

Name: _____

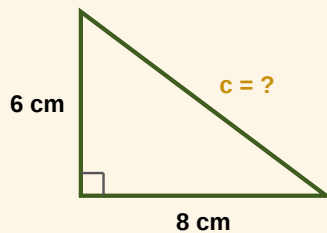
Date: _____

Score: _____ / 60

The Pythagorean Theorem

Missing sides, checking for right angles, reading diagrams, and real situations.

WORKED EXAMPLE Find c



$$a^2 + b^2 = c^2$$

$$6^2 + 8^2 = c^2$$

$$36 + 64 = c^2$$

$$100 = c^2$$

$$c = \sqrt{100} = 10$$

c is always the side opposite the right angle
and it is always the longest.

Finding a short side instead? Subtract: $b^2 = c^2 - a^2$.

Section A — Find the missing side

12 marks

Read carefully - some ask for the hypotenuse, some ask for a short side.

1. Legs 3 cm and 4 cm. Find c. _____
2. c = 13 cm, one leg 5 cm. Find the other leg. _____
3. Legs 8 m and 15 m. Find c. _____
4. c = 25 cm, one leg 7 cm. Find the other leg. _____
5. Legs 4 cm and 7 cm. Find c to 1 d.p. _____
6. c = 17 m, one leg 8 m. Find the other leg. _____
7. Legs 9 cm and 12 cm. Find c. _____
8. c = 20 cm, one leg 9 cm. Find the other to 1 d.p. _____
9. Legs 20 m and 21 m. Find c. _____
10. c = 41 cm, one leg 40 cm. Find the other leg. _____
11. Legs 6 m and 11 m. Find c to 1 d.p. _____
12. c = 37 cm, one leg 12 cm. Find the other leg. _____

Section B — Is it a right triangle?

12 marks

Square the two shorter sides and add. If the total matches the longest side squared, the answer is yes.

- | | | |
|---------------------|----------------------|----------------------|
| 13. 3, 4, 5 _____ | 14. 6, 7, 9 _____ | 15. 5, 12, 13 _____ |
| 16. 9, 12, 16 _____ | 17. 8, 15, 17 _____ | 18. 10, 12, 15 _____ |
| 19. 7, 24, 25 _____ | 20. 11, 12, 15 _____ | 21. 20, 21, 29 _____ |
| 22. 9, 40, 41 _____ | 23. 12, 16, 21 _____ | 24. 28, 45, 53 _____ |

Section C — Fill in the missing number

12 marks

Every missing value here is a whole number.

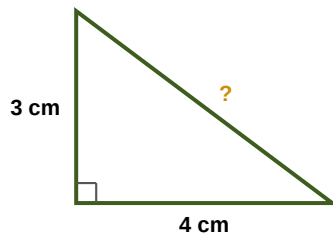
- | | | |
|-------------------------------|-------------------------------|-------------------------------|
| 25. $6^2 + ?^2 = 10^2$ _____ | 26. $?^2 + 24^2 = 25^2$ _____ | 27. $15^2 + 8^2 = ?^2$ _____ |
| 28. $?^2 = 13^2 - 12^2$ _____ | 29. $20^2 + ?^2 = 29^2$ _____ | 30. $?^2 = 41^2 - 40^2$ _____ |
| 31. $12^2 + 35^2 = ?^2$ _____ | 32. $?^2 + 45^2 = 51^2$ _____ | 33. $?^2 = 17^2 - 15^2$ _____ |
| 34. $20^2 + 48^2 = ?^2$ _____ | 35. $33^2 + ?^2 = 65^2$ _____ | 36. $?^2 + 80^2 = 89^2$ _____ |

Section D — Read the diagram

12 marks

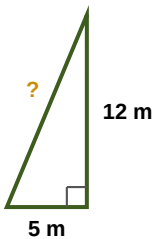
Every figure contains a right angle. Work out the length marked with a ?.

37.



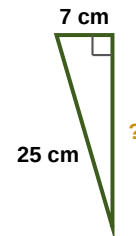
c = _____

38.



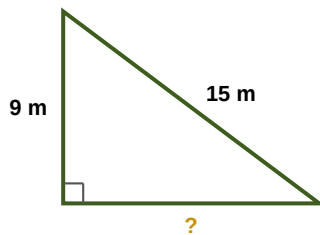
c = _____

39.



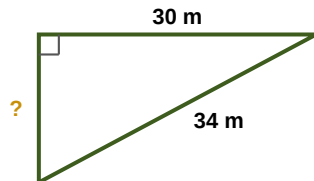
a = _____

40.



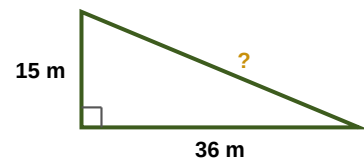
b = _____

41.



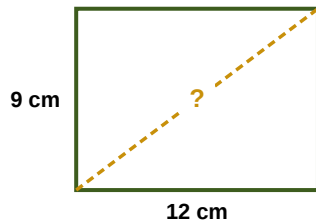
a = _____

42.



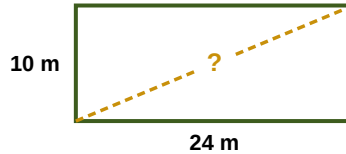
c = _____

43.



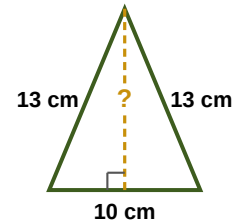
diagonal = _____

44.



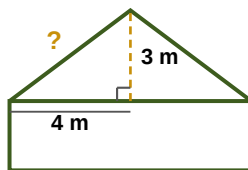
diagonal = _____

45.



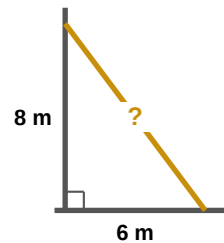
height = _____

46.



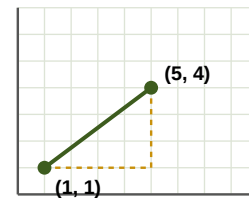
slope = _____

47.



ladder = _____

48.



distance = _____

Section E — Spot the mistake

4 marks

Each student made one error. Say what went wrong, then give the correct answer.

49. Finding c with legs 9 and 12, a student writes: $9^2 + 12^2 = 81 + 144 = 225$, so $c = 225$.

50. A triangle has $c = 13$ and one leg 5. A student writes $13^2 + 5^2 = b^2$, so $b = \sqrt{194} \approx 13.9$.

51. A student writes: $6^2 + 8^2 = (6 \times 2) + (8 \times 2) = 12 + 16 = 28$.

52. A triangle has sides 7 cm, 24 cm and 25 cm. A student checks $7^2 + 25^2 = 24^2$ and says it is not a right triangle.

Section F — Word problems

8 marks

Sketch the triangle first, then label a , b and c .

53. A ladder 13 m long leans against a wall with its foot 5 m from the base. How far up the wall does it reach?

54. A television screen measures 36 cm by 15 cm. What is its diagonal measurement?

55. A boat sails 9 km east, then 12 km north. How far is it from where it started?

56. A rectangular garden is 24 m by 10 m. Walking the two sides is one route; cutting across the diagonal is another. How much shorter is the diagonal route?

57. A carpenter builds a frame 90 cm by 120 cm and measures the diagonal as 145 cm. Are the corners true right angles?

58. A baseball diamond is a square with 27 m between bases. How far does the catcher at home plate throw to reach second base?

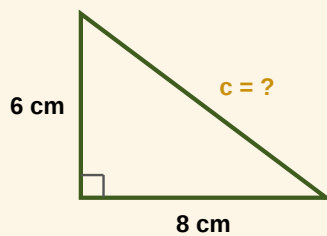
59. A guy wire runs from the top of an 18 m mast to a point 24 m from its base. How long is the wire?

60. A ramp must reach a doorway 7 m above the ground, and there is 24 m of space in front of the building. How long will the ramp surface be?

The Pythagorean Theorem

Missing sides, checking for right angles, reading diagrams, and real situations.

WORKED EXAMPLE Find c



$$a^2 + b^2 = c^2$$

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$$36 + 64 = c^2$$

$$100 = c^2$$

$$c = \sqrt{100} = 10$$

c is always the side opposite the right angle and it is always the longest.

Finding a short side instead? Subtract: $b^2 = c^2 - a^2$.

Section A — Find the missing side

12 marks

Read carefully - some ask for the hypotenuse, some ask for a short side.

1. Legs 3 cm and 4 cm. Find c. **5 cm**
2. c = 13 cm, one leg 5 cm. Find the other leg. **12 cm**
3. Legs 8 m and 15 m. Find c. **17 m**
4. c = 25 cm, one leg 7 cm. Find the other leg. **24 cm**
5. Legs 4 cm and 7 cm. Find c to 1 d.p. **8.1 cm**
6. c = 17 m, one leg 8 m. Find the other leg. **15 m**
7. Legs 9 cm and 12 cm. Find c. **15 cm**
8. c = 20 cm, one leg 9 cm. Find the other to 1 d.p. **17.9 cm**
9. Legs 20 m and 21 m. Find c. **29 m**
10. c = 41 cm, one leg 40 cm. Find the other leg. **9 cm**
11. Legs 6 m and 11 m. Find c to 1 d.p. **12.5 m**
12. c = 37 cm, one leg 12 cm. Find the other leg. **35 cm**

Section B — Is it a right triangle?

12 marks

Square the two shorter sides and add. If the total matches the longest side squared, the answer is yes.

- | | | |
|-------------------------|--------------------------|--------------------------|
| 13. 3, 4, 5 Yes | 14. 6, 7, 9 No | 15. 5, 12, 13 Yes |
| 16. 9, 12, 16 No | 17. 8, 15, 17 Yes | 18. 10, 12, 15 No |

19. 7, 24, 25 **Yes**

20. 11, 12, 15 **No**

21. 20, 21, 29 **Yes**

22. 9, 40, 41 **Yes**

23. 12, 16, 21 **No**

24. 28, 45, 53 **Yes**

Section C — Fill in the missing number

12 marks

Every missing value here is a whole number.

25. $6^2 + ?^2 = 10^2$ **8**

26. $?^2 + 24^2 = 25^2$ **7**

27. $15^2 + 8^2 = ?^2$ **17**

28. $?^2 = 13^2 - 12^2$ **5**

29. $20^2 + ?^2 = 29^2$ **21**

30. $?^2 = 41^2 - 40^2$ **9**

31. $12^2 + 35^2 = ?^2$ **37**

32. $?^2 + 45^2 = 51^2$ **24**

33. $?^2 = 17^2 - 15^2$ **8**

34. $20^2 + 48^2 = ?^2$ **52**

35. $33^2 + ?^2 = 65^2$ **56**

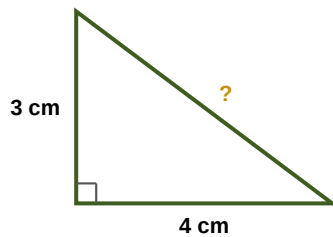
36. $?^2 + 80^2 = 89^2$ **39**

Section D — Read the diagram

12 marks

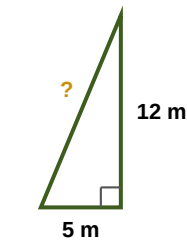
Every figure contains a right angle. Work out the length marked with a ?.

37.



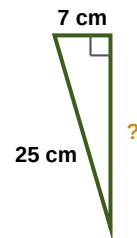
$c = 5 \text{ cm}$

38.



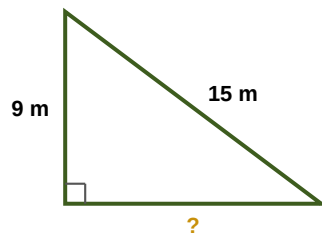
$c = 13 \text{ m}$

39.



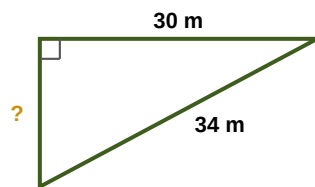
$a = 24 \text{ cm}$

40.



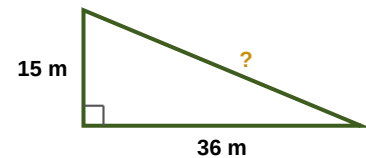
$b = 12 \text{ m}$

41.



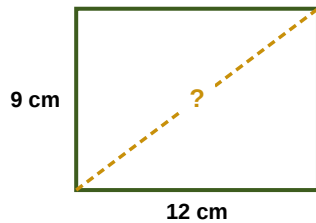
$a = 16 \text{ m}$

42.



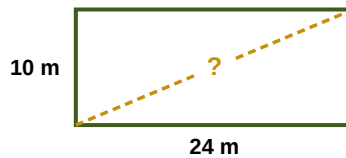
$c = 39 \text{ m}$

43.



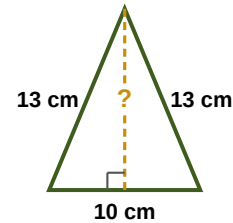
diagonal = 15 cm

44.



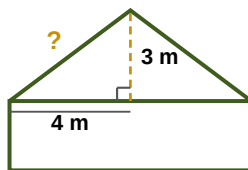
diagonal = 26 m

45.



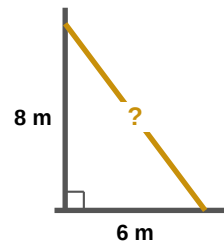
height = 12 cm

46.



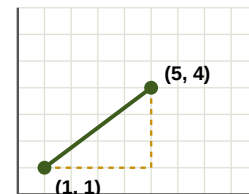
slope = 5 m

47.



ladder = 10 m

48.



distance = 5 units

Section E — Spot the mistake

4 marks

Each student made one error. Say what went wrong, then give the correct answer.

49. Finding c with legs 9 and 12, a student writes: $9^2 + 12^2 = 81 + 144 = 225$, so $c = 225$.

→ They stopped at c^2 . The square root is still needed: $c = \sqrt{225} = 15$.

50. A triangle has $c = 13$ and one leg 5. A student writes $13^2 + 5^2 = b^2$, so $b = \sqrt{194} \approx 13.9$.

→ They added instead of subtracting. $b^2 = 13^2 - 5^2 = 169 - 25 = 144$, so $b = 12$. A short side can never come out longer than the hypotenuse.

51. A student writes: $6^2 + 8^2 = (6 \times 2) + (8 \times 2) = 12 + 16 = 28$.

→ Squaring is not doubling. $6^2 = 36$ and $8^2 = 64$, so $c^2 = 100$ and $c = 10$.

52. A triangle has sides 7 cm, 24 cm and 25 cm. A student checks $7^2 + 25^2 = 24^2$ and says it is not a right triangle.

→ The longest side must be the hypotenuse. $7^2 + 24^2 = 49 + 576 = 625 = 25^2$, so it is a right triangle.

Section F — Word problems

8 marks

Sketch the triangle first, then label a , b and c .

53. A ladder 13 m long leans against a wall with its foot 5 m from the base. How far up the wall does it reach?

→ $a^2 = 13^2 - 5^2 = 169 - 25 = 144$, so height = 12 m

54. A television screen measures 36 cm by 15 cm. What is its diagonal measurement?

→ $c^2 = 36^2 + 15^2 = 1296 + 225 = 1521$, so diagonal = 39 cm

55. A boat sails 9 km east, then 12 km north. How far is it from where it started?

→ $c^2 = 9^2 + 12^2 = 81 + 144 = 225$, so distance = 15 km

56. A rectangular garden is 24 m by 10 m. Walking the two sides is one route; cutting across the diagonal is another. How much shorter is the diagonal route?

→ Diagonal = $\sqrt{(24^2 + 10^2)} = \sqrt{676} = 26$ m. Two sides = $24 + 10 = 34$ m. The diagonal saves 8 m.

57. A carpenter builds a frame 90 cm by 120 cm and measures the diagonal as 145 cm. Are the corners true right angles?
 → A true rectangle would give $\sqrt{(90^2 + 120^2)} = \sqrt{22500} = 150$ cm. The measured 145 cm does not match, so the corners are not square.
58. A baseball diamond is a square with 27 m between bases. How far does the catcher at home plate throw to reach second base?
 → $c^2 = 27^2 + 27^2 = 729 + 729 = 1458$, so the throw is $\sqrt{1458} \approx 38.2$ m
59. A guy wire runs from the top of an 18 m mast to a point 24 m from its base. How long is the wire?
 → $c^2 = 18^2 + 24^2 = 324 + 576 = 900$, so the wire is 30 m
60. A ramp must reach a doorway 7 m above the ground, and there is 24 m of space in front of the building. How long will the ramp surface be?
 → $c^2 = 7^2 + 24^2 = 49 + 576 = 625$, so the ramp is 25 m