Pythagorean problems in 2-dimensions.
*Drawings are NOT to scale.*

1. Find the length of the diagonal of an oblong measuring 5.7 cm by 17.6 cm.

2. A rectangle measures 27 cm by 34 cm. What is the length of its diagonal?

3. The diagonal of a rectangle is 6.7 cm long, and one edge measures 2.3 cm. What is the other edge-length of the rectangle?

4. What is the length of the diagonal of a square whose edge-length is 9.6 cm?

5. Find the length of the edge of a square whose diagonal measures 96 mm
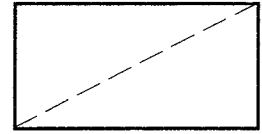
6. An isosceles triangle has base edge of length 70 mm. Its perpendicular height is 110 mm. Calculate the length of one of its other edges.

7. An isosceles triangle has a base length of 13.8 cm. Its other edge length is 21.4 cm. What is its perpendicular height?
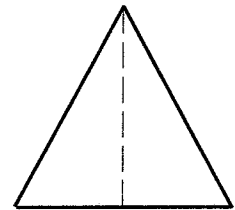
8. A ladder is 7 metres long. It leans against a wall with the foot of the ladder 2 metres out from the bottom of the wall. How far up the wall does the ladder reach?

9. In the previous question, if the foot of the ladder is moved another 2 metres away from the wall, by how much will the top slide down the wall?
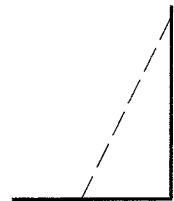
10. A straight road 8 miles long runs from A to B. Another straight road goes from B to C and is 3.5 miles long. The angle between these two roads is a right angle. It is proposed to build a new straight road from A to C. What distance would be saved on the journey from A to C?

11. A traditional 5-bar gate is 3.5 metres wide. The vertical distance between the horizontal bars is 0.5 metres. What is the length of the diagonal strut?
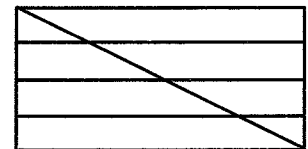
12. A pattern is made by drawing a large square, then marking the middle-point of each edge and joining them to make another square. This is repeated on each square in turn until they become so small it is impossible to draw them. In one case the 1st square has an edge-length of 14 cm. What is the edge-length of the 2nd square? And the 3rd? How many squares must be drawn until one has an edge less than 2 cm? By looking at the sequence of edge-lengths, can you see a simple relationship between them? If so, then use that to determine the size of the 10th square to be drawn.
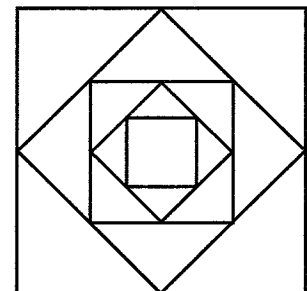
$l^2 = 5.7^2 + 17.6^2$

$\quad = 342.25$ ✓

$l = 18.5$ ✓

2. $d^2 = 27^2 + 34^2$

$\quad = 1885$ ✓

$d = 43.4 \text{ cm} \ (1dp)$ ✓

3. $6.7^2 = x^2 + 2.3^2$

$x^2 = 39.6$ ✓

$x = 6.3 \text{ cm} \ (1dp)$ ✓

4. $d^2 = 2 \times 9.6^2$

$\quad = 184.32$ ✓

$d = 13.6 \text{ cm} \ (1dp)$ ✓

5. $96 = 2l^2$

$l^2 = 48$ ✓

$L = 6.9 \text{ mm} \ (1dp)$ ✓

6. $x^2 = 110^2 + 35^2$

$\quad = 13325$ ✓

$x = 115.4 \text{ mm} \ (1dp)$ ✓

7. $21.4^2 = 6.9^2 + h^2$

$h^2 = 410.35$ ✓

$h = 20.3 \text{ cm} \ (1dp)$ ✓

8. $7^2 = x^2 + 2^2$

$x^2 = 45$ ✓

$x = 6.7 \text{ m} \ (dp)$ ✓

$7^2 = y^2 + 4^2$

$y^2 = 33$ ✓

$y = 5.7 \text{ m}$ ✓

$6.7 - 5.7 = 1 \text{ m}$ ✓

10.
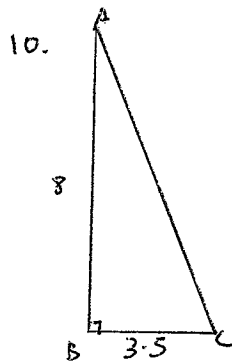
$AC^2 = 8^2 + 3.5^2$

$\quad = 76.25$ ✓

$AC = 8.7 \text{ miles}$ ✓

$AB + BC = 11.5$

$11.5 - 8.7 = 2.8 \text{ miles}$ ✓

∴ 2.8 miles would be saved ✓

11. $D^2 = 3.5^2 + 2.0^2$

$\quad = 16.25$ ✓

$D = 4.0 \text{ m} \ (1dp)$ ✓

12. $x^2 = 2 \times 7^2$

$\quad = 98$

$x = \sqrt{98}$ ✓

side of 2nd square $= 9.7 \text{ cm} \ (1dp)$

$y^2 = 2 \times \left(\frac{\sqrt{98}}{2}\right)^2$

$\quad = 49$ ✓

$y = 7$

side of 3rd square $= 7 \text{ cm}$ ✓

Pattern - The side of each square is found by halving the side of the previous 2 squares. ✓

eg. 1st square $= 14 \text{ cm}$

3rd square length $= 14 \div 2 = 7 \text{ cm}$

$14 \div 2^3 = 1.75 \text{ cm}$

∴ 7 squares must be drawn until one has an edge of less than 2 cm ✓

8th square $- 14 \div 2^4 = 0.875$

Let the edge of the 10th square be x

$0.875 \div 2 = 0.4375$ ✓

$x^2 = 2 \times 0.4375^2$

$\quad = 0.4 \text{ cm} \ (1dp)$ ✓