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GCSE MATHEMATICS • GEOMETRY

Pythagoras

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator allowed

Full worked solutions for the free Pythagoras worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Pythagoras worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $x^2 = 9^2 + 5^2 = 106$ $x = \sqrt{106} \approx \boxed{10.3}$

A2 $x^2 = 11^2 - 6^2 = 85$ $x = \sqrt{85} \approx \boxed{9.2}$

A3 Across 5, down 5: $\sqrt{25 + 25} = \sqrt{50} \approx \boxed{7.1}$

HIGHER

A4 $AG^2 = 7^2 + 4^2 + 4^2 = 81$ $AG = \boxed{9}$ cm

A5 $\sqrt{9 + 36} = \sqrt{45} = \sqrt{9 \times 5} = \boxed{3\sqrt{5}}$ cm

A6 Height = $\sqrt{25^2 - 7^2} = \sqrt{576} = \boxed{24}$ Area = $\frac{1}{2} \times 14 \times 24 = \boxed{168}$ cm²

A7 $x^2 + (x+1)^2 = (x+2)^2$ gives $x^2 - 2x - 3 = 0$, so $(x-3)(x+1) = 0$ $\boxed{x = 3}$

B**Fluency solutions**One mark for each correct part. The notes in *italics* explain why each sequence was chosen.**FOUNDATION**

B1 (a) $\boxed{15}$ (b) $\boxed{25}$ (c) $\sqrt{74} \approx \boxed{8.6}$ (d) $\sqrt{42.25} = \boxed{6.5}$ (all cm)

B2 (a) $\sqrt{625 - 49} = \boxed{24}$ (b) $\boxed{24}$ (c) $\boxed{12}$ (d) $\sqrt{90.25 - 16} \approx \boxed{8.6}$

For a shorter side, subtract the squares.

B3 (a) $\boxed{17}$ cm (b) $\sqrt{50} \approx \boxed{7.1}$ cm (c) $\sqrt{2500 - 1600} = \boxed{30}$ inches (d) $\boxed{13}$ m



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B4 (a) $\boxed{5}$ (b) $\boxed{10}$ (c) across 6, down 8: $\boxed{10}$ (d) $\boxed{5}$

B5 (a) $64 + 225 = 289 = 17^2$: yes (b) $49 + 64 = 113 \neq 121$: no (c) $144 + 256 = 400 = 20^2$: yes

B6 (a) half the base is 3: $\sqrt{25 - 9} = \boxed{4}$ cm (b) $\sqrt{169 - 25} = \boxed{12}$ cm (c) $\frac{1}{2} \times 6 \times 4 = \boxed{12}$ cm²
(d) $\sqrt{100 - 25} \approx \boxed{8.7}$ cm

HIGHER

B7 (a) $\sqrt{9} = \boxed{3}$ (b) $\sqrt{121} = \boxed{11}$ (c) $\sqrt{50} \approx \boxed{7.1}$ (d) $\sqrt{75} \approx \boxed{8.7}$ (all cm)

B8 (a) $\boxed{\sqrt{5}}$ (b) $\sqrt{40} = \boxed{2\sqrt{10}}$ (c) $\sqrt{32} = \boxed{4\sqrt{2}}$ (d) $\sqrt{20 - 4} = \boxed{4}$

B9 (a) $5x^2 = 100$, $x^2 = 20$: $\boxed{2\sqrt{5}}$ cm (b) $x^2 + 25 = x^2 + 2x + 1$: $\boxed{x = 12}$ (c) $2x^2 = 64$: $\boxed{4\sqrt{2}}$ cm (d) $(k - 5)^2 = 16$: $\boxed{1}$ or $\boxed{9}$

B10 (a) half the chord is 8: $\sqrt{100 - 64} = \boxed{6}$ cm (b) $2\sqrt{169 - 25} = \boxed{24}$ cm (c) angle $OTP = 90^\circ$:
 $\sqrt{100 - 36} = \boxed{8}$ cm (d) $\sqrt{169 - 25} = \boxed{12}$ cm

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 He added the lengths instead of the squares. $\sqrt{9 + 16} = \sqrt{25} = 5$ cm

C2 For a shorter side, subtract the squares: $\sqrt{169 - 25} = \sqrt{144} = 12$ cm

C3 $c^2 = a^2 + b^2$ is bigger than a^2 and bigger than b^2 , so c is longer than both other sides.

C4 $7^2 + 24^2 = 49 + 576 = 625 = 25^2$, so by the converse of Pythagoras the triangle is right-angled.



HIGHER

C5 5 cm is only the diagonal of the base. Use it with the height: $\sqrt{5^2 + 12^2} = \boxed{13}$ cm

C6 The diagonal is the hypotenuse of a right-angled triangle with sides s and s : $\sqrt{s^2 + s^2} = \sqrt{2s^2} = s\sqrt{2}$

C7 The face diagonal is $s\sqrt{2}$. With the height s : $\sqrt{2s^2 + s^2} = \sqrt{3s^2} = s\sqrt{3}$

C8 (a) $(m^2 - n^2)^2 + (2mn)^2 = m^4 - 2m^2n^2 + n^4 + 4m^2n^2 = m^4 + 2m^2n^2 + n^4 = (m^2 + n^2)^2$, as required

(b) $m^2 - n^2 = \boxed{21}$, $2mn = \boxed{20}$, $m^2 + n^2 = \boxed{29}$

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 $\sqrt{5^2 - 1.4^2} = \sqrt{23.04} = \boxed{4.8}$ m

D2 Amir walks 7 km. Bea: $\sqrt{9 + 16} = 5$ km. Bea's route is $\boxed{2}$ km shorter.

D3 Diagonal = $\sqrt{3600 + 6400} = 100$ m Cost = $100 \times 4.50 = \text{£}\boxed{450}$

D4 Side s : $s^2 + s^2 = 100$, so $s^2 = 50$. The area is $s^2 = \boxed{50}$ cm²

HIGHER

D5 (a) From M to the middle of an edge is 4 cm: $\sqrt{3^2 + 4^2} = \boxed{5}$ cm

(b) From M to a corner is half the base diagonal, $4\sqrt{2}$: $\sqrt{9 + 32} = \sqrt{41} \approx \boxed{6.4}$ cm

D6 The diagonals bisect each other at right angles: half-diagonals 5 and 12, side $\sqrt{25 + 144} = 13$ Perimeter = $4 \times 13 = \boxed{52}$ cm

D7 (a) The perpendicular from O bisects AB : $\sqrt{10^2 - 6^2} = \boxed{8}$ cm **(b)** $\frac{1}{2} \times 12 \times 8 = \boxed{48}$ cm²



- D8** (a) Unfolding gives three possible rectangles: $\sqrt{5^2 + 7^2} = \sqrt{74}$, $\sqrt{4^2 + 8^2} = \sqrt{80}$, $\sqrt{3^2 + 9^2} = \sqrt{90}$. The shortest is $\sqrt{74} \approx 8.60$ cm
- (b) Straight line: $\sqrt{25 + 16 + 9} = \sqrt{50} \approx 7.07$ $8.60 - 7.07 = 1.53$ cm

E**Exam practice solutions**

Marks are shown on the right of each line.

FOUNDATION*Foundation and Higher crossover*

- E1** $x^2 = 81 + 49 = 130$ M1
 $x \approx 11.4$ A1
- E2** $x^2 = 13^2 - 5^2$ M1
 $= 144$ M1
 $x = 12$ A1
- E3** (a) $\sqrt{6.5^2 - 2.5^2}$ M1
 $= 6$ m A1
 (b) $\sqrt{6.5^2 - 4^2} \approx 5.12$, so it slides $6 - 5.12 \approx 0.88$ m B1
- E4** Across 6, up 8 M1
 $\sqrt{36 + 64}$ M1
 $= 10$ A1
- E5** (a) $20^2 + 21^2 = 400 + 441 = 841 = 29^2$ M1
 so it is right-angled A1
 (b) $9^2 + 12^2 = 225$ but $16^2 = 256$ M1
 Not right-angled A1

HIGHER

- E6** Height = $\sqrt{13^2 - 5^2} = 12$ M1 A1
 Area = $\frac{1}{2} \times 10 \times 12 = 60$ cm² A1
- E7** $AG^2 = 12^2 + 4^2 + 3^2$ M1 M1
 $AG = 13$ cm A1



E8 (a) $\sqrt{4^2 + 6^2} = \sqrt{52}$ M1
 $= \sqrt{4 \times 13} = 2\sqrt{13}$, as required A1
(b) $4 + 6 + 2\sqrt{13} = 10 + 2\sqrt{13}$ cm B2

E9 (a) $x^2 + (x + 7)^2 = (x + 8)^2$ M1
 $x^2 + x^2 + 14x + 49 = x^2 + 16x + 64$, so $x^2 - 2x - 15 = 0$ A1
(b) $(x - 5)(x + 3) = 0$, so $x = 5$ (a length cannot be negative) M1 A1
Area = $\frac{1}{2} \times 5 \times 12 = \boxed{30}$ cm² A1

