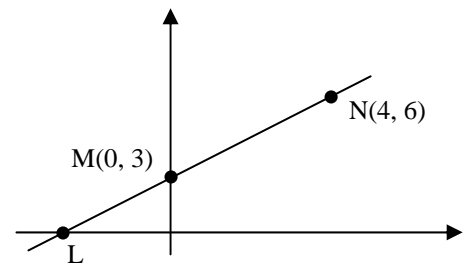
Doreen stays for 5 nights and has breakfast on 3 mornings.  
Her bill is £240.

Find the cost of one breakfast.

- g) A straight line is shown through the points  $M(0, 3)$  and  $N(4, 6)$ .

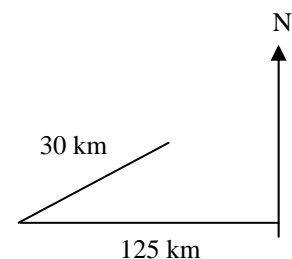
The point  $L$  is where the line  $MN$  cuts the  $x$ -axis.

- a) Find the equation of the straight line  $MN$ .  
b) Use the equation to find the coordinates of point  $L$ .

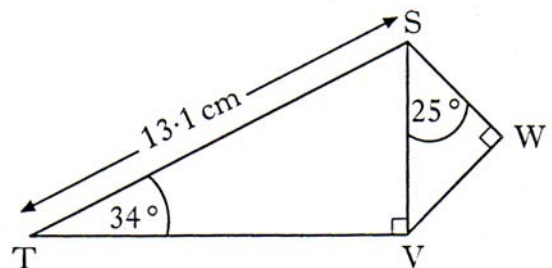


- h) A plane takes off from Aberdeen and flies due west for 125km. It then changes to a bearing of  $040^\circ$  and flies for a distance of 30 km.

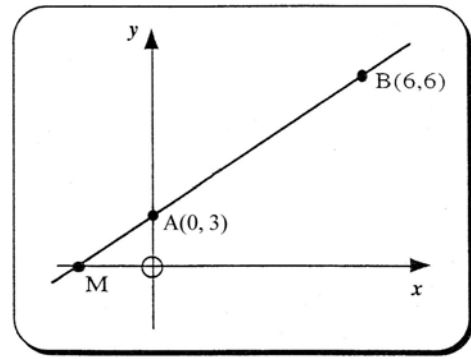
How much further must it fly so that it is due north of Aberdeen again ?



- i) In the diagram,  
Angle  $STV = 34^\circ$   
Angle  $VSW = 25^\circ$   
Angle  $SVT = \text{Angle } SWV = 90^\circ$   
 $ST = 13.1$  centimetres  
Calculate the length of  $SW$ .



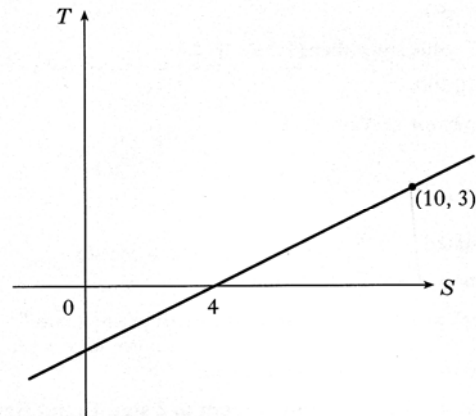
- j) The straight line through the points  $A(0, 3)$  and  $B(6, 6)$  is shown in the diagram.



The point  $M$  is where the line  $AB$  cuts the  $x$ -axis.

- Find the equation of the straight line  $AB$ .
- Use this equation to find the coordinates of the point  $M$ .

- k) Find the equation of the given straight line in terms of  $S$  and  $T$ .



#### 4. Statistics

- a) The price in pence per litre, of petrol at 10 city garages is shown below:

84.2	84.4	85.1	83.9	81.0
84.2	85.6	85.2	84.9	84.8

- Calculate the mean and standard deviation of these prices.
- In 10 rural garages, the petrol prices had a mean of 88.8 and a standard deviation of 2.4. How do the rural prices compare with the city prices?

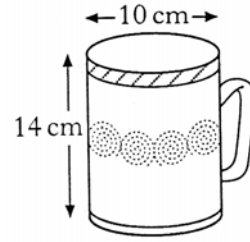
- b) Fiona checks out the price of a litre of milk in several shops. The prices in pence are:

49	44	41	52	47	43
----	----	----	----	----	----

- Find the mean price of a litre of milk
- Find the standard deviation of the prices.
- Fiona also checks out the price of a kilogram of sugar in the same shops and finds that the standard deviation of the prices is 2.6. Make one valid comparison between the two sets of prices.

**5. Problem Solving**

a) A mug is in the shape of a cylinder with diameter 10 centimetres and height 14 centimetres.

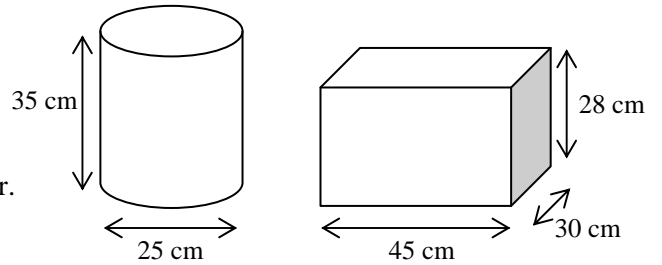


- i) Calculate the volume of the mug.
- ii) 600 millilitres of coffee are poured in. Calculate the depth of coffee in the cup.

b) A cylindrical container with diameter 25 cm and height 35 cm is full of fuel.

This is then emptied into a cuboidal container of length 45 cm, width 30 cm and height 28 cm.

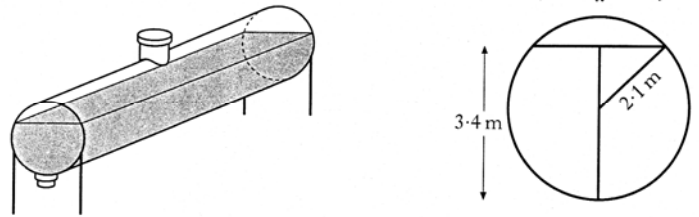
What will be the depth of fuel in the cuboidal container.



c) An water feed tank has a circular cross section of radius 2.1 metres.

It is filled to a depth of 3.4 metres.

- i) Calculate  $x$ , the width in metres of the surface of the water.
- ii) What other depth of water would give the same surface width ?



d) A cylindrical soft drinks can is 15 centimetres in height and 6.5 centimetres in diameter.

A new cylindrical can holds the same volume but has a reduce height of 12 centimetres.

What is the diameter of the new can ?

Give your answer **to 1 decimal place**.

e) A sheep shelter is part of a cylinder as shown in Figure 1.

It is 6 metres wide and 2 metres high.

The cross section of the shelter is a segment of a circle with centre  $O$  as shown in Figure 2.

$OB$  is the radius of the circle.

Calculate the length of  $OB$ .

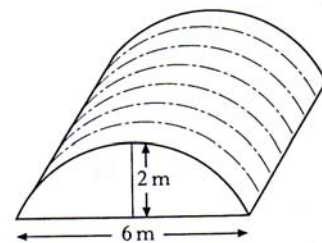


Figure 1

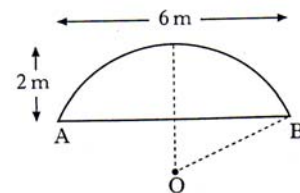
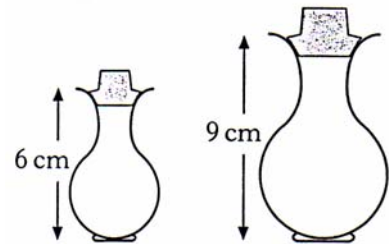


Figure 2

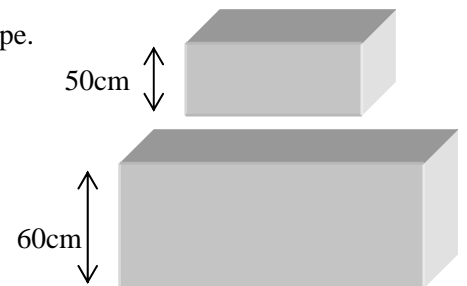
## 6. Similar Triangles

- a) Two perfume bottles are mathematically similar in shape.  
The smaller one is 6 cm high and holds 30 millilitres of perfume.  
The larger one is 9 centimetres high.



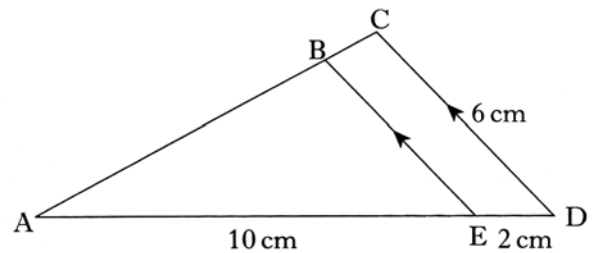
- i) What volume will the larger one hold ?
- ii) If the surface area of the large one is  $180 \text{ cm}^2$ , what will be the surface area of the smaller one ?

- b) Robert has two wooden boxes that are mathematically similar in shape.  
He finds that it takes 3.4 litres of paint to paint the large box.



How much paint will it take to paint the small box ?

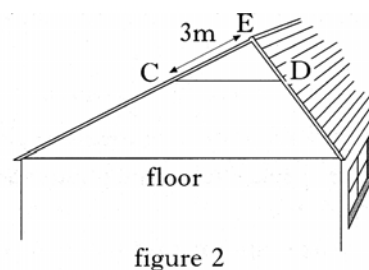
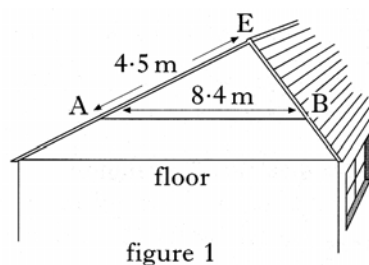
- c) Triangles ABE and ACD with some of their measurements are shown opposite.  
Triangle ABE is similar to triangle ACD.



Calculate the length of BE.

**Do not use a scale drawing.**

- d) The brown family want to convert the roof space in their bungalow into an extra room.



The position, AB, of the wooden beam must be changed to position CD, as shown in figure 2.

The wooden beam must always be parallel to the floor.

By considering the similar triangles EAB and ECD, calculate the length of the wooden beam in position CD.

**Do not use a scale drawing.**