

Form 2 were asked to make a poster of the favourite topic they have studied this term. They could choose between Ratios, Circles or Pythagoras' Theorem. Here is a selection of them. Pythagoras looks to be the clear winner.

# PYTHAGORAS

**Questions:**

- 1)  $a^2 + b^2 = c^2$
- 2)  $a^2 + b^2 = c^2$
- 3)  $a^2 + b^2 = c^2$

**Pythagoras was born** by the town of Samos, an island in the Ionian Greek philosopher (c.530-470 BC) about 2500 years ago.

When a triangle has a right angle (90°) and squares are made on each of the three sides.

Then the biggest square has the same area as the other two squares added together!

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

An isosceles triangle can be split into two right-angled triangles, and this can sometimes help when finding missing lengths.

In  $\triangle ABC$ ,  $AB = AC = 10\text{cm}$  and  $BC = 12\text{cm}$ . Find the height of the triangle.

$AD = 8\text{cm}$   
 $BD = 6\text{cm}$   
 $CD = 6\text{cm}$   
 $AD = 8\text{cm}$   
 $BD = 6\text{cm}$   
 $CD = 6\text{cm}$   
 $AD = 8\text{cm}$   
 $BD = 6\text{cm}$   
 $CD = 6\text{cm}$

$a^2 + b^2 = c^2$  is a quadratic equation, in Pythagoras it has only one answer because it's a length of a shape, it can't have a negative measurement.

$a > 0$   $b > 0$   $c > 0$

# PYTHAGORAS

**TRY THIS:**

Answer:  $c = \sqrt{17}$   
 $= 5.29$  units (3sf)

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

**Pythagoras' Theorem** → A theorem attributed to Pythagoras that the squares on the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides.

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

**Who is Pythagoras?**  
 Pythagoras was a Greek philosopher and mathematician who lived about 2500 years ago. His theorem is named after him, 'Pythagoras' theorem.'

**3,4,5 triangle**  
 The Egyptians made the pyramid using this way of measuring. The 3,4,5 triangle is the simplest right-angled triangle many other triangles were discovered that will do the same job.

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**Even though  $a^2 + b^2 = c^2$  is a quadratic equation, in Pythagoras it has only one answer because it's a length of a shape, it can't have a negative measurement.**

$a > 0$   $b > 0$   $c > 0$

# Circles

How do you find the area of a circle?

$A = \pi r^2$  formula  
 $= 7 \times 3.14$   
 $= 21.98$   
 $= 22.0$  (3sf)

you can use a calculator

What about the circumference? (perimeter)

$C = 2\pi r$  formula  
 $= 2 \times 3.14 \times 3$   
 $= 10 \times 3.14$   
 $= 31.4$  cm (3sf) → calculator

**more challenging**

$C = 2\pi r$  formula  
 $= 2 \times 3.14 \times 3$   
 $= 10 \times 3.14$   
 $= 31.4$  cm (3sf) → with calculator

**even more challenging:**

$C = 2\pi r$  formula  
 $= 2 \times 3.14 \times 3$   
 $= 10 \times 3.14$   
 $= 31.4$  cm (3sf) → calculator

# PYTHAGORAS

Pythagoras is a very easy way to work out the missing side of a right-angled triangle.

**How does it work?**

To work out Pythagoras we use an equation. This equation can work out any sized right-angled triangle.

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

$$5^2 + 4^2 = x^2$$

$$25 + 16 = x^2$$

$$41 = x^2$$

$$x = 6.40$$
 (3sf)

Let's say  $a$  is 5 and  $b$  is 4 and we need to find side  $c$  or you can also call it  $x$ .

But no, let me ask you a question: what is the opposite of squaring? Yes you're right: square root is the correct answer.

So now all you need to do is to get your calculator and work out what the square root of 41 and that will be your answer.

# RATIO

A ratio is a comparison of two or more things.

2 parts water to 1 part lemonade

to find the fraction you add all parts to the fraction of cement is

Some questions: Simplify

$4:5 = 24:30$   
 $4:5 = 24:30$   
 $4:5 = 24:30$

word questions: According to the recipe, how many packets of 240 grams does he need to make 9 pies? 240 x 3 = 720 grams

# Circles

**Introduction**

radius - the radius is a line from the centre of the circle to the edge of the circle. It is always the same length.

circumference - the distance around the circle.

**Circumference**

The circumference of a circle is the distance around it. It is calculated using the formula  $C = 2\pi r$ , where  $r$  is the radius.

**Area**

The area of a circle is calculated using the formula  $A = \pi r^2$ , where  $r$  is the radius.

# PYTHAGORAS

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

Pythagoras was a Greek philosopher and mathematician. He is famous for his theorem, which states that in a right-angled triangle, the square of the length of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the lengths of the other two sides.

**Example:**

$a = 3$ ,  $b = 4$ ,  $c = 5$   
 $3^2 + 4^2 = 5^2$   
 $9 + 16 = 25$   
 $25 = 25$

# PYTHAGORAS

Have you ever wondered how to calculate the mystery value of a right-angled triangle? Well we use Pythagoras theorem!

Pythagoras was a Greek philosopher and came up with a theorem. We use this theorem to calculate the length of the long side of a right-angled triangle.

Pythagoras theorem states that the sum of the 2 sides of the right angle squared is equal to the longest side of a right-angled triangle, opposite the right angle.

The formula is

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

$a$  = side of the right triangle  
 $b$  = side of the right triangle  
 $c$  = the longest side of a right-angled triangle, opposite the right angle

**Some Examples**

**Have a go at some practice questions**

(e)  $a = 9\text{m}$ ,  $b = 12\text{m}$ , find  $c$

(c)  $a = 8\text{cm}$ ,  $b = 9\text{cm}$ , find  $c$

The diagram shows a right-angled triangle. The distance AC is 12m. Given your answer to question 1, calculate the distance AB (2).

(a)  $BC = 20\text{cm}$  (b)  $BC = 30\text{cm}$

# PYTHAGORAS

What is it?

Pythagoras is an equation which enables you to find unknown lengths in many triangles that has a right angle.

**How do you solve it?**

$a^2 + b^2 = c^2$   
 $3^2 + 4^2 = 5^2$   
 $9 + 16 = 25$   
 $25 = 25$

**EQUATION COMPLETE**

# RATIOS!

Question: Simplify the ratio of 3:5:8

3:5:8  
 $3 \times 2 = 6$   
 $5 \times 2 = 10$   
 $8 \times 2 = 16$   
 $6:10:16$

Question: Simplify the ratio of 12:18:24

12:18:24  
 $12 \div 6 = 2$   
 $18 \div 6 = 3$   
 $24 \div 6 = 4$   
 $2:3:4$

# PYTHAGORAS

What is Pythagoras used for?

We use Pythagoras when we need to find the length of a side in a right-angled triangle.

Who invented the Pythagoras theorem?

Pythagoras of Samos, who was a Greek mathematician.

Solve this question using Pythagoras.

**Solution:**

Step 1: Write the formula  $a^2 + b^2 = c^2$

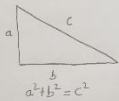
Step 2: Use the formula  $a^2 + b^2 = c^2$

Step 3: Use the formula  $a^2 + b^2 = c^2$

Step 4: Square root of answer

$a^2 + b^2 = c^2$   
 $9^2 + 12^2 = c^2$   
 $81 + 144 = c^2$   
 $225 = c^2$   
 $c = 15\text{cm}$

Pythagoras



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

a theorem attributed to pythagoras that the square on hypotenuse of right angle triangle is equal in area to the sum of the squares on the other two sides

# CIRCLES

Area of a circle

$$A = \pi r^2$$

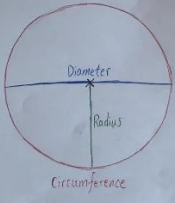
Example

What is the area when  $r = 11m$

$$A = \pi r^2$$

$$= \pi \times 11^2$$

$$= 380.13 \text{ (2.dp)}$$



Diameter

Radius

Circumference

Circumference of a circle

$$C = 2\pi r$$

or

$$C = \pi d$$

Example


What is the circumference when  $d = 22m$

$$C = \pi d$$

$$= \pi \times 22$$

$$= 69.12 \text{ (2.dp)}$$

## RATIOS



Ratios are easy to write

Example

2:3

1:2

3:4

4:5

5:6

6:7

7:8

8:9

9:10

10:11

11:12

12:13

13:14

14:15

15:16

16:17

17:18

18:19

19:20

20:21

21:22

22:23

23:24

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81:82

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83:84

84:85

85:86

86:87

87:88

88:89

89:90

90:91

91:92

92:93

93:94

94:95

95:96

96:97


97:98

98:99


99:100

# PYTHAGORAS

When you square the shortest side and the middle side and add them together and square root them they will equal the longest side !!



$b^2$



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

$60^2 + x^2 = 150^2$

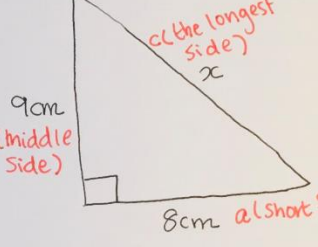
$3600 + x^2 = 22500$

$-3600 \quad -3600$

$\sqrt{x^2} = \sqrt{18900}$

$x = 137.4 \text{ cm (3sf)}$

$a^2$



9cm b(middle side)

8cm a(short side)

c(the longest side) x

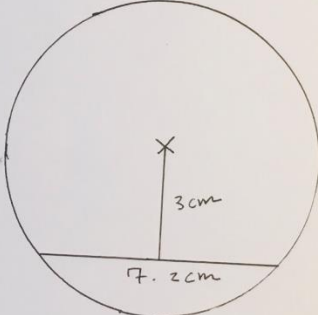
$a^2 + b^2 = c^2$

$8^2 + 9^2 = x^2$

$64 + 81 = x^2$

$\sqrt{145} = \sqrt{x^2}$

$x = 12.0 \text{ (3sf)}$

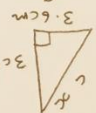


3cm

7.2cm

SOLVE THIS

ANSWER



3.6cm

3cm

c

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

$3.6^2 + 3^2 = x^2$

$12.96 + 9 = x^2$

$\sqrt{21.96} = \sqrt{x^2}$

$x = 4.69 \text{ cm (3sf)}$