IM-081 · Pythagoras' theorem

IGCSE Mathematics (0580) · HomiLabs: Maths · Ep 081 · Core + Extended

Pythagoras' theorem is not on the formula page: learn $a^2 + b^2 = c^2$ (c is the hypotenuse, opposite the right angle).

Set A · Fluency

1. (C) Triangle LMN has a right angle at M. Which side is the hypotenuse?

2. (C) A right-angled triangle has shorter sides 9 cm and 40 cm. Find the hypotenuse.

3. (C) A right-angled triangle has shorter sides 2.4 m and 7 m. Find the hypotenuse.

4. (C) The hypotenuse of a right-angled triangle is 25 cm and one side is 20 cm. Find the third side.

5. (C) The hypotenuse of a right-angled triangle is 11.5 cm and one side is 6.8 cm. Find the third side, correct to 3 s.f.

6. (C) An isosceles triangle has sides 10 cm, 10 cm and 12 cm. Find (a) its height (b) its area.

7. (C) Find the distance between the points (−3, 4) and (5, −2).

8. (C) Which of these triangles are right-angled? Show your working. (a) 10 cm, 24 cm, 26 cm (b) 6 cm, 7 cm, 9 cm

Set B · Exam style

1. (Paper 1/2 · no calculator) (C) A rectangle measures 15 cm by 8 cm. Find the length of its diagonal. [2]

2. (Paper 3/4 · calculator) (C) A ladder 6.5 m long leans against a vertical wall on flat ground. The top of the ladder is 6.1 m above the ground.
   (a) Calculate the distance from the foot of the ladder to the wall. [2]
   (b) The foot of the ladder slides 0.5 m further away from the wall. Calculate how far the top of the ladder slides down the wall. [3]

3. (Paper 1/2 · no calculator) (E) Triangle ABC has a right angle at B. AB = 4 cm and BC = 2 cm. Find AC, giving your answer in the form $k\sqrt{5}$. [2]

4. (Paper 3/4 · calculator) (C) A walker goes 3.6 km due east and then 5.2 km due south. Calculate the straight-line distance back to the start. [2]

Challenge

(E) The points are A(1, 1), B(4, 5) and C(8, 2). Show that triangle ABC is isosceles and right-angled, and find its area. (Links to Ep 50, length of a line segment.)

Answers

Set A

1. LN

2. $\sqrt{(81 + 1600)} = \sqrt{1681} = 41$ cm

3. $\sqrt{(5.76 + 49)} = \sqrt{54.76} = 7.4$ m

4. $\sqrt{(625 - 400)} = \sqrt{225} = 15$ cm

5. $\sqrt{(132.25 - 46.24)} = \sqrt{86.01} = 9.27$ cm

6. (a) $\sqrt{(100 - 36)} = 8$ cm (b) $\frac{1}{2} \times 12 \times 8 = 48$ cm²

7. Across 8, up 6: $\sqrt{(64 + 36)} = 10$

8. (a) $100 + 576 = 676 = 26^2$: right-angled (b) $36 + 49 = 85 \neq 81 = 9^2$: not right-angled

Set B

1. $15^2 + 8^2 = 289$ M1; 17 cm A1.

2. (a) $6.5^2 - 6.1^2 = 5.04$ M1; 2.24 m A1 (2.2449…).
   (b) New distance 2.2449… + 0.5 = 2.7449… M1; new height $\sqrt{(6.5^2 - 2.7449\ldots^2)} = 5.8919\ldots$ M1; slides $6.1 - 5.8919\ldots = 0.208$ m A1.

3. $4^2 + 2^2 = 20$ M1; $\sqrt{20} = 2\sqrt{5}$ cm A1.

4. $3.6^2 + 5.2^2 = 40$ M1; $\sqrt{40} = 6.32$ km A1.

Challenge

AB = $\sqrt{(3^2 + 4^2)} = 5$, BC = $\sqrt{(4^2 + 3^2)} = 5$, AC = $\sqrt{(7^2 + 1^2)} = \sqrt{50}$.
AB = BC, so the triangle is isosceles; $AB^2 + BC^2 = 25 + 25 = 50 = AC^2$, so it has a right angle at B (converse of Pythagoras).
Area = $\frac{1}{2} \times 5 \times 5 = 12.5$ square units.