THE BRITISH INTERNATIONAL SCHOOL ABU DHABI

A NORD ANGLIA EDUCATION SCHOOL

Year 8 Maths

Topic 10–11–12 Workbook

In the table below translate the key terms into your home language and write a short definition for each term [if needed visit www.mathsisfun.com/definitions/].

TOPIC 10 – POWERS & ROOTS		
Powers		
Index Notation		
Prime Factors		
Highest Common Factor		
Lowest Common Multiple		
Venn Diagram		
TOPIC 11 – MAP SCALES & BEARINGS		
Scale Factor		
Ratio		
Bearings		
Parallel Lines		
TOPIC 12 – PYTHAGORAS' THEOREM		
Right-Angled Triangle		
Hypotenuse		

Powers and Roots

1. Fill in each box with the correct power.

$32 = 2^{\square}$ $81 = 3^{\square}$ $256 = 4^{\square}$ $125 = 5^{\square}$ $216 = 6^{\square}$

2. Tracey knows that $7^5 = 16\,807$ and $9^5 = 59\,049$.

a) Use Tracey's knowledge to circle the value of 8^5 from the choices below.

15 776 17 741 32 768 61 051

b) Explain how you chose your answer.

.....

.....

3. Tick the box next to the decimal approximation of $\sqrt{8}$.

1.954... ☐ 2.828... ☐ 4.237... ☐

Use values of square roots you know to work out what it lies between.

4. Draw a line from each of the exact roots on the left to its decimal value.

$\sqrt{5}$	2.9624...
$\sqrt{17}$	4.1231...
$\sqrt[3]{26}$	4.9324...
$\sqrt[3]{120}$	2.2360...

5. Arrange the digits 1 to 9 in the boxes so that each equation shows an exact power or root.

You can only use each digit once.

$2^{\square} = 25^{\square}$ $5^{\square} = 1\square 5$ $\sqrt[\square]{1024} = 4$ $\sqrt[\square]{2401} = \square$ $\square^4 = 656\square$

How did you do?

Powers are repeated multiplications — use your arithmetic skills if you don't have a calculator. Roots are trickier to deal with, but knowing the common ones is a good start. You need to be able to:

☐ **Recognise and calculate powers.** ☐ **Recognise and calculate roots.**

Powers

Maths powers aren't quite as fun as the superhero kind... but they do obey nifty rules. When you're multiplying, add the powers, and when you're dividing, subtract them.

Q1 Rewrite the following using powers:

a) $2 \times 2 \times 2 \times 2 =$ .....

b) $3 \times 3 \times 3 \times 3 =$ .....

c) $6 \times 6 \times 6 =$ .....

d) $5 \times 5 \times 5 \times 5 \times 5 =$ .....

Q2 Calculate the following (use the x^n button on your calculator to help):

a) $4^7 =$ .....

b) $5^6 =$ .....

c) $10^6 =$ .....

d) $2^{20} =$ .....

Q3 Simplify these multiplications by writing each one as a number with a single power.

a) $2^3 \times 2^2 =$ .....

b) $3 \times 3^3 =$ .....

c) $4^4 \times 4^3 =$ .....

d) $5^2 \times 5^7 =$ .....

Q4 Simplify these divisions by writing each one as a number with a single power.

a) $2^{10} \div 2^8 =$ .....

b) $3^7 \div 3^5 =$ .....

c) $10^{12} \div 10^9 =$ .....

d) $5^6 \div 5^2 =$ .....

Q5 Simplify these calculations by writing each one as a number with a single power.

a) $(4^4 \times 4^6) \div 4^5 =$ .....

b) $(3^7 \div 3^3) \times 3^5 =$ .....

c) $(8^{12} \times 8^7) \div 8^3 =$ .....

d) $(9^6 \div 9^4) \times 9^9 =$ .....

Indices 1

C **1** Write as a power of 7

(a) $7^3 \times 7^{10}$

Guided $7^3 \times 7^{10} = 7^{3+10} =$ ..... **(1 mark)**

(b) $7^{15} \div 7^9$

Guided $7^{15} \div 7^9 = 7^{15-9} =$ ..... **(1 mark)**

(c) $\dfrac{7^{12}}{7^4 \times 7}$

Guided $\dfrac{7^{12}}{7^4 \times 7} = \dfrac{7^{12}}{7^4 \times 7^1} = \dfrac{7^{12}}{7^{\cdots}}$

$=$ ..... **(2 marks)**

(d) $(7^5)^4$

Guided $(7^5)^4 = 7^{5 \times 4} =$ ..... **(1 mark)**

C **2** Write as a power of 5

(a) $5^8 \times 5^4$ ..... **(1 mark)**

(b) $\dfrac{5^{12} \times 5}{5^4 \times 5^3}$ ..... **(2 marks)**

(c) $(5^2)^3$ ..... **(1 mark)**

C **3** $6^8 \times 6^3 = 6^5 \times 6^x$
Find the value of x.

Use the index laws to simplify each side of the equation.

$x =$ ..... **(2 marks)**

B **4** Simplify 4^0

..... **(1 mark)**

A **5** Write $9^3 \times 27^2$ as a single power of 3

Guided $9^3 \times 27^2 = (3^{\cdots\cdots})^3 \times (3^{\cdots\cdots})^2$

$= 3^{\cdots\cdots} \times 3^{\cdots\cdots}$

$=$ ..... **(2 marks)**

A **6** Write $8^6 \div 4^3 \times 2^5$ as a single power of 2

..... **(2 marks)**

Factors and HCF

1. The factors of 15 are 1, 3, 5 and 15.

a) What are the factors of 18?

....., ..., ..., ..., ... and .....

b) What are the common factors of 15 and 18?

..... and .....

2. Matt has the following sweets: 10 chocolate bars, 30 lollipops and 70 gummy bears.

a) What are the common factors of 10, 30 and 70?

....., ..., ... and .....

b) Matt shares the sweets equally into party bags, so that each bag has the same number of each type of sweet. He makes as many party bags as possible.

(i) How many party bags does Matt make?

..... party bags

(ii) How many of each sweet is in each party bag?

..... chocolate bar(s), ... lollipop(s) and ..... gummy bear(s)

3. Polly is finding common factors.

a) Write down all the factors of the following numbers.

(i) 60 .....

(ii) 84 .....

b) What is the highest common factor of 60, 84 and 140?

.....

How did you do?

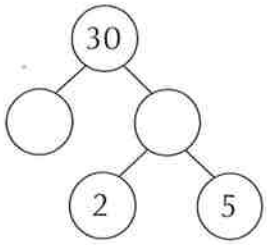
Finding factors can be hard work, so you've done well to make it this far.
Here are the things that you should be able to do:

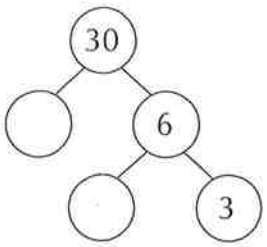
- ☐ **Find factors of a number.**
- ☐ **Find common factors.**
- ☐ **Find the highest common factor of two or three numbers.**

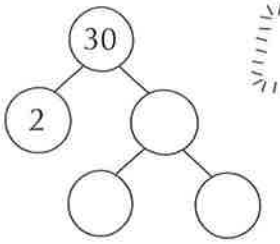
Prime Factors

1. Lloyd is investigating prime factorisation using factor trees.

a) Complete the following trees, so that each number is the product of the two beneath.







The branches must end with primes.

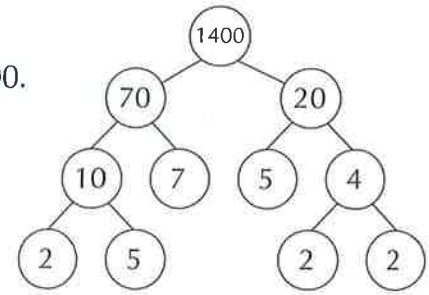
b) Write 30 as a product of primes.

30 = ... × ..... × .....

c) $900 = 30^2$. Write 900 as a product of primes.

900 = ...

2. Abigail has made a factor tree for the number 1400.



a) Fill in the boxes to complete the prime factorisation of 1400.

$1400 = 2^{\square} \times 5^{\square} \times \square$

b) Abigail thinks that if she makes a different factor tree for 1400, she will get a different prime factorisation. Use the space below to show that she is wrong.

3. Martin claims there are no five-digit numbers that have more than 6 different prime factors.

a) What is the smallest number with 6 different prime factors?

..... Hint: what are the smallest primes?

b) Explain why Martin's claim is correct.

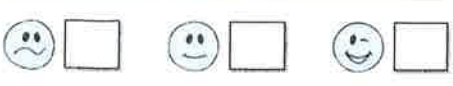
.....

.....

How did you do?

Factor trees are a neat way of showing prime factorisation — they can be drawn in many different ways but will always end on the same prime numbers. Before you move on, check that you can:

- ☐ **Write a number as a product of its prime factors.**
- ☐ **Use prime factorisation to solve problems.**



Prime Factors, LCM and HCF

These aren't as complicated as they sound, honest...
Here's a beautiful page of questions to help you practise, you lucky devil.

Factor trees are dead useful for this kind of question. I'd highly recommend them.

Q1 Find the prime factors of these numbers, and then write each number as a "product of prime factors":

a) 12

b) 48

c) 200

d) 350

Q2 What is the lowest common multiple (LCM) of:

a) 3 and 8 .....

.....

b) 8 and 12 .....

.....

c) 6 and 9 .....

.....

d) 18 and 24 .....

.....

Q3 What is the highest common factor (HCF) of:

a) 25 and 70 .....

.....

b) 28 and 42 .....

.....

c) 64 and 24 .....

.....

d) 56 and 77 .....

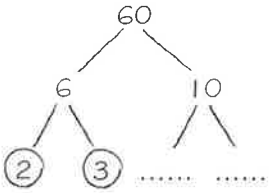
.....

Factors and primes

C **1** (a) Express the following numbers as products of their prime factors.

(i) 60

Guided

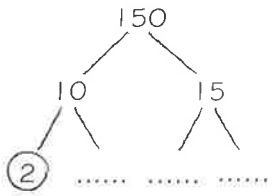


Remember to circle the prime factors as you go along.

60 = 2 × ..... × ..... × .....

(2 marks)

(ii) 150



150 = 2 × ..... × ..... × .....

(2 marks)

(b) Find the highest common factor (HCF) of 60 and 150

Guided

60 = 2 × 3 × ..... × .....

150 = 2 × ..... × ..... × .....

HCF = 2 × ..... × .....

= .....

Circle all the prime numbers which are common to both products of prime factors. Multiply the circled numbers together to find the HCF.

(1 mark)

(c) Find the lowest common multiple (LCM) of 60 and 150

Guided

LCM = ... × ..... × .....

= .....

To find the LCM, multiply the HCF by the numbers in both products that were not circled in part (b).

(1 mark)

C **2** (a) Express 72 as a product of its prime factors.

..... **(2 marks)**

(b) Find the highest common factor (HCF) of 72 and 120

HCF = ... **(1 mark)**

(c) Find the lowest common multiple (LCM) of 72 and 120

LCM = ... **(1 mark)**

Scales and Scale Drawings

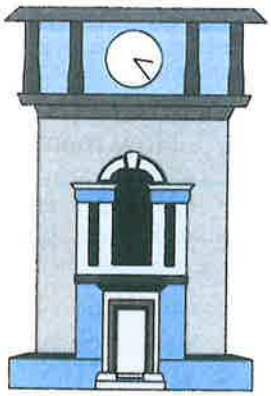
1. Fill in the table below to convert between the map distances and real-life distances.

Scale	Map Distance	Real-Life Distance
1 cm = 5 m	2 cm	.....
1 mm = 100 cm	.....	400 cm
1 inch = 2 feet	6 inches	.....
.....	5 cm	10 km

2. Khamil is making a scale model of the Elizabeth Tower using the scale 1 cm = 12 m. Given that the Elizabeth Tower is 96 m tall, how tall will his scale model be?

..... cm

3. The building on the right is part of a model of a village.



a) In real life, the building is 15 m tall.
What scale was used to make the model of the village?
Give your answer in the form 1 cm = n m.

Use a ruler to measure the height of the building.

.....

b) In the model, a church is 9 cm tall. How tall is it in real life?

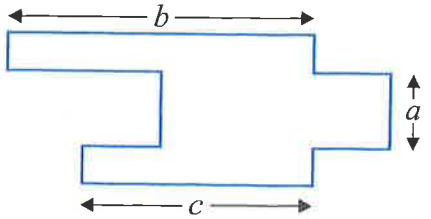
..... m

4. For this question, 1 cm represents 5 m.

a) Draw a straight line representing a distance of 25 m, starting at P.

P•

b) Measure the sides a, b and c of the following shape, and use the scale above to find the real-life lengths.



a = ... m

b = ... m

c = ... m

Scales and Scale Drawings

5. On this scale drawing of Tia's bedroom, 1 cm represents 0.5 m.

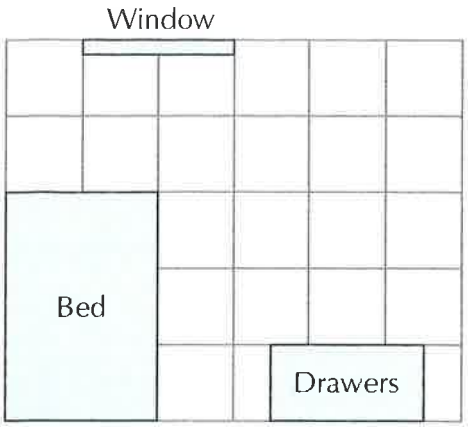
a) What are the dimensions of the room in real life?

..... m × ..... m

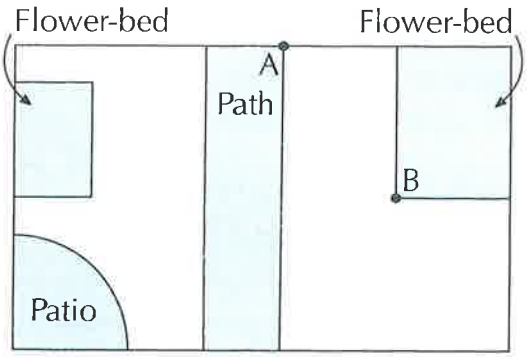
b) Draw and label a wardrobe measuring 0.5 m × 1.5 m against a wall on the scale drawing.

c) Tia wants to put a bedside table between the bed and the drawers. What is the maximum width possible for the bedside table so that it can fit in the space?

..... m



6. Fiona uses a scale drawing to plan her garden. She uses the scale 1 cm = 1 m.



a) How wide, in cm, is the path in real-life?

..... cm

b) Use the plan to find the real-life distance, in metres, between the points labelled A and B.

..... m

c) Fiona also wants to add a 2 m × 1.5 m greenhouse to her garden. Draw and label the greenhouse on the plan.

7. A model of a train is made using the scale 1 : 200. The actual length of the train is 20 m.

How long, in cm, is the model of the train?

If no units are given in the scale, you can use any as long as they're the same on both sides.

..... cm

How did you do?

It's nice to finish off the section with a bit of artistic flair for a change... Though it's best to leave your Picasso tendencies to art class and stick with a trusty ruler and pencil. You should be able to:

- ☐ **Use scales with units.**
- ☐ **Use scales without units.**
- ☐ **Measure lines and draw them to scale.**
- ☐ **Work out measurements from scale drawings.**

Maps and Scale Drawings

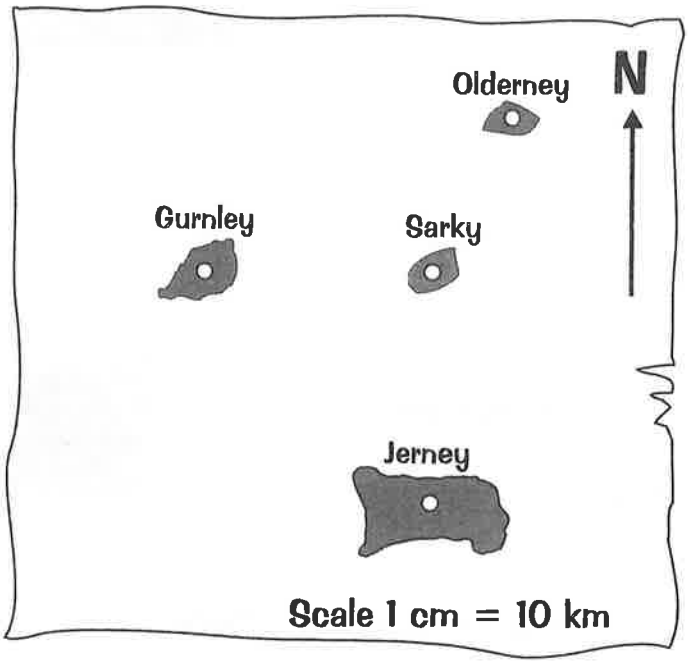
You might have GPS built into your snazzy Cyborg phone, but it's still good to know how to use maps and scales — they come up in tests all the time.

Q1 The scale on a scale drawing is "1 cm = 1 m". How many metres are represented by:

a) 2 cm on the drawing ..... **c)** 10 cm on the drawing .....

b) 4 cm on the drawing ..... **d)** 15 cm on the drawing .....

Q2 The map below has a scale of "1 cm = 10 km".



Multiply by the scale to get the real-life distance. Divide by the scale to get the distance on the map.

a) What is the distance, in real life, from the centre of Jerney to the centre of Sarky?

.....

b) What is the distance, in real life, between the centre of Gurnley and the centre of Olderney?

.....

c) In which compass direction would you travel to get from Gurnley to Jerney?

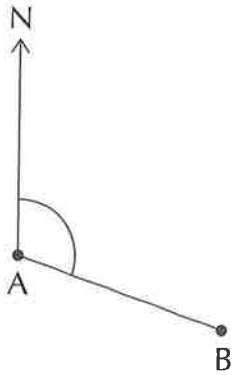
.....

d) Another island, 'Hermy', is 15 km away from Sarky in real life.
How far away from Sarky should it be on the map?

.....

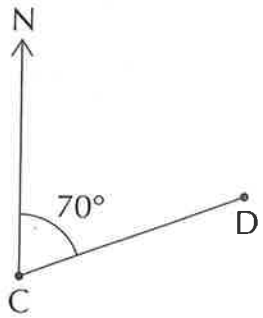
Bearings

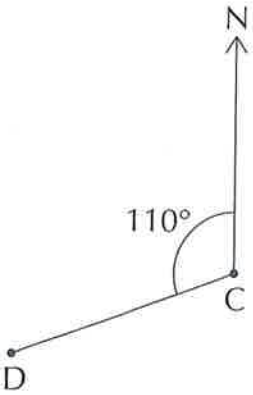
1. Measure the angle below. Use it to write the bearing of B from A.

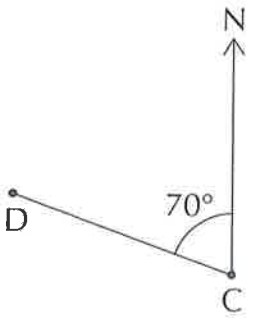


..... °

2. The bearing of D from C is 290°. Circle the diagram that shows this.







3. Point Y is 3 cm away from point X, on a bearing of 065°. Accurately draw and label the position of Point Y.

How did you do?

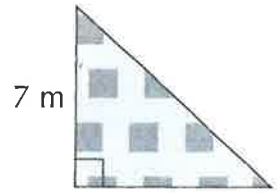
Bear with me while I try and think of something funny to put here... In the meantime, check you can:

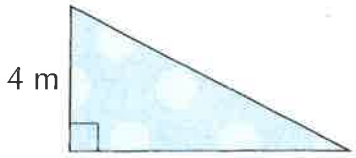
- ☐ Find the bearing of one point from another.
- ☐ Make accurate drawings using bearings.

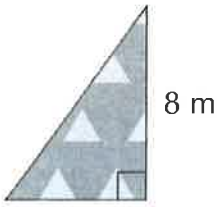
Pythagoras' Theorem

1. Circle the triangle with a hypotenuse of 10 m.

None of the diagrams on this page are drawn accurately.

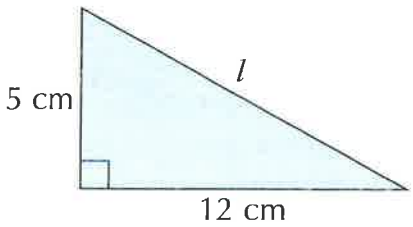






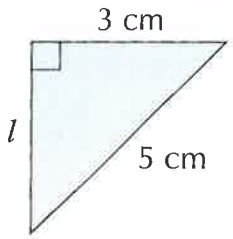
2. Find the missing length, l, in each right-angled triangle below.

a)



l = ... cm

b)



l = ... cm

3. Bailey's front door is 0.4 m above the horizontal ground.
Bailey uses a 6 m long ramp to get from the front door to the ground.

How far does the ramp extend horizontally from the front door? Give your answer to 2 d.p.

Sketch a diagram of the ramp first to help you.

..... m

How did you do?

When Pythagoras was playing around with this theorem way back in the 6th century BC, I wonder if he knew it'd be the best thing about school* for so many teenagers one day... See if you can now:

☐ **Use Pythagoras' theorem to find any missing side length of a right-angled triangle.**

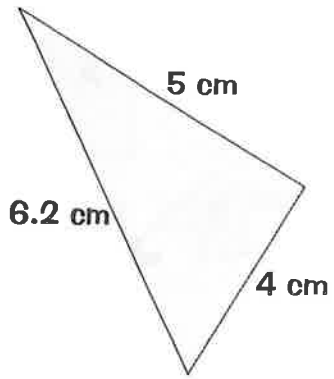
*based on my own experience

Pythagoras' Theorem

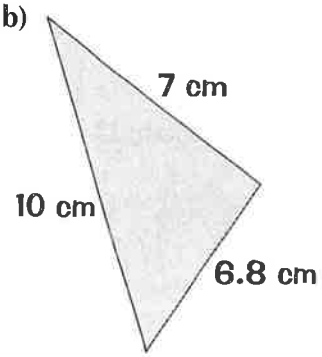
There's only one formula to learn for this whole page — $a^2 + b^2 = c^2$. It's a really important one though, so make sure you know exactly how to use it. Remember — it only works on right-angled triangles.

Q1 Use Pythagoras' Theorem to decide which of these is a right-angled triangle. Say whether the other triangles have their biggest angles greater or less than 90°.

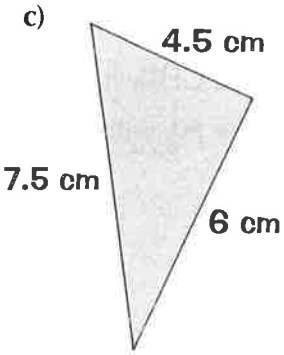
a)



b)

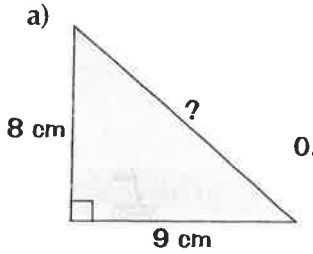


c)

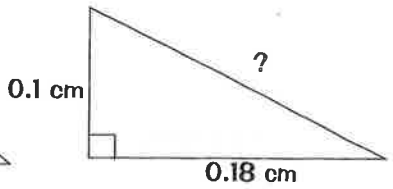


Q2 Find the missing sides. Give your answers to 3 significant figures.

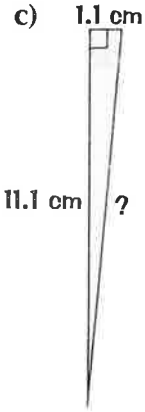
a)



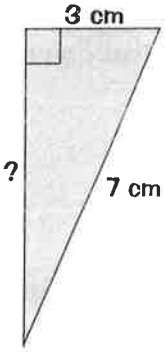
b)



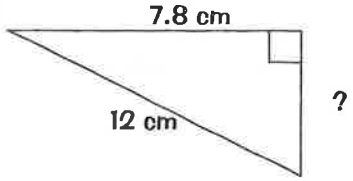
c)



d)



e)



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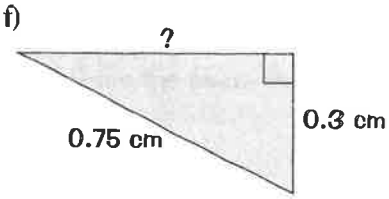

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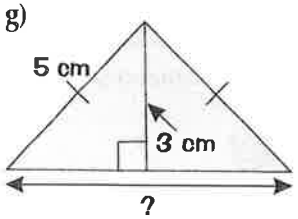

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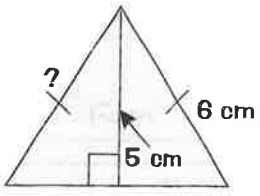

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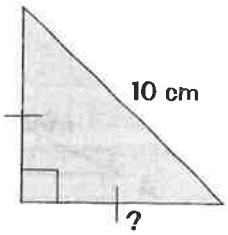

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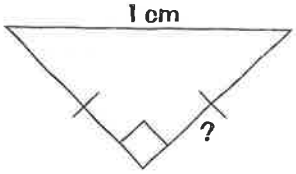

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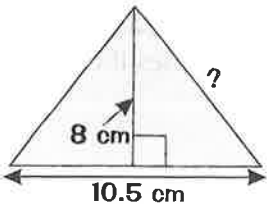
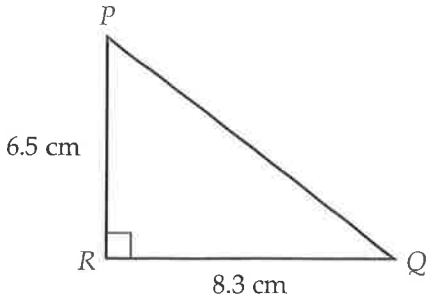


Pythagoras' theorem

C **1** Work out the length of PQ.
Give your answer correct to 3 significant figures.



Guided

$PQ^2 = 6.5^2 +$ .....

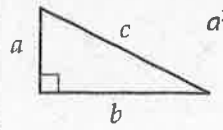
$PQ^2 =$ .....

$PQ = \sqrt{}$ .....

$PQ =$ .....

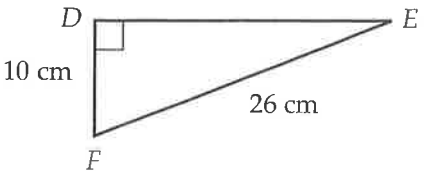
$PQ =$ ..... cm correct to 3 s.f. **(3 marks)**

Pythagoras' theorem



$a^2 + b^2 = c^2$

C **2** Work out the length of DE.



Guided

$DE^2 +$ ..... $= 26^2$

$DE^2 = 26^2 -$ .....

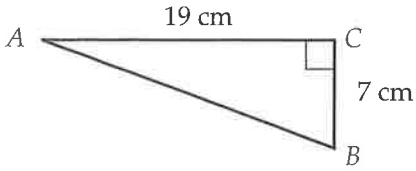
$DE^2 =$ .....

$DE = \sqrt{}$ .....

$DE =$ ..... cm **(3 marks)**

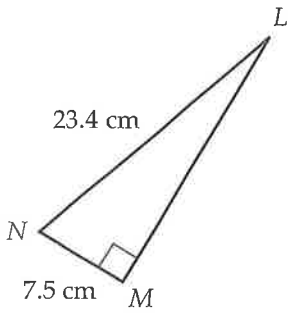
The hypotenuse is 26 cm so you are finding one of the shorter sides.

C **3** Work out the length of AB.
Give your answer correct to 3 significant figures.



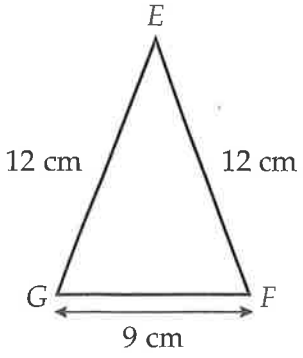
..... cm **(3 marks)**

C **4** Work out the length of LM.
Give your answer correct to 3 significant figures.



..... cm **(3 marks)**

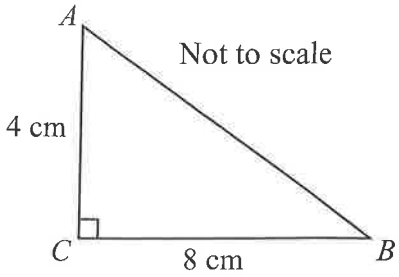
C **5** Work out the height of the isosceles triangle.
Give your answer correct to 1 decimal place.



..... cm **(3 marks)**

Pythagoras' Theorem

1 The diagram shows a right-angled triangle ABC. AC is 4 cm long. BC is 8 cm long.



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

..... cm
[Total 3 marks]

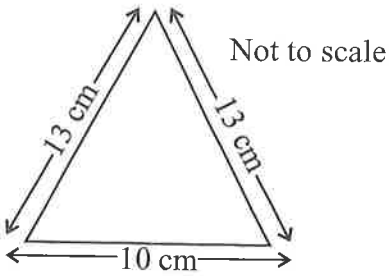
2 A ladder is 3.5 m long. For safety, when the ladder is leant against a wall, the base should never be less than 2.1 m away from the wall.

What is the maximum vertical height that the top of the ladder can safely reach to?

..... m
[Total 3 marks]

3 A triangle has a base of 10 cm. Its other two sides are both 13 cm long.

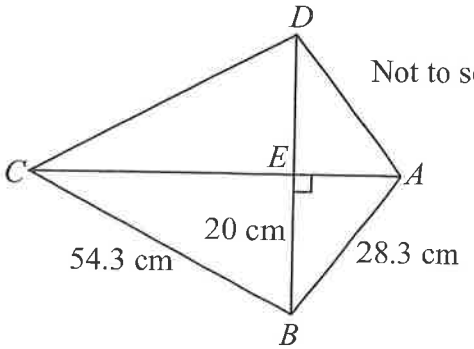
Calculate the area of the triangle.



..... cm^2
[Total 4 marks]

4 The diagram shows a kite $ABCD$. AB is 28.3 cm long. BC is 54.3 cm long. BE is 20 cm in length.

Work out the perimeter of triangle ABC. Give your answer to 1 decimal place.



..... cm
[Total 5 marks]

Score: ☐/15