

The converse of Pythagoras' theorem

Year 8 About 70 minutes Calculator allowed 45 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/ks3-year-8-the-converse-of-pythagoras-theorem/

Date _____

A Do Now

Quick questions to start.

- A1** Needed today [1 mark] **A2** Needed today [1 mark]
Work out $2.5^2 + 1.2^2$. Write down the value of $\sqrt{225}$.

Answer

Answer

- A3** Last lesson [1 mark] **A4** Year 7 [1 mark]
A 6 m ladder stands 2 m from a wall. How high does it reach, to 1 d.p.? A triangle has angles 90° and 37° . Find the third.

Answer

Answer

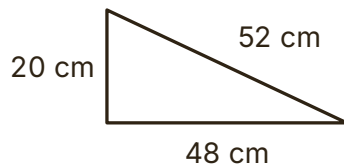
B Example, then your turn

Year 8

Your teacher works through each example with you. Then try the one beside it. Call the longest side c . If $a^2 + b^2 = c^2$, the angle opposite c is a right angle.

EXAMPLE 1

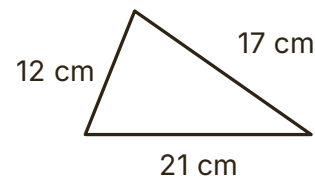
Is this triangle right-angled?



Not drawn accurately

Hint Square the two shorter sides and add. Compare with the square of the longest side.

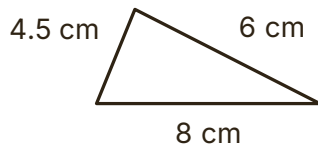
- B1** Is this triangle right-angled? [3 marks]
Show your working.



Not drawn accurately

EXAMPLE 2

Is the largest angle of this triangle acute, right or obtuse?



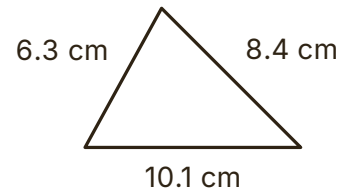
Not drawn accurately

Hint If $a^2 + b^2 < c^2$, the longest side is too long for a right angle, so the angle opposite it is obtuse.

B2

Is the largest angle of this triangle acute, right or obtuse? Show your working.

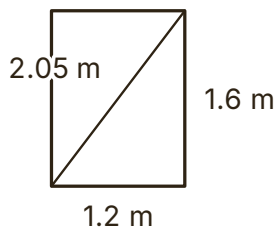
[3 marks]



Not drawn accurately

EXAMPLE 3

A gate frame is 1.2 m wide and 1.6 m high. Its diagonal measures 2.05 m. Is the frame a rectangle?



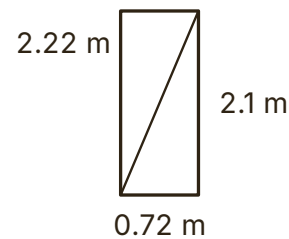
Not drawn accurately

Hint A rectangle has right angles at its corners. Test one corner with the converse.

B3

A door frame is 0.72 m wide and 2.1 m high. Its diagonal measures 2.22 m. Is the frame a rectangle? Show your working.

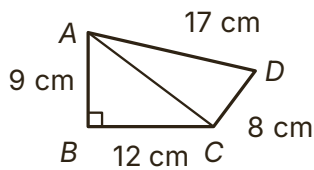
[3 marks]



Not drawn accurately

EXAMPLE 4

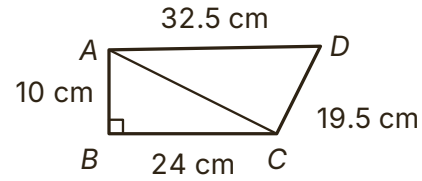
Angle $ABC = 90^\circ$. Show that angle $ACD = 90^\circ$.



Not drawn accurately

Hint First use Pythagoras in triangle ABC to find AC . Then test triangle ACD .

B4 Angle $ABC = 90^\circ$. Show that angle $ACD = 90^\circ$. [3 marks]

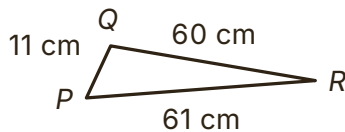


Not drawn accurately

c Practice

Year 8

C1 In triangle PQR , $PQ = 11$ cm, $QR = 60$ cm and $PR = 61$ cm. Show that the triangle is right-angled, and say which angle is the right angle. [2 marks]



Not drawn accurately

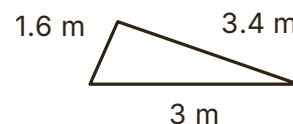
C2 These are the sides of four triangles. Which one is NOT right-angled? Show how you know. (a) 9, 40, 41 (b) 15, 36, 39 (c) 10, 22, 25 (d) 16, 30, 34 [2 marks]

C3 Jo walks 3.6 km due north, turns, then walks 1.5 km. She is now 3.9 km from her start. Did she turn through a right angle? Show your working. [3 marks]



Not drawn accurately

C4 A triangle has sides 1.6 m, 3 m and 3.4 m. Show that it is right-angled. Then work out its area. [3 marks]

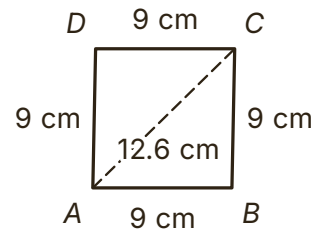


Not drawn accurately

- D1** Ben draws a quadrilateral with all four sides 9 cm. The diagonal AC is 12.6 cm. Ben says, "My quadrilateral is a square."

[3 marks]

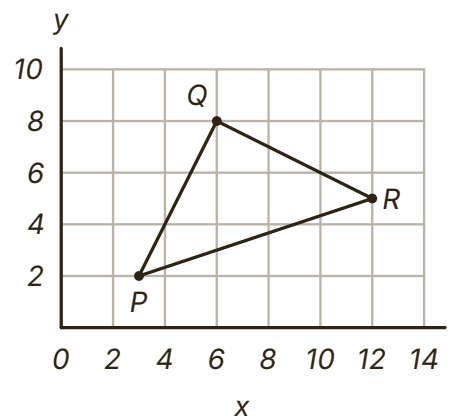
Is Ben right? You must show your working.



- D2** P is the point $(3, 2)$, Q is the point $(6, 8)$ and R is the point $(12, 5)$.

- (a) Work out PQ^2 , QR^2 and PR^2 . [2 marks]

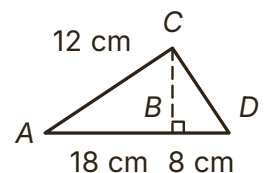
- (b) Show that triangle PQR is right-angled. [2 marks]
Which angle is the right angle?



Total for D2: 4 marks

- D3** A , B and D lie on a straight line. CB is perpendicular to AD . $AB = 18$ cm, $BD = 8$ cm and $CB = 12$ cm.

- (a) Work out AC^2 and CD^2 . [2 marks]



- (b) Show that angle $ACD = 90^\circ$. [2 marks]

- (c) Work out the area of triangle ACD . [1 mark]

Answer ... cm²

Total for D3: 5 marks

- D4** A builder checks the corner of a room. She marks a point 0.9 m along one wall and a point 1.2 m along the other wall. The two points are 1.53 m apart. Is the corner a right angle? If not, is it more or less than 90° ? Show your working. [3 marks]

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** A triangle has sides 9 cm, 12 cm and x cm, where x is a whole number. For how many values of x is the triangle obtuse? [4 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** The third side must be more than $12 - 9$ and less than $12 + 9$. So x is one of 4, 5, ..., 20.
- Hint 2** If x is the longest side, the triangle is obtuse when $x^2 > 9^2 + 12^2 = 225$. If 12 is the longest side, it is obtuse when $9^2 + x^2 < 144$.
- Hint 3** $x^2 > 225$ gives $x = 16, 17, 18, 19, 20$. $x^2 < 63$ gives $x = 4, 5, 6, 7$. That is 9 values.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can use the converse of Pythagoras' theorem to test for a right angle. ☐ ☐ ☐
- I can tell whether the largest angle is acute, right or obtuse. ☐ ☐ ☐
- I can check a frame, a walk or a corner for a right angle. ☐ ☐ ☐
- I can use Pythagoras' theorem and its converse in one problem. ☐ ☐ ☐