Name	Class

MATHS TEACHER HUB

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Similarity and congruence

(9 – 1) Topic booklet

Higher

These questions have been collated from previous years GCSE Mathematics papers.

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser.

Total Marks

Instructions

•Use **black** ink or ball-point pen.
•**Fill in the boxes** at the top of this page with your name, centre number and candidate number.
•Answer **all** questions.
•Answer the questions in the spaces provided
– *there may be more space than you need*.
•Diagrams are NOT accurately drawn, unless otherwise indicated.
•You must **show all your working out.**
•If the question is a **1H** question you are not allowed to use a calculator.
•If the question is a **2H** or a **3H** question, you may use a calculator to help you answer.

Information

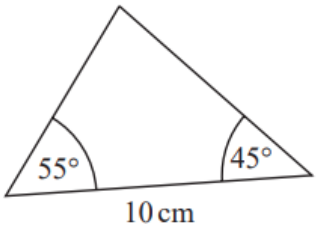
•The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question*.

Advice

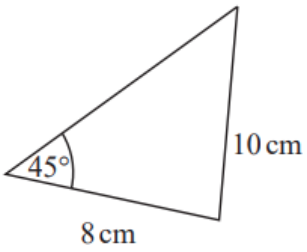
•Read each question carefully before you start to answer it.
•Keep an eye on the time.
•Try to answer every question.
•Check your answers if you have time at the end.

Answer ALL questions
Write your answers in the space provided.
You must write down all the stages in your working.

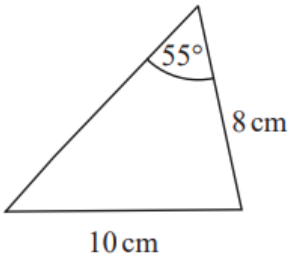
4 The diagram shows four triangles.



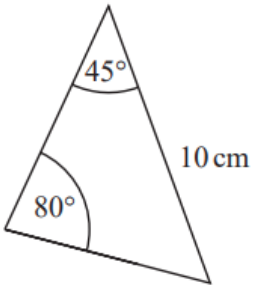
Triangle **A**



Triangle **B**



Triangle **C**



Triangle **D**

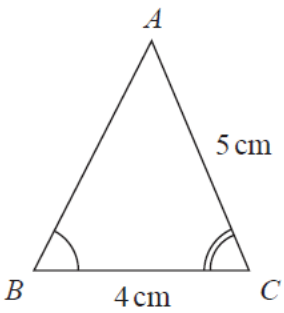
Two of these triangles are congruent.

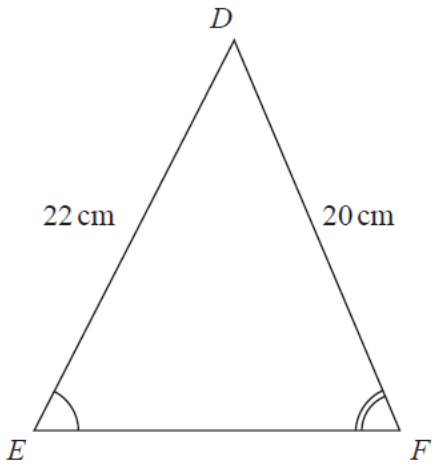
Write down the letters of these two triangles.

..... and .....

(Total for Question 4 is 1 mark)

5 Triangle ABC and triangle DEF are similar.





(a) Work out the length of EF.

..... cm

(2)

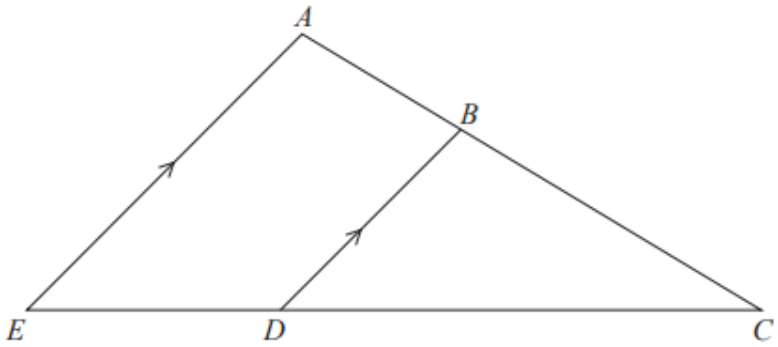
(b) Work out the length of AB.

..... cm

(2)

(Total for Question 5 is 4 marks)

5



ABC and *EDC* are straight lines.
EA is parallel to *DB*.

EC = 8.1 cm.
DC = 5.4 cm.
DB = 2.6 cm.

(a) Work out the length of *AE*.

..... cm

(2)

AC = 6.15 cm.

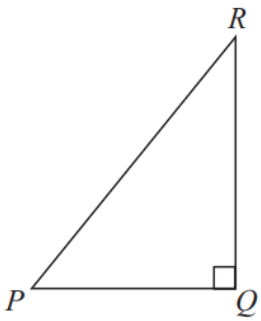
(b) Work out the length of *AB*.

..... cm

(2)

(Total for Question 5 is 4 marks)

8 A playground is in the shape of a right-angled triangle.



Dan makes a scale drawing of the playground.
He uses a scale of 1 cm represents 5 m

The area of the playground on the scale drawing is 28 cm^2

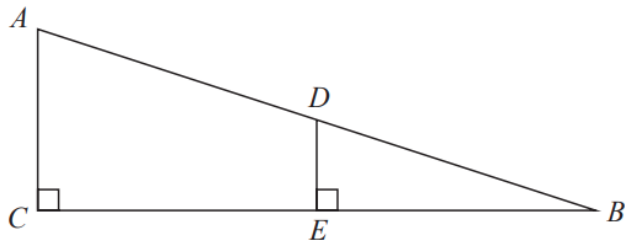
The real length of QR is 40 m

Work out the real length of PQ.

..... m

(Total for Question 8 is 3 marks)

10 The diagram shows two right-angled triangles ACB and DEB.



$AD = 9$ cm
$DE = 2$ cm
$DB = 6$ cm

Calculate the length of CB.
Give your answer correct to 2 decimal places.

..... cm

(Total for Question 10 is 4 marks)

13 Solid **A** and solid **B** are similar.

The ratio of the height of solid **A** to the height of solid **B** is 2 : 5

The volume of solid **A** is 12 cm^3

Work out the volume of solid **B**.

..... cm^3

(Total for Question 13 is 3 marks)

13 Here are two similar solid shapes.

A

B

surface area of shape **A** : surface area of shape **B** = 3 : 4

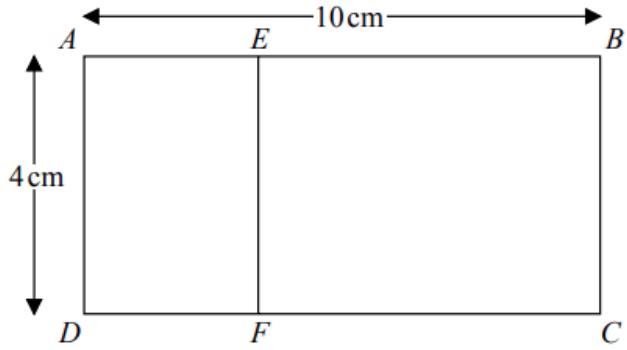
The volume of shape **B** is 10 cm^3

Work out the volume of shape **A**.
Give your answer correct to 3 significant figures.

..... cm^3

(Total for Question 13 is 3 marks)

13 Rectangle *ABCD* is mathematically similar to rectangle *DAEF*.



AB = 10 cm.
AD = 4 cm.

Work out the area of rectangle *DAEF*.

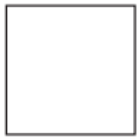
..... cm^2

Sample 1 – Paper 1H

(Total for Question 13 is 3 marks)

14 Here are two squares, **A** and **B**.

A



B

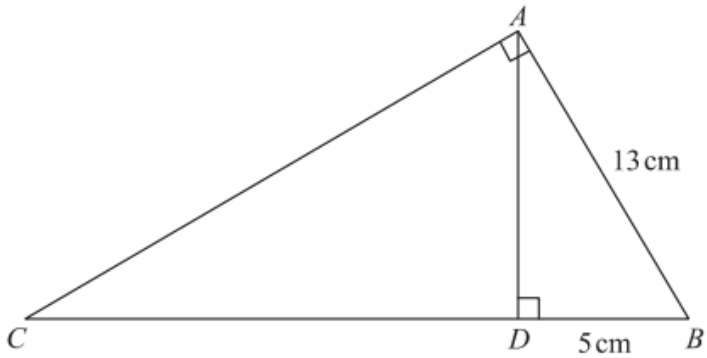
The length of each side of square **B** is 4 cm greater than the length of each side of square **A**.
The area of square **B** is 70 cm^2 greater than the area of square **A**.

Find the area of square **B**.
Give your answer correct to 3 significant figures.
You must show all your working.

..... cm^2

(Total for Question 14 is 4 marks)

14 *ABC* and *ABD* are two right-angled triangles.



Angle *BAC* = angle *ADB* = 90°

AB = 13 cm
DB = 5 cm

Work out the length of *CB*.

..... cm

(Total for Question 14 is 3 marks)

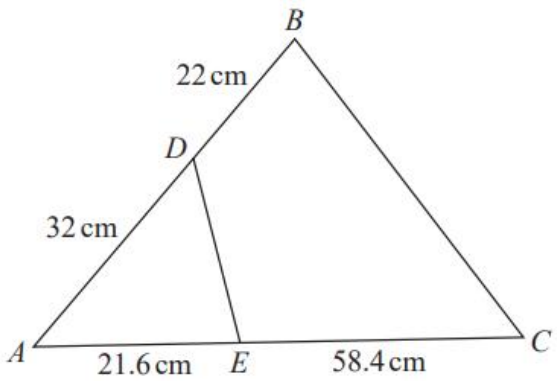
14 Cone **A** and cone **B** are mathematically similar.
The ratio of the volume of cone **A** to the volume of cone **B** is 27 : 8

The surface area of cone **A** is 297 cm^2

Show that the surface area of cone **B** is 132 cm^2

November 2017 – Paper 3H **(Total for Question 14 is 3 marks)**

15 The diagram shows triangle ABC and triangle AED.



Show that triangle ABC and triangle AED are similar.

(Total for Question 15 is 2 marks)

15 Three solid shapes **A**, **B** and **C** are similar.

The surface area of shape **A** is $4\,cm^2$
The surface area of shape **B** is $25\,cm^2$

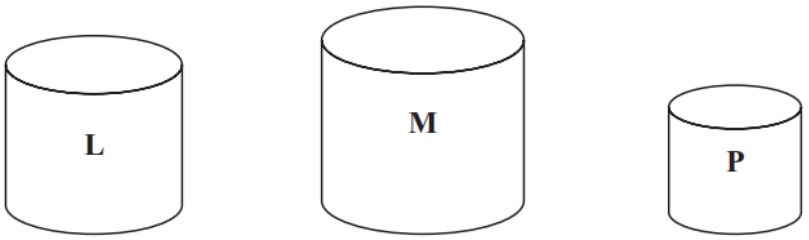
The ratio of the volume of shape **B** to the volume of shape **C** is 27 : 64

Work out the ratio of the height of shape **A** to the height of shape **C**.
Give your answer in its simplest form.

.....

(Total for Question 15 is 4 marks)

17 **L**, **M** and **P** are three similar solid cylinders made from the same material.



L has a mass of 64 g
M has a mass of 125 g

M has a total surface area of 144 cm^2
P has a total surface area of 16 cm^2

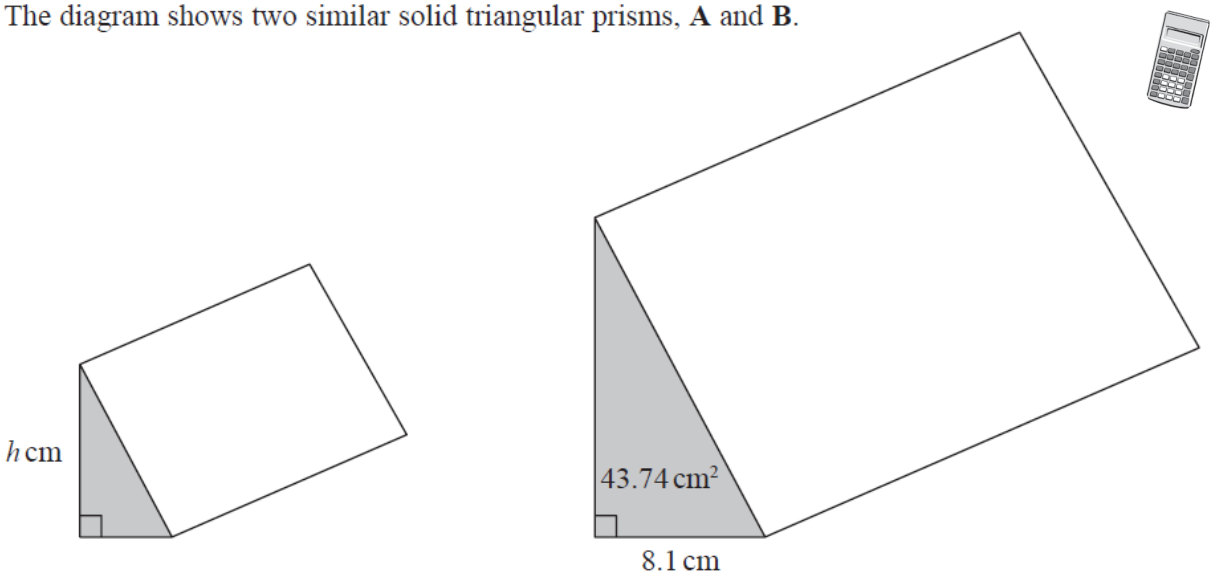
Work out

height of cylinder **L** : height of cylinder **M** : height of cylinder **P**

.....

(Total for Question 17 is 4 marks)

17 The diagram shows two similar solid triangular prisms, **A** and **B**.



Prism **A**

Prism **B**

The volume of prism **A** is 58.806 cm³
The volume of prism **B** is 1587.762 cm³

The cross section of each prism is a right-angled triangle.

For prism **B**
the length of the base of the triangle is 8.1 cm
the area of the triangle is 43.74 cm²

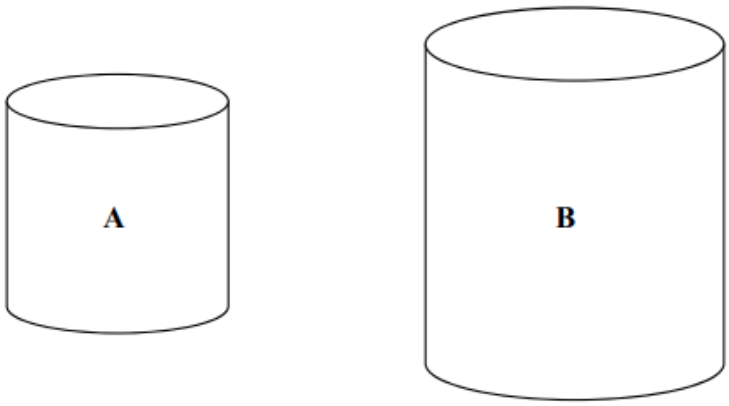
The height of the triangle for prism **A** is h cm.

Work out the value of h.

$h =$ .....

(Total for Question 17 is 4 marks)

17 **A** and **B** are two similar cylindrical containers.



the surface area of container **A** : the surface area of container **B** = 4 : 9

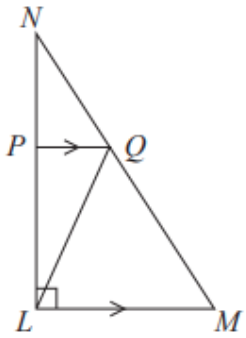
Tyler fills container **A** with water.
She then pours all the water into container **B**.
Tyler repeats this and stops when container **B** is full of water.

Work out the number of times that Tyler fills container **A** with water.
You must show all your working.

.....

(Total for Question 17 is 4 marks)

18 LMN is a right-angled triangle.



Angle $NLM = 90°$
PQ is parallel to LM.

The area of triangle PNQ is 8 cm^2
The area of triangle LPQ is 16 cm^2

Work out the area of triangle LQM.

..... cm^2

(Total for Question 18 is 4 marks)

18 Solid **A** and solid **B** are mathematically similar.
The ratio of the surface area of solid **A** to the surface area of solid **B** is 4 : 9

The volume of solid **B** is 405 cm^3.

Show that the volume of solid **A** is 120 cm^3.

(Total for Question 18 is 3 marks)

19 **A**, **B** and **C** are three spheres.

The volume of sphere **A** is $125\,cm^3$
The volume of sphere **B** is $27\,cm^3$

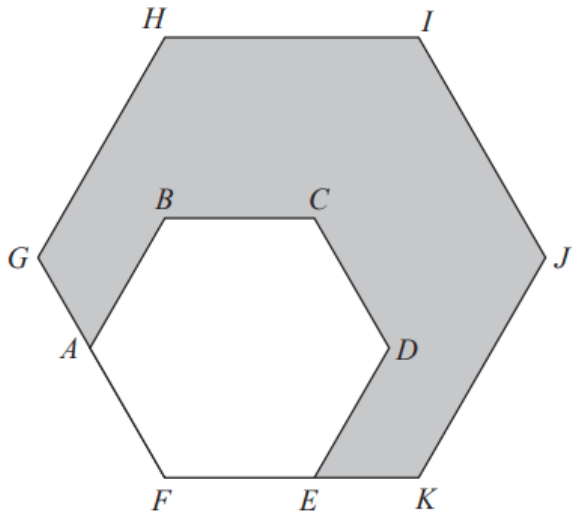
The ratio of the radius of sphere **B** to the radius of sphere **C** is 1 : 2

Work out the ratio of the surface area of sphere **A** to the surface area of sphere **C**.

.....

(Total for Question 19 is 3 marks)

19

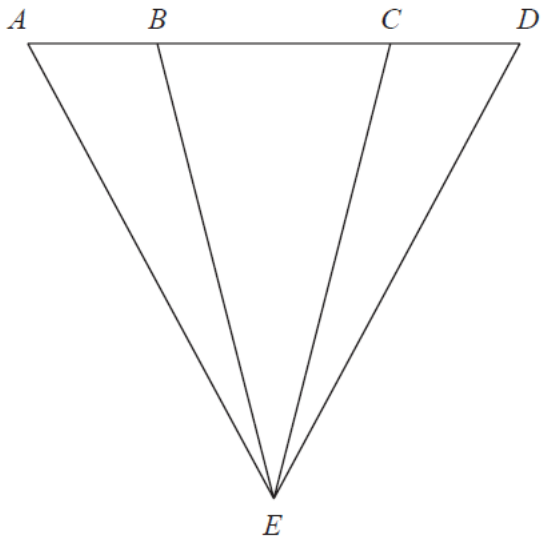


ABCDEF is a regular hexagon with sides of length x.
This hexagon is enlarged, centre F, by scale factor p to give hexagon *FGHIJK*.

Show that the area of the shaded region in the diagram is given by $\frac{3\sqrt{3}}{2}(p^2 - 1)x^2$

(Total for Question 19 is 4 marks)

20 The diagram shows a triangle ADE.



$AE = DE$
$AB : BC : CD = 1 : 2 : 1$

Prove that triangle ACE is congruent to triangle DBE.

(Total for Question 20 is 3 marks)

20 Mark has made a clay model.
He will now make a clay statue that is mathematically similar to the clay model.

The model has a base area of $6\,cm^2$
The statue will have a base area of $253.5\,cm^2$

Mark used 2 kg of clay to make the model.

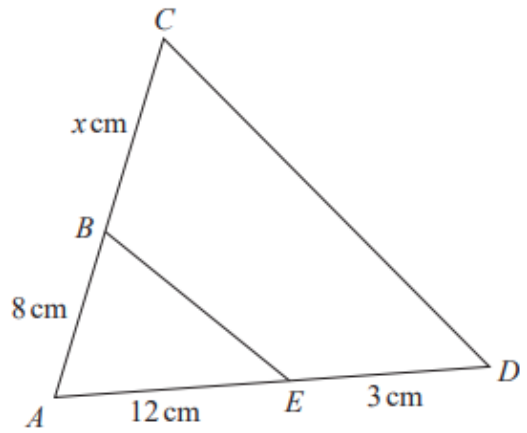
Clay is sold in 10 kg bags.
Mark has to buy all the clay he needs to make the statue.

How many bags of clay will Mark need to buy?

.....

(Total for Question 20 is 3 marks)

22 The two triangles in the diagram are similar.

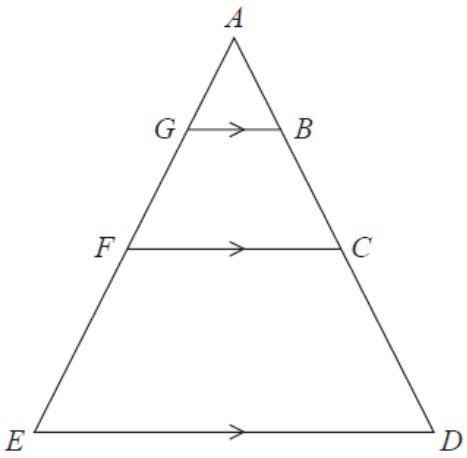


There are two possible values of x.

Work out each of these values.
State any assumptions you make in your working.

(Total for Question 22 is 5 marks)

23 Here are three similar triangles, ABG, ACF and ADE.



$ABCD$ and $AGFE$ are straight lines.

$AB : BC : CD = 1 : 2 : 3$

Show that

area of ABG : area of $BCFG$: area of $CDEF = 1 : 8 : 27$

(Total for Question 23 is 3 marks)