

# SCAVENGER HUNT



## PYTHAGOREAN THEOREM APPLICATIONS AND TRIPLES

### Which Side Is the Hypotenuse?

Ladders, wires, kites and walks · draw the right triangle · the cards  
check the answers

FREE

ANSWER

**53 ft**

Ana leans a ladder against a wall. The wall stands straight up from level ground. The ladder is 10 ft long. The top of the ladder touches the wall 8 ft above the ground.

**How far is the foot of the ladder from the wall? Round to the nearest foot.**

*A leg is always shorter than the hypotenuse. Is the answer shorter?*

**B**

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# Scavenger Hunt — how to run it

a full class period

1. **Tape the 16 cards around the room**, in any order. Each card has a large letter in its bottom left corner. Start each group at a *different* one of these eight cards: *B J Q K N R A E*.
2. **Say this once:** “*First draw the right triangle in the box on your sheet. Mark the right angle. The side across from it is the hypotenuse. Then find the length and round it to the nearest foot. Walk to the card with that number at the top.*”
3. **Each group writes one line per card.** Eight right answers bring the group back to its first card.

|                     |                                                                                                                                 |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>16 cards</b>     | pages 3–10, one copy. There are two cards on each sheet. Cut the whole stack once.                                              |
| <b>Record sheet</b> | page 11, one per student. It shows a right triangle with its sides named, the two ways to find a side, and the triples to know. |
| <b>Answers</b>      | pages 12–13, for you only. Do not put them up in the room.                                                                      |

**No card has a drawing.** Each card tells a situation in words, such as a ladder against a wall, a wire from a pole, or a walk east and then north. The student draws the right triangle and decides which length is the hypotenuse. That decision is the hard part of this lesson. The arithmetic is not.

**Eight of the sixteen cards make the ring.** A group reaches the other eight only by a wrong answer, but all the cards look the same. On four ring cards the hypotenuse is given and a leg is asked. A group that adds the squares instead of subtracting them gets the number at the top of another card. On the other four ring cards both given lengths are legs, and they look like part of a known triple. For example, card J gives 28 ft and 35 ft as two legs. A group that takes the bigger number as the hypotenuse and subtracts gets 21, a whole number, and walks to that card. The right answer, 45, is not a whole number before rounding. The card that a wrong answer leads to sends the group to the card it got wrong.

**The check is the length of the group’s list.** A clean run is **eight lines**. Each wrong answer adds two. Every card has a line in small type under the question. It tells a group that arrived by a wrong answer what to check. A group that arrived by a right answer skips it. If a group keeps coming back to the same cards, do not give the answer. Ask: “*Where is the right angle in your drawing? Which side does not touch it?*”



**This is the free lesson this activity came from.** The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.  
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ANSWER

**41 ft**

Kim walks due east across a flat field. Then Kim turns and walks due north. Kim ends up 30 ft from the starting point. Kim walks 18 ft north.

**How far does Kim walk east? Round to the nearest foot.**

*Draw the triangle. Mark the right angle. Which side does not touch it?*

**A**

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ANSWER

**53 ft**

Ana leans a ladder against a wall. The wall stands straight up from level ground. The ladder is 10 ft long. The top of the ladder touches the wall 8 ft above the ground.

**How far is the foot of the ladder from the wall? Round to the nearest foot.**

*A leg is always shorter than the hypotenuse. Is the answer shorter?*

**B**

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ANSWER

**19 ft**

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Ben leans a ladder against a wall. The wall stands straight up from level ground. The top of the ladder touches the wall 39 ft above the ground. The foot of the ladder is 22 ft from the wall.

**How long is the ladder? Round to the nearest foot.**

*Find the right angle first. The two sides that meet at it are the legs.*

**C**

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ANSWER

**13 ft**

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A pine tree stands straight up on level ground. The sun makes a shadow on the ground. Its shadow is 25 ft long. The pine tree is 47 ft tall.

**How far is it from the top of the pine tree to the tip of its shadow? Round to the nearest foot.**

*To find a leg, take the smaller square from the larger one.*

**D**

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ANSWER

**24 ft**

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A playground is a rectangle. A straight path goes from one corner of the playground to the opposite corner. The playground is 39 ft long. The playground is 36 ft wide.

**How long is the path? Round to the nearest foot.**

*Do the two given sides meet at the right angle? Then add the squares.*

**E**

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ANSWER

**52 ft**

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A flagpole stands straight up on level ground. A tight wire runs from the top of the flagpole to a stake in the ground. The flagpole is 51 ft tall. The stake is 39 ft from the foot of the flagpole.

**How far is it from the top of the flagpole to the stake? Round to the nearest foot.**

*Check the answer. Is the hypotenuse still the longest of the three sides?*

**F**

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ANSWER

**28 ft**

A field is a rectangle. A straight path goes from one corner of the field to the opposite corner. The field is 17 ft wide. The path is 51 ft long.

**How long is the field? Round to the nearest foot.**

*A whole number is not a sign of a right answer. Check the roles.*

**G**

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ANSWER

**30 ft**

Mia walks due east across a flat field. Then Mia turns and walks due north. Mia ends up 20 ft from the starting point. Mia walks 18 ft east.

**How far does Mia walk north? Round to the nearest foot.**

*Does a triple fit these numbers? Check which number is the hypotenuse first.*

**H**

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ANSWER

**6 ft**

Sam walks due east across a flat field. Then Sam turns and walks due north. Sam walks 28 ft east. Sam walks 35 ft north.

**How far is Sam from the starting point? Round to the nearest foot.**

*Are both given lengths legs? Then the answer is the longest side.*

**J**

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ANSWER

**9 ft**

Leo flies a kite over level ground and holds the string tight at ground level. The kite is straight above a point on the ground. The kite is 50 ft above the ground. That point is 40 ft from Leo.

**How far is the kite from Leo, in a straight line? Round to the nearest foot.**

*A triple helps only when each number has its own role in it.*

**K**

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ANSWER

**21 ft**

A straight ramp goes up from level ground to a flat platform. The ramp is 7 ft long. The platform is 4 ft above the ground.

**How far along the ground does the ramp go? Round to the nearest foot.**

*The biggest given number is not always the hypotenuse. Read the situation again.*

**L**

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ANSWER

**35 ft**

Rosa flies a kite over level ground and holds the string tight at ground level. The kite is straight above a point on the ground. The kite is 34 ft above the ground. That point is 23 ft from Rosa.

**How long is the string? Round to the nearest foot.**

*Is the hypotenuse one of the given lengths? Then subtract the squares.*

**M**

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ANSWER

**64 ft**

A lawn is a rectangle. A straight path goes from one corner of the lawn to the opposite corner. The path is 50 ft long. The lawn is 14 ft wide.

**How long is the lawn? Round to the nearest foot.**

*The longest side is the hypotenuse. Check that no side is longer than it.*

**N**

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ANSWER

**15 ft**

A post stands straight up on level ground. The sun makes a shadow on the ground. The post is 7 ft tall. From the top of the post to the tip of its shadow is 25 ft.

**How long is the shadow? Round to the nearest foot.**

*Two legs make the right angle. The hypotenuse is the side that joins their far ends.*

**P**

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ANSWER

**45 ft**

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A pole stands straight up on level ground. A tight wire runs from the top of the pole to a stake in the ground. The wire is 15 ft long. The pole is 12 ft tall.

**How far is the stake from the foot of the pole? Round to the nearest foot.**

*Which length is across from the right angle? That one is the hypotenuse.*

**Q**

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ANSWER

**48 ft**

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A tree stands straight up on level ground. The sun makes a shadow on the ground. The tree is 35 ft tall. Its shadow is 21 ft long.

**How far is it from the top of the tree to the tip of its shadow? Round to the nearest foot.**

*Most right triangles have no whole-number sides. A decimal answer is normal.*

**R**

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# Scavenger Hunt — where I went

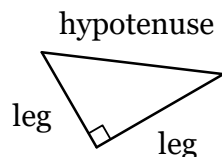
Pythagorean applications

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

**Draw the right triangle first**, on one line below. Mark the right angle. Round your answer to the nearest foot. Then find the card with your answer at the top. A clean run is eight lines. Each card has a line in small type under the question. **If you are on a card because you went wrong, its line says what to check. If you were right, skip it.**



The **hypotenuse** is across from the right angle. It is the longest side. The other two sides are the **legs**. To find the hypotenuse, **add** the squares:  $c^2 = a^2 + b^2$ . To find a leg, **subtract** them:  $b^2 = c^2 - a^2$ . Triples to know: 3, 4, 5 · 5, 12, 13 · 8, 15, 17 · 7, 24, 25, and their multiples, like 6, 8, 10. Most right triangles do not have whole-number sides. Legs of 2 and 7 give a hypotenuse of  $\sqrt{53}$ , about 7.28. That is normal.

| Card letter | My right triangle | My answer |
|-------------|-------------------|-----------|
| 1           |                   |           |
| 2           |                   |           |
| 3           |                   |           |
| 4           |                   |           |
| 5           |                   |           |
| 6           |                   |           |
| 7           |                   |           |
| 8           |                   |           |
| 9           |                   |           |
| 10          |                   |           |

## Why does a right triangle win every argument?

Every number stands for a letter. Write the letter for each answer in the box above its number. Read the boxes you filled, left to right. **If they do not spell the answer, one of your answers is wrong.**

6 = I   9 = T   13 = G   15 = H   19 = I   21 = T   24 = S   28 = S   30 = I   35 = R   41 = R   45 = I   48 = G   52 = T   53 = H  
64 = T

|   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| 6 | 9 | 13 | 15 | 19 | 21 | 24 | 28 | 30 | 35 | 41 | 45 | 48 | 52 | 53 | 64 |



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# Scavenger Hunt — answers

For the teacher

The ring in order, with the answer found on each card. A group may begin anywhere on it. Wherever it begins, eight right answers bring it back to that card. Every answer is rounded to the nearest foot.

**B (6 ft) → J (45 ft) → Q (9 ft) → K (64 ft) → N (48 ft) → R (41 ft) → A (24 ft) → E (53 ft) → B**

**Why does a right triangle win every argument?** The answer is *IT'S RIGHT!* It is read along the boxes of the record sheet, which run from the smallest number to the largest.

| Card       | The question on the card                                                                                                                                                                                                                             | Answer, and why                                                                                                                                                 | The wrong answer it catches                                                                           | Letter of its top |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------|
| 1 <b>B</b> | Ana leans a ladder against a wall. The wall stands straight up from level ground. The ladder is 10 ft long. The top of the ladder touches the wall 8 ft above the ground. How far is the foot of the ladder from the wall?                           | <b>6 ft.</b> The hypotenuse is given (the ladder), so subtract: $10^2 - 8^2 = 36$ . The square root is 6, so the answer is 6 ft.                                | 13 ft. The squares are added: $10^2 + 8^2 = 164$ , and its square root is 12.81.                      | H                 |
| 2 <b>J</b> | Sam walks due east across a flat field. Then Sam turns and walks due north. Sam walks 28 ft east. Sam walks 35 ft north. How far is Sam from the starting point?                                                                                     | <b>45 ft.</b> Both given lengths are legs, so add the squares: $28^2 + 35^2 = 2009$ . The square root is 44.82, so the answer is 45 ft.                         | 21 ft. The bigger number is taken as the hypotenuse: $35^2 - 28^2 = 441$ , and its square root is 21. | I                 |
| 3 <b>Q</b> | A pole stands straight up on level ground. A tight wire runs from the top of the pole to a stake in the ground. The wire is 15 ft long. The pole is 12 ft tall. How far is the stake from the foot of the pole?                                      | <b>9 ft.</b> The hypotenuse is given (the wire), so subtract: $15^2 - 12^2 = 81$ . The square root is 9, so the answer is 9 ft.                                 | 19 ft. The squares are added: $15^2 + 12^2 = 369$ , and its square root is 19.21.                     | I                 |
| 4 <b>K</b> | Leo flies a kite over level ground and holds the string tight at ground level. The kite is straight above a point on the ground. The kite is 50 ft above the ground. That point is 40 ft from Leo. How far is the kite from Leo, in a straight line? | <b>64 ft.</b> Both given lengths are legs, so add the squares: $50^2 + 40^2 = 4100$ . The square root is 64.03, so the answer is 64 ft.                         | 30 ft. The bigger number is taken as the hypotenuse: $50^2 - 40^2 = 900$ , and its square root is 30. | T                 |
| 5 <b>N</b> | A lawn is a rectangle. A straight path goes from one corner of the lawn to the opposite corner. The path is 50 ft long. The lawn is 14 ft wide. How long is the lawn?                                                                                | <b>48 ft.</b> The hypotenuse is given (the path), so subtract: $50^2 - 14^2 = 2304$ . The square root is 48, so the answer is 48 ft.                            | 52 ft. The squares are added: $50^2 + 14^2 = 2696$ , and its square root is 51.92.                    | T                 |
| 6 <b>R</b> | A tree stands straight up on level ground. The sun makes a shadow on the ground. The tree is 35 ft tall. Its shadow is 21 ft long. How far is it from the top of the tree to the tip of its shadow?                                                  | <b>41 ft.</b> Both given lengths are legs, so add the squares: $35^2 + 21^2 = 1666$ . The square root is 40.82, so the answer is 41 ft.                         | 28 ft. The bigger number is taken as the hypotenuse: $35^2 - 21^2 = 784$ , and its square root is 28. | G                 |
| 7 <b>A</b> | Kim walks due east across a flat field. Then Kim turns and walks due north. Kim ends up 30 ft from the starting point. Kim walks 18 ft north. How far does Kim walk east?                                                                            | <b>24 ft.</b> The hypotenuse is given (the straight distance from the start), so subtract: $30^2 - 18^2 = 576$ . The square root is 24, so the answer is 24 ft. | 35 ft. The squares are added: $30^2 + 18^2 = 1224$ , and its square root is 34.99.                    | R                 |
| 8 <b>E</b> | A playground is a rectangle. A straight path goes from one corner of the playground to the opposite corner. The playground is 39 ft long. The playground is 36 ft wide. How long is the path?                                                        | <b>53 ft.</b> Both given lengths are legs, so add the squares: $39^2 + 36^2 = 2817$ . The square root is 53.08, so the answer is 53 ft.                         | 15 ft. The bigger number is taken as the hypotenuse: $39^2 - 36^2 = 225$ , and its square root is 15. | S                 |

# Scavenger Hunt — the cards off the ring

For the teacher

**A group reaches these eight cards only by a wrong answer.** The number at the top of each one is the wrong answer from one ring card. Its right answer is the number at the top of that ring card, so the group goes to the card it got wrong and tries it again. If the group makes the same kind of mistake here, its answer is at the top of no ring card. So a second wrong answer never moves a group forward.

| Card     | The question on the card                                                                                                                                                                                                                                       | Answer, and why                                                                                                                                                                          | The wrong answer it catches                                                                               | Letter of its top |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------|
| <b>D</b> | A pine tree stands straight up on level ground. The sun makes a shadow on the ground. Its shadow is 25 ft long. The pine tree is 47 ft tall. How far is it from the top of the pine tree to the tip of its shadow?                                             | <b>53 ft.</b> Both given lengths are legs, so add the squares: $25^2 + 47^2 = 2834$ . The square root is 53.24, so the answer is 53 ft.                                                  | 40 ft. The bigger number is taken as the hypotenuse: $47^2 - 25^2 = 1584$ , and its square root is 39.80. | G                 |
| <b>L</b> | A straight ramp goes up from level ground to a flat platform. The ramp is 7 ft long. The platform is 4 ft above the ground. How far along the ground does the ramp go?                                                                                         | <b>6 ft.</b> The hypotenuse is given (the ramp), so subtract: $7^2 - 4^2 = 33$ . The square root is 5.74, so the answer is 6 ft.                                                         | 8 ft. The squares are added: $7^2 + 4^2 = 65$ , and its square root is 8.06.                              | T                 |
| <b>C</b> | Ben leans a ladder against a wall. The wall stands straight up from level ground. The top of the ladder touches the wall 39 ft above the ground. The foot of the ladder is 22 ft from the wall. How long is the ladder?                                        | <b>45 ft.</b> Both given lengths are legs, so add the squares: $39^2 + 22^2 = 2005$ . The square root is 44.78, so the answer is 45 ft.                                                  | 32 ft. The bigger number is taken as the hypotenuse: $39^2 - 22^2 = 1037$ , and its square root is 32.20. | I                 |
| <b>H</b> | Mia walks due east across a flat field. Then Mia turns and walks due north. Mia ends up 20 ft from the starting point. Mia walks 18 ft east. How far does Mia walk north?                                                                                      | <b>9 ft.</b> The hypotenuse is given (the straight distance from the start), so subtract: $20^2 - 18^2 = 76$ . The square root is 8.72, so the answer is 9 ft.                           | 27 ft. The squares are added: $20^2 + 18^2 = 724$ , and its square root is 26.91.                         | I                 |
| <b>F</b> | A flagpole stands straight up on level ground. A tight wire runs from the top of the flagpole to a stake in the ground. The flagpole is 51 ft tall. The stake is 39 ft from the foot of the flagpole. How far is it from the top of the flagpole to the stake? | <b>64 ft.</b> Both given lengths are legs, so add the squares: $51^2 + 39^2 = 4122$ . The square root is 64.20, so the answer is 64 ft.                                                  | 33 ft. The bigger number is taken as the hypotenuse: $51^2 - 39^2 = 1080$ , and its square root is 32.86. | T                 |
| <b>G</b> | A field is a rectangle. A straight path goes from one corner of the field to the opposite corner. The field is 17 ft wide. The path is 51 ft long. How long is the field?                                                                                      | <b>48 ft.</b> The hypotenuse is given (the path), so subtract: $51^2 - 17^2 = 2312$ . The square root is 48.08, so the answer is 48 ft.                                                  | 54 ft. The squares are added: $51^2 + 17^2 = 2890$ , and its square root is 53.76.                        | S                 |
| <b>M</b> | Rosa flies a kite over level ground and holds the string tight at ground level. The kite is straight above a point on the ground. The kite is 34 ft above the ground. That point is 23 ft from Rosa. How long is the string?                                   | <b>41 ft.</b> Both given lengths are legs, so add the squares: $34^2 + 23^2 = 1685$ . The square root is 41.05, so the answer is 41 ft.                                                  | 25 ft. The bigger number is taken as the hypotenuse: $34^2 - 23^2 = 627$ , and its square root is 25.04.  | R                 |
| <b>P</b> | A post stands straight up on level ground. The sun makes a shadow on the ground. The post is 7 ft tall. From the top of the post to the tip of its shadow is 25 ft. How long is the shadow?                                                                    | <b>24 ft.</b> The hypotenuse is given (the distance from the top of the post to the tip of the shadow), so subtract: $25^2 - 7^2 = 576$ . The square root is 24, so the answer is 24 ft. | 26 ft. The squares are added: $25^2 + 7^2 = 674$ , and its square root is 25.96.                          | H                 |

**Other mistakes lead to no card.** A group might forget to take the square root, or add or subtract the two lengths without squaring them. Its answer is then not the number at the top of any card.