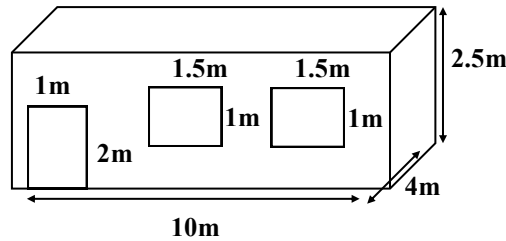


Planning and Measuring

**N4 Applications of Maths
Geometry and Measures**

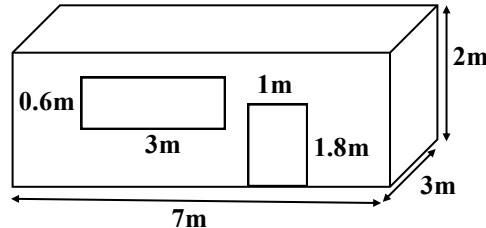
3. Kevin is planning to make his basement into a gym. The basement is in the shape of a cuboid with a door and 2 windows as shown.



- Work out the total area of the basement walls?
- What volume of paint must Kevin buy?
- How many tins of paint must Kevin buy?
- Paint is sold in 1 litre tins costing £12.50 each. What will be the cost of painting the bedroom?
- New skirting boards need to be fitted around room at floor level. (the perimeter of the basement excluding the door). Calculate the total length of skirting board needed.



4. Kate is planning to make her garage into an office. The office is in the shape of a cuboid with a door and window as shown.



- Work out the total area of the bedroom walls?
- What volume of paint must Lisa buy?
- How many tins of paint must Lisa buy?
- Paint is sold in 1 litre tins costing £14.45 each. What will be the cost of painting the bedroom?
- New skirting boards need to be fitted around room at floor level. (the perimeter of the office excluding the door). Calculate the total length of skirting board needed.



1. Time Management.

- It takes Mandy 40 minutes to walk from her home to the dentist. Her appointment is at 14:15. What is the latest time she could leave home and be in time for her appointment?
- Darren has to catch a train at 11:10. It takes him 25 minutes to drive from home to the station. What is the latest time that he could leave home to catch the train?
- Calum wants to visit a car exhibition after work. It will take him 35 minutes to drive there and he wants to spend two hours visiting the exhibition. The exhibition closes at 17:30. What time should he leave work.
- It takes Lisa 45 minutes to drive to work in the morning. She has to be at work by 08:30. What is the latest time that she can leave home?
- Sammy is planning to cook dinner for her boyfriend. She is making beef stew which takes 1 hour 45 minutes to cook in the oven. She calculates that it will take 25 minutes to prepare the stew before putting it in the oven. If they plan to eat at 16:15, at what time should she start to prepare dinner?
- Keiran is planning to go to the cinema in Aberdeen. He needs to catch a bus which takes 1 hour 55 minutes. In Aberdeen he will need to walk for 25 minutes to get to the cinema. The film starts at 16:40. What is the latest time that he can catch the bus?
- Aaron has to catch a plane which leaves at 10:05. He has to be at the airport 1 hour before the plane leaves. He estimates that it will take him 1 hour 45 minutes to drive to the airport and get parked. At what time should he leave home?

2. Using Formulae

1. The formula for finding the perimeter of a triangle (P) when you know its three sides called S_1 , S_2 and S_3 is

$$P = S_1 + S_2 + S_3$$

Work out the value of P when :

- (a) $S_1 = 12$, $S_2 = 7$ and $S_3 = 9$ (b) $S_1 = 72$, $S_2 = 68$ and $S_3 = 55$
 (c) $S_1 = 324$, $S_2 = 176$ and $S_3 = 228$ (d) $S_1 = 0.2$, $S_2 = 0.7$ and $S_3 = 0.4$

2. The formula for finding the area of a kite (A) when you know the length of its diagonals d_1 and d_2 is

$$A = \frac{d_1 + d_2}{2}$$

Work out the value of A when :

- (a) $d_1 = 12$ and $d_2 = 8$ (b) $d_1 = 57$ and $d_2 = 39$
 (c) $d_1 = 7.6$ and $d_2 = 5.8$ (d) $d_1 = 150$ and $d_2 = 124$

3. The formula for working out the area of plastic needed to make a beach ball is

$$A = 12.56 r^2$$

Work out the value of A when :

- (a) $r = 8$ cm (b) $r = 18$ cm (c) $r = 12.5$ cm (d) $r = 142$ mm
4. Newton's formula for working out the Force (F) on an object when you know the mass (m) and acceleration (a) is

$$F = ma$$

Work out the value of F when :

- (a) $m = 2$ and $a = 36$ (b) $m = 0.5$ and $a = 120$ (c) $m = 7$ and $a = 45$
5. The cost (£C) of hiring a car when you know the number of days (d) that you need to hire it for is :

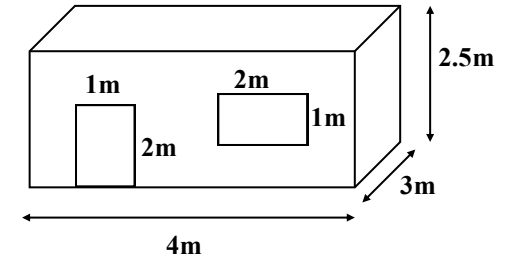
$$C = 65d + 54$$

Work out the cost of hiring the car for:

- (a) 3 days (b) 7 days (c) 15 days

10. Area

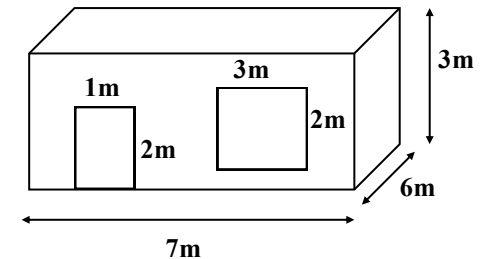
1. Alan is planning to decorate a bedroom for the new baby. The bedroom is in the shape of a cuboid with a door and window as shown.



- Work out the total area of the bedroom walls?
- What volume of paint must Alan buy?
- How many tins of paint must Alan buy?
- Paint is sold in 1 litre tins costing £12.50 each. What will be the cost of painting the bedroom?
- New skirting boards need to be fitted around room at floor level. (the perimeter of the bedroom excluding the door). Calculate the total length of skirting board needed.



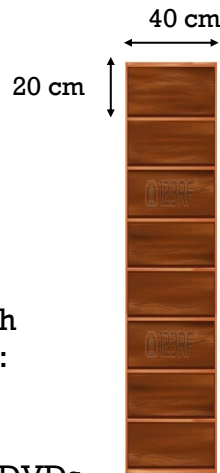
2. Lisa is planning to decorate her bedroom. The bedroom is in the shape of a cuboid with a door and window as shown.



- Work out the total area of the bedroom walls?
- What volume of paint must Lisa buy?
- How many tins of paint must Lisa buy?
- Paint is sold in 2 litre tins costing £28.25 each. What will be the cost of painting the bedroom?
- New skirting boards need to be fitted around room at floor level. (the perimeter of the bedroom excluding the door). Calculate the total length of skirting board needed.



3. In this DVD cabinet, each shelf measures 40 cm across and is 20 cm deep.

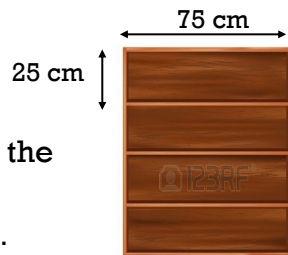


The DVDs which need to be stacked into the shelves each measure

20 cm by 13.5 cm by 1 cm (spine width).

- A. Work out the maximum number of DVDs which can be put into one shelf if they are arranged :
- (a) Horizontally (b) Vertically
- B. There are 8 shelves in the cabinet. How many DVDs could be stacked in the whole cabinet if they are arranged:
- (a) Horizontally (b) Vertically
- C. Write a clear solution to explain which is the best way of stacking the DVDs in the cabinet so that the maximum number can be stored.

4. In this bookcase, each shelf measures 75 cm across and is 25 cm deep.



The books which need to be stacked into the shelves each measure

25 cm by 15 cm by 2.5 cm (spine width).

- A. Work out the maximum number of books which can be put into the bookcase if they are arranged :
- (a) Horizontally (b) Vertically
- B. Write a clear solution to explain which is the best way of stacking the books in the bookcase so that the maximum number can be stored.

6. The formula for finding the density (D) of an object when you know its mass (M) and its Volume (V)

$$D = \frac{M}{V}$$

Work out the value of D when :

- (a) M = 240 and V = 80 (b) M = 500 and V = 20
(c) M = 9 and V = 0.3 (d) M = 2000 and V = 100

7. The formula for finding the final velocity (v) when you know the initial velocity (u), the acceleration (a) and the time (t).

$$v = u + at$$

Work out the value of v when :

- (a) u = 30, a = 12 and t = 10 (b) u = 12, a = 7 and t = 20
(c) u = 25, a = 45 and t = 4 (d) u = 100, a = 36 and t = 75

8. Einstein's formula for calculating Energy (E) when you know the mass (m) and the velocity (v).

$$E = mv^2$$

Work out the value of E when :

- (a) m = 20 and v = 6 (b) m = 150 g and v = 9
(c) m = 4 and v = 100 (d) m = 0.5 and v = 300

9. Pythagoras formula for working out the length of the longest side (c) in a triangle when you know the length of the other two sides (a and b).

$$c = \sqrt{a^2 + b^2}$$

Work out the value of c when :

- (a) a = 6 and b = 8 (b) a = 5 and b = 12
(c) a = 7 and b = 24 (d) a = 8 and b = 15

3. Time and Formulae

- (a) The time taken for a journey in minutes is $T = 5s + 20$.
If $s = 20$ what is the value of T . (in hours)
(b) If I have to get to Banff at 18:00 what time would I have to leave my house?
- (a) The time taken for a journey in minutes is $M = 25d + 35$.
If $d = 4$ what is the value of M . (in hours and minutes)
(b) If I have to get to Aberdeen for 20:30 what time would I have to leave my house?
- Daniel is cooking a 3 kg joint of pork. The formula for calculating the cooking time is: $T = 35w + 20$. w is the weight in kg.
(a) How long, (in hours and minutes), will it take the pork to cook?
(b) If the pork needs to be ready by 12:45 when does he need to start cooking?
- Natasha is cooking a 7 kg turkey. The formula for calculating the cooking time is: $T = 20w + 45$. w is the weight in kg.
(a) How long, (in hours and minutes), will it take the turkey to cook?
(b) If the turkey needs to be ready by 18:15 when does she need to start cooking?
- Colin is cooking a 4 kg of lamb. The formula for calculating the cooking time is: $T = 35w + 20$. w is the weight in kg.
(a) How long, (in hours and minutes), will it take the lamb to cook?
(b) If the lamb needs to be ready by 18:15 when does he need to start cooking?
- (a) The time taken for a journey in minutes is $P = 20q + 45$.
If $q = 5$ what is the value of P . (in hours and minutes)
(b) If I have to get to Banff at 20:50 what time would I have to leave my house?
- (a) The time taken to cook pork in minutes is $T = 55w + 25$, where w stands for the weight in kg.
If $w = 4$ what is the value of T . (in hours and minutes)
(b) If the pork needs to be ready by 17:30 when do I need to start cooking?

9. Packing


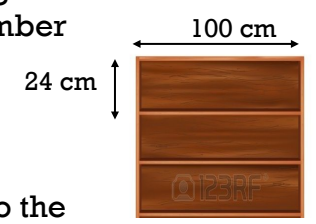
Books can be stacked into the shelves in a bookcase in two different ways.



Horizontally



or vertically

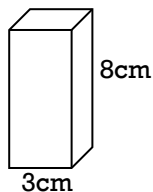
- In this bookcase, each shelf measures 16 cm deep. 
50 cm across and is 16 cm deep.
The books which need to be stacked into the shelves each measure 15 cm by 10 cm by 2 cm (spine width).
A. Work out the maximum number of books which can be put into one shelf if they are arranged :
(a) Horizontally (b) Vertically
B. There are 5 shelves in the bookcase. How many books could be stacked in the whole bookcase if they are arranged:
(a) Horizontally (b) Vertically
C. Explain which is the best way of stacking the books in the bookcase so that the maximum number can be stored.
- In this bookcase, each shelf measures 24 cm deep. 
100 cm across and is 24 cm deep.
The books which need to be stacked into the shelves each measure 24 cm by 20 cm by 1.5 cm (spine width).
A. Work out the maximum number of books which can be put into one shelf if they are arranged :
(a) Horizontally (b) Vertically
B. There are 3 shelves in the bookcase. How many books could be stacked in the whole bookcase if they are arranged:
(a) Horizontally (b) Vertically
C. Write a clear solution to explain which is the best way of stacking the books in the bookcase so that the maximum number can be stored.

5. Orange juice is sold in square based cartons like the ones shown.

(a) Calculate the volume of the carton.

(b) If the cartons are *filled* from a 5 litre tub, how many cartons can be *filled*?

(c) If the volume of the carton was doubled how many cartons can now be *filled* from the tub?



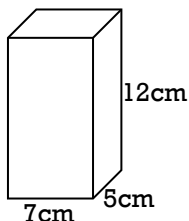
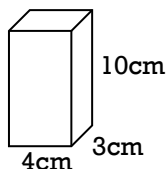
6. Smoothies are sold in cartons like the ones shown here.

(a) Calculate the volume of the carton.

(b) If the cartons are *filled* from an 8 litre tub, how many cartons can be *filled*?

(c) A new super sized carton is to replace the older one. A diagram of the new carton is shown here.

How many of the new cartons can be *filled* from the 8 litre tub?

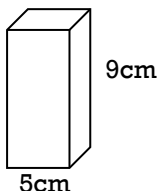


7. Children's poster paint is sold in cuboid containers with a square base like the ones shown.

(a) Calculate the volume of the container.

(b) If the containers are *filled* from a 10 litre tub, how many containers can be *filled*?

(c) If the volume of the container was doubled how many containers can now be *filled* from the tub?



4. Tolerance

1. A sample of eight boxes contains the following number of sweets per box:

43 39 41 40 39 44 41 42

The company which produces the sweets claims that the mean number sweets per box is 40 ± 2 .

Does the data support the claim made by the company?

Give a reason for your answer.

2. A sample of six bags contains the following number of marbles per bag:

26 25 26 30 28 27

The company which produces the sweets claims that the mean number of marbles per bag is 22 ± 3 .

Does the data support the claim made by the company?

Give a reason for your answer.

3. A sample of ten boxes contains the following number of matches per box:

74 80 77 74 75 81 79 76 80 77

The company which produces the matches claims that the mean number of matches per box is 76 ± 3 .

Does the data support the claim made by the company?

Give a reason for your answer.

4. A sample of seven packets contains the following number of biscuits per packet:

42 44 40 38 45 44 40

The company which produces the biscuits claims that the mean number of biscuits per packet is 39 ± 2 .

Does the data support the claim made by the company?

Give a reason for your answer.

5. A sample of ten boxes contains the following number of nails per box:

22 24 19 18 19 23 22 20 22 24

The company which produces the nails claims that the mean number of nails per box is 20 ± 1 .

Does the data support the claim made by the company?

Give a reason for your answer.

6. A sample of eight boxes contains the following number of cheese bites per box:

13 15 17 14 18 16 16 17

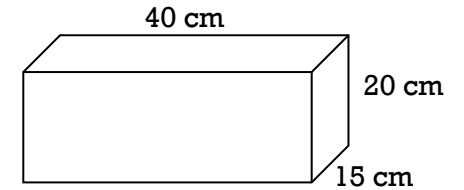
The company which produces the cheese bites claims that the mean number of cheese bites per box is 15 ± 3 .

Does the data support the claim made by the company?

Give a reason for your answer.

8. Volume

Remember $1 \text{ litre} = 1000 \text{ cm}^3$
 $1 \text{ cm}^3 = 1 \text{ ml}$

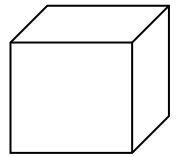


1. A tank holding soup is in the shape of a cuboid,

(a) Find the volume of the tank.

It is used to fill cans which hold 330 cm^3 .

(b) How many cans can be *filled* from the tank?



9 cm

2. Small boxes are to be filled with liquid soap.

The boxes are in the shape of a cube shown.

(a) Work out the volume of the cube.

The boxes are filled from a container which holds 20 litres.

(b) How many boxes can be *filled* from the container?

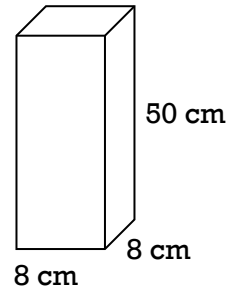
3. Small moulds are to be filled with chocolate from a metal box which holds the melted chocolate.

The box is in the shape of a cuboid shown.

(a) Work out the volume of the cuboid.

The volume of a mould is

(b) How many boxes can be *filled* from the container?

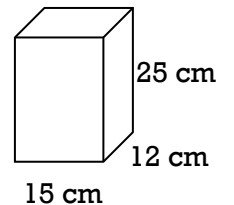


4. A tank holding custard is in the shape of a cuboid,

(a) Find the volume of the tank.

It is used to fill packets which hold 420 cm^3 .

(b) How many packets can be *filled* from the tank?



5. A dinghy race takes the following route:

From the Race Start, sail 80 m on a bearing of 160° to the first buoy, then sail 50m on a bearing of 075° to the second marker buoy.

Using a scale of 1 cm = 10m make a scale drawing of the journey. How far must the dingy sail from the second marker buoy back to the Start?

6. An orienteering course takes the following route:

From the start walk 100m on a bearing of 095° to the first turn. Then walk 140 m on a bearing of 015° to the second turn.

Using a scale of 1 cm = 20m make a scale drawing of the journey. How far is it now from the start of the course?

7. A helicopter, searching for a lost ship takes the following route:

From the Airport fly 150 km on a bearing of 030° to the Last Reef. Then fly 120 km on a bearing of 065° to the Radar Location.

Using a scale of 1cm = 30km make a scale drawing of the journey. How far does the helicopter have to fly to return to the Airport?

8. A cruise ship sailing round the islands takes the following route:

From the Base Harbour, sail 35 km on a bearing of 125° to island A. Then fly 40 km on a bearing of 025° to Island B.

Using a scale of 1 cm = 5km make a scale drawing of the journey. How far does the ship have to sail to return to the Base Harbour?

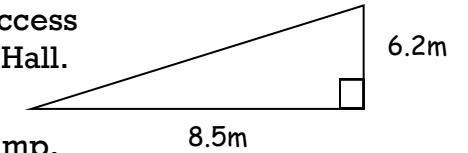
9. A sailing boat takes the following route:

From the start sail 150 m on a bearing of 055° to checkpoint 1 then sail 350 m on a bearing of 145° to checkpoint 2.

Using a scale of 1 cm = 50m make a scale drawing of the journey. How far will the boat have to sail back to the Start?

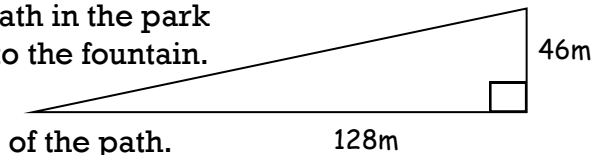
5. Gradient

1. The diagram shows the planned access ramp for wheelchairs at the Town Hall.



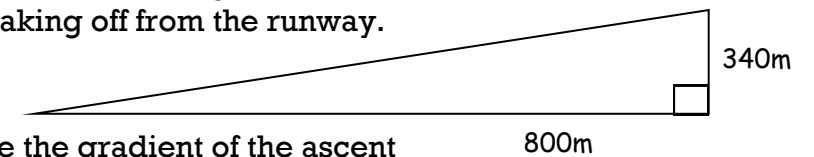
- Calculate the gradient of the ramp.
- For safety reasons the gradient must not exceed 0.8. Will this ramp satisfy the regulations?

2. The diagram shows the path in the park leading from the swings to the fountain.



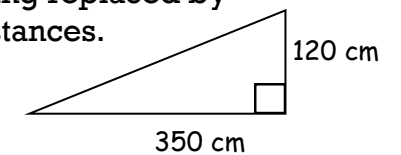
- Calculate the gradient of the path.
- For safety reasons the gradient must not exceed 0.2. Will this ramp satisfy the regulations?

3. The diagram shows the flight plan for an aircraft taking off from the runway.



- Calculate the gradient of the ascent
- For safety reasons the gradient must not exceed 0.8. Will this plan satisfy the regulations?

4. The steps up to the library door are being replaced by an access ramp. The plan shows the distances.

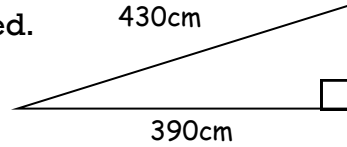


- Calculate the gradient of the ramp.
- For safety reasons the gradient must not exceed 0.5. Will this ramp satisfy the regulations?

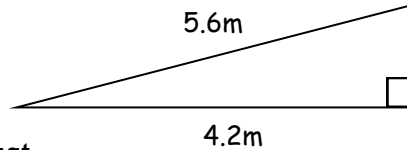
6. Gradient and Pythagoras

Each of these diagrams shows the proposal for a ramp which needs to be constructed.

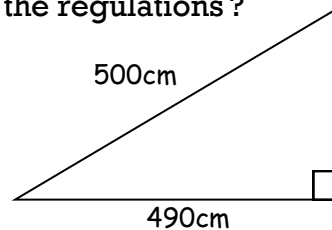
1. a. Calculate the height
- b. Calculate the gradient
- c. For safety reasons the gradient must not exceed 0.7. Will this diagram satisfy the regulations?



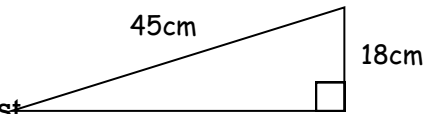
2. a. Calculate the height
- b. Calculate the gradient
- c. For safety reasons the gradient must not exceed 0.9. Will this diagram satisfy the regulations?



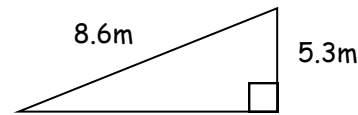
3. a. Calculate the height
- b. Calculate the gradient
- c. For safety reasons the gradient must not exceed 0.4. Will this diagram satisfy the regulations?



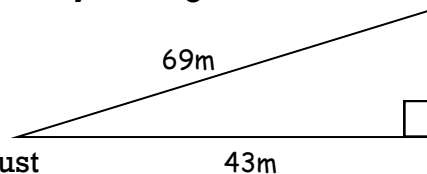
4. a. Calculate the length.
- b. Calculate the gradient.
- c. For safety reasons the gradient must not exceed 0.5. Will this diagram satisfy the regulations?



5. a. Calculate the length.
- b. Calculate the gradient
- c. For safety reasons the gradient must not exceed 0.7. Will this diagram satisfy the regulations?



6. a. Calculate the height
- b. Calculate the gradient
- c. For safety reasons the gradient must not exceed 1.3. Will this diagram satisfy the regulations?



7. Bearing and Scale

1. A racing car takes the following route:

From the start drive 35km on a bearing of 040° to checkpoint 1 then drive 30km on a bearing of 155° to checkpoint 2.

Using a scale of 1 cm = 5km make a scale drawing of the journey.

Work out how far from the start the car is now?

2. Following directions an aeroplane flies the following route:

Form the Airport, fly 55km on a bearing of 070° to Red Hill then fly 40km on a bearing of 125° to the Observatory.

Using a scale of 1 cm = 5km make a scale drawing of the journey.

How far will the aeroplane have to fly from the Observatory back to the Airport.?

- 3 A sailing boat takes the following route:

From the River Mouth sail 50km on a bearing of 080° to the Secure Anchorage, then sail 30km on a bearing of 120° to the Final Harbour.

Using a scale of 1 cm = 5km make a scale drawing of the journey.

If the boat now sails back to the River Mouth, how far will it have to go?

4. A rally car follows these directions:

From the start drive 35km on a bearing of 070° to checkpoint 1 then drive 20km on a bearing of 155° to checkpoint 2.

Using a scale of 1 cm = 5km make a scale drawing of the journey.

Calculate how far from the start the car is now?