

WA8MMGTW3

Two-dimensional space and structures

Core + Challenge

Pythagoras' Theorem in Problems — Marking Key

I can use Pythagoras' theorem to solve practical problems, find distances on a grid and test for right angles.

For tutors and parents. Award method marks for correct working even if the final answer is wrong.

Marks summary

Section A Fluency: 16 Section B Core: 23 Section C Reasoning: 9 Section D Challenge: 11 **Total: 59**

Fluency: 1 mark each; accept an equivalent unsimplified answer for half credit at tutor's discretion.

A

Fluency *answers and working*

/ 16 marks

Q	Answer	Working
1	4 units	same y-value: $1 - (-3)$
2	6 units	same x-value: $1 - (-5)$
3	3	$4 - 1$
4	4	$5 - 1$
5	5 units	$\sqrt{3^2 + 4^2} = \sqrt{25}$
6	7.2 units	gaps 4 and 6: $\sqrt{52} = 7.211\dots$
7	8.9 units	gaps 8 and 4: $\sqrt{80} = 8.944\dots$
8	6.1 units	gaps 1 and 6: $\sqrt{37} = 6.082\dots$
9	yes	$36 + 64 = 100$
10	no	$25 + 36 = 61 \neq 64$
11	yes	$81 + 1600 = 1681$
12	no	$16 + 25 = 41 \neq 36$
13	13	$\sqrt{25 + 144} = \sqrt{169}$
14	1.41	$\sqrt{2} = 1.414\dots$
15	29	$\sqrt{400 + 441} = \sqrt{841}$
16	yes	$2.25 + 4 = 6.25$

Pythagoras' Theorem in Problems · WA8MMGTW3

B

Core answers, working and marks

/ 23 marks

Q	Answer	Working / sample response	Marks
1	4.8 m	$h^2 = 5^2 - 1.4^2 = 25 - 1.96 = 23.04$ $h = \sqrt{23.04} = 4.8$ <i>1 mark: subtraction</i> <i>1 mark: 4.8 m</i>	2
2	139 cm; 55 inches	$d^2 = 121^2 + 68^2 = 14\,641 + 4\,624 = 19\,265$ $d = 138.79... \approx 139$ cm $138.79 \div 2.54 = 54.6... \approx 55$ inches <i>1 mark: 19 265</i> <i>1 mark: 139 cm</i> <i>1 mark: 55 inches</i>	3
3	6.02 m	$r^2 = 36 + 0.25 = 36.25$ $r = 6.020... \approx 6.02$ <i>1 mark: 36.25</i> <i>1 mark: 6.02 m</i>	2
4	1000 m	Gaps: $8 - 2 = 6$ and $9 - 1 = 8$ $\sqrt{(36 + 64)} = 10$ units = 1000 m <i>1 mark: 10 units</i> <i>1 mark: 1000 m</i>	2
5	45 m	Diagonal: $\sqrt{(10\,000 + 4096)} = \sqrt{14\,096} = 118.73... \text{ m}$ Two sides: 164 m $164 - 118.73 = 45.27 \approx 45$ m <i>1 mark: diagonal</i> <i>1 mark: 164</i> <i>1 mark: 45 m</i>	3
6	No	$60^2 + 80^2 = 3600 + 6400 = 10\,000$ $99^2 = 9801 \neq 10\,000$ (it should be 100 cm) <i>1 mark: calculation</i> <i>1 mark: no, with reason</i>	2
7	(a) and (c)	(a) $64 + 225 = 289 = 17^2$ (b) $100 + 121 = 221 \neq 225$ (c) $6.25 + 36 = 42.25 = 6.5^2$ <i>1 mark: working for all three</i> <i>1 mark: (a) and (c)</i>	2
8	AD = 12 cm; AC = 20 cm	$AD^2 = 13^2 - 5^2 = 169 - 25 = 144$, AD = 12 $AC^2 = 12^2 + 16^2 = 144 + 256 = 400$, AC = 20 <i>1 mark: AD</i> <i>1 mark: method for AC</i> <i>1 mark: 20 cm</i>	3
9	40 m	$h^2 = 50^2 - 30^2 = 2500 - 900 = 1600$ $h = 40$ <i>1 mark: subtraction</i> <i>1 mark: 40 m</i>	2

Pythagoras' Theorem in Problems · WA8MMGTW3

Q	Answer	Working / sample response	Marks
10	No	The diagonal of the side view must fit under the ceiling as it tips $\sqrt{(2.4^2 + 0.6^2)} = \sqrt{6.12} = 2.473... \approx 2.47 \text{ m} > 2.45 \text{ m}$ 1 mark: diagonal 2.47 m 1 mark: no, with reason	2

C

Reasoning *sample answers and marking criteria*

/ 9 marks

Q	Answer	Working / sample response	Marks
1	Yes	Every side is doubled, so the shape is an enlargement with the same angles Check: $100 + 576 = 676 = 26^2$ 1 mark: yes 1 mark: reason or check	2
2	Not right-angled	$7 + 8 > 11$ only shows the triangle exists $7^2 + 8^2 = 49 + 64 = 113 \neq 121 = 11^2$, so it is not right-angled 1 mark: error 1 mark: correct test	2
3	Diagonal is a hypotenuse; triangle inequality	The diagonal is the hypotenuse, so it is the longest side of the triangle Triangle inequality: two sides of a triangle add to more than the third 1 mark: longer 1 mark: shorter than the sum	2
4	The height decreases	As d increases, d^2 increases So $25 - d^2$ gets smaller So h gets smaller (the ladder length stays 5 m) 1 mark: d^2 grows 1 mark: h^2 shrinks 1 mark: conclusion	3

D

Challenge *solutions and marking criteria*

/ 11 marks

Q	Answer	Working / sample response	Marks
1	77.6 cm	Base diagonal: $\sqrt{(3600 + 2025)} = \sqrt{5625} = 75$ Space diagonal: $\sqrt{(75^2 + 20^2)} = \sqrt{6025}$ $= 77.62... \approx 77.6 \text{ cm}$ 1 mark: 75 1 mark: second triangle 1 mark: 77.6 cm	3
2	0.4 m	Foot at first: $\sqrt{(42.25 - 36)} = 2.5 \text{ m}$ New foot: 3.3 m; new height $\sqrt{(42.25 - 10.89)} = \sqrt{31.36} = 5.6 \text{ m}$ $6 - 5.6 = 0.4 \text{ m}$ 1 mark: 2.5 m 1 mark: 5.6 m 1 mark: 0.4 m	3

Pythagoras' Theorem in Problems · WA8MMGTW3

Q	Answer	Working / sample response	Marks
3	P(3, 0); 5 units	Let $P = (x, 0)$: $x^2 + 16 = (8 - x)^2$ $x^2 + 16 = 64 - 16x + x^2$, so $16x = 48$ and $x = 3$ Distance: $\sqrt{9 + 16} = 5 = 8 - 3$ <i>1 mark: equation (or systematic trial)</i> <i>1 mark: $x = 3$</i> <i>1 mark: 5 units</i>	3
4	22.4 cm	Unfolded, two faces make a 20 cm $\times$ 10 cm rectangle $\sqrt{20^2 + 10^2} = \sqrt{500} = 22.36... \approx 22.4$ cm <i>1 mark: net idea</i> <i>1 mark: 22.4 cm</i>	2