

MYSTERY PICTURE



CLASSIFYING TRIANGLES ON THE COORDINATE PLANE

Slopes or Lengths? Classifying Triangles

25 claims about triangles · which tool settles each · nothing to calculate
· a picture appears

FREE

1 Sides PQ and PR are the same length.	2 Side PQ is perpendicular to side PR.	3 In triangle JKL, the angle at K is a right angle.	4 In triangle ABC, the angle at B is not a right angle.	5 Triangle DEF is a right triangle.
6 Triangle DEF is isosceles.	7 Triangle XYZ has no right angle.	8 Triangle XYZ is scalene.	9 Triangle ABC is acute, with no right angle.	10 Triangle JKL is obtuse.
11 In triangle ABC, the angle at B is obtuse.	12 Sides MN and ML meet at a right angle.	13 The right angle of triangle STU is at T.	14 Sides GH and GK are not perpendicular.	15 In triangle PQR, side QR is the longest side.
16 Triangle STU is right and isosceles.	17 Triangle ABC is not a right triangle.	18 Triangle GHK is right and scalene.	19 Triangle LMN is right or obtuse.	20 In triangle JKL, the angle at K is a right angle. Side KL is vertical.
21 Sides MN and ML are perpendicular. Side MN is vertical.	22 In triangle UVW, the angle at W is 90° .	23 In triangle PQR, the angles at Q and R are the same size.	24 In triangle UVW, the angle at W is acute.	25 Sides TU and TV have the same length.

1. **Give each student page 3** and a pencil. Nothing is calculated.
2. **Say this once:** *“Each square makes a claim about a triangle. Could the slope test settle it? If yes, fill the square with slanted lines. If only the side lengths can settle it, leave it white.”*
3. **Let them work.** The picture shows when they are right. Nothing else is needed.

Student sheet page 3, one per student. A box at the top shows the six triangle names and the slope test.
Answers page 4, for you.

The question in every square is the first step of this lesson: does the claim need a length or a direction? The slope test answers one thing only: are two sides perpendicular? So it settles a claim about a right angle and nothing else. The side lengths settle every claim on the sheet. Ten squares are filled and fifteen are white.

The white squares are the mistakes students make. Five are about side lengths, such as “isosceles”. A pair of slopes never shows that two sides are the same length. Five are about acute or obtuse, which the slope test cannot tell apart. Two ask for “right” and a side name together, and two have a vertical side, where the slope test gives no answer at all. One more, square 23, says two angles are equal. That is a claim about lengths too, because the sides opposite equal angles are equal.

If part of a student’s picture looks wrong, ask about that square: *“Is this claim about a direction or about a length?”* Guessing does not work. Every simple guessing rule, such as filling every square that says “right”, gets at least six squares wrong.



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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Mystery Picture — slopes or lengths?

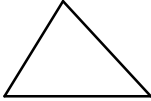
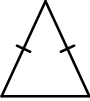
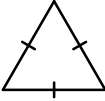
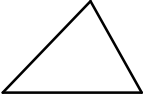
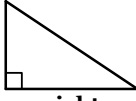
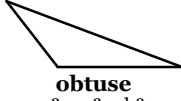
Classifying triangles

Name _____

Period _____

Date _____

Each square makes one claim about a triangle. No square gives coordinates, and nothing is calculated. **Could the slope test settle the claim? If yes, fill the square with slanted lines. If only the side lengths can settle it, leave it white.** No side is vertical unless the square says so. A picture appears. If part of it is missing, or one square does not fit, check that square again.

 scalene no two sides the same length	 isosceles at least two sides the same length	 equilateral all three sides the same length	 acute $c^2 < a^2 + b^2$	 right $c^2 = a^2 + b^2$	 obtuse $c^2 > a^2 + b^2$
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A full name is two words, one for the sides and one for the angles: *isosceles right*, *scalene obtuse*.

Sides: find the squares of the three side lengths, (across)² + (up)². Two equal squares mean two equal sides.

Angles: c is the longest side, and a and b are the other two. Compare c^2 with $a^2 + b^2$.

The slope test: multiply the slopes of the two sides that meet at a corner. If the product is -1 , the angle there is a right angle. If it is any other number, it is not. A vertical side has no slope, so the test gives no answer.

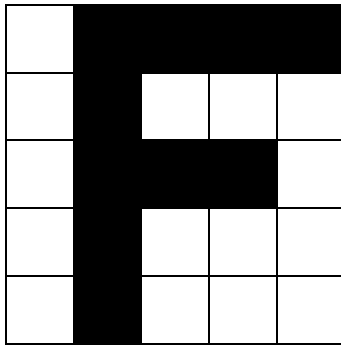
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Mystery Picture — answers

For the teacher



The finished picture is **the letter F**. Ten squares are filled.

A square is filled when the slope test could settle its claim. That is only a claim about a right angle or about two perpendicular sides, with no vertical side. This sheet calls a triangle isosceles when at least two sides are the same length. Some textbooks use other definitions, so tell the class which ones this sheet uses.

	The claim	Answer	Why
1	Sides PQ and PR are the same length.	white	It is about how long PQ and PR are. Slopes give directions, not lengths.
2	Side PQ is perpendicular to side PR.	fill	It is about the directions of PQ and PR. Their slopes multiply to -1 exactly when they are perpendicular.
3	In triangle JKL, the angle at K is a right angle.	fill	It is about the directions of KJ and KL. Their slopes multiply to -1 exactly when they are perpendicular.
4	In triangle ABC, the angle at B is not a right angle.	fill	It is about the directions of BA and BC. Their slopes multiply to -1 exactly when they are perpendicular.
5	Triangle DEF is a right triangle.	fill	It is about right angles. The slope test at each of the three corners settles it.
6	Triangle DEF is isosceles.	white	It is about whether two sides are the same length. Slopes give directions, not lengths.
7	Triangle XYZ has no right angle.	fill	It is about right angles. The slope test at each of the three corners settles it.
8	Triangle XYZ is scalene.	white	It is about whether all three sides have different lengths. Slopes give directions, not lengths.
9	Triangle ABC is acute, with no right angle.	white	The slope test only says “right” or “not right”. It cannot tell acute from obtuse.
10	Triangle JKL is obtuse.	white	The slope test only says “right” or “not right”. It cannot tell acute from obtuse.
11	In triangle ABC, the angle at B is obtuse.	white	The slope test only says “right” or “not right”. It cannot tell acute from obtuse.
12	Sides MN and ML meet at a right angle.	fill	It is about the directions of MN and ML. Their slopes multiply to -1 exactly when they are perpendicular.
13	The right angle of triangle STU is at T.	fill	It is about the directions of TS and TU. Their slopes multiply to -1 exactly when they are perpendicular.
14	Sides GH and GK are not perpendicular.	fill	It is about the directions of GH and GK. Their slopes multiply to -1 exactly when they are perpendicular.
15	In triangle PQR, side QR is the longest side.	white	It is about which side is the longest. Slopes give directions, not lengths.
16	Triangle STU is right and isosceles.	white	The slopes can show the right angle, but only the side lengths can show “isosceles”.
17	Triangle ABC is not a right triangle.	fill	It is about right angles. The slope test at each of the three corners settles it.
18	Triangle GHK is right and scalene.	white	The slopes can show the right angle, but only the side lengths can show “scalene”.
19	Triangle LMN is right or obtuse.	white	The slope test only says “right” or “not right”. It cannot tell acute from obtuse.
20	In triangle JKL, the angle at K is a right angle. Side KL is vertical.	white	Side KL is vertical, so it has no slope. The slope test multiplies two slopes, so it cannot be done here.
21	Sides MN and ML are perpendicular. Side MN is vertical.	white	Side MN is vertical, so it has no slope. The slope test multiplies two slopes, so it cannot be done here.
22	In triangle UVW, the angle at W is 90° .	fill	It is about the directions of WU and WV. Their slopes multiply to -1 exactly when they are perpendicular.
23	In triangle PQR, the angles at Q and R are the same size.	white	In a triangle, the sides opposite two equal angles are equal (the converse of the isosceles triangle theorem). So the claim is about side lengths, and slopes do not show lengths.
24	In triangle UVW, the angle at W is acute.	white	The slope test only says “right” or “not right”. It cannot tell acute from obtuse.
25	Sides TU and TV have the same length.	white	It is about how long TU and TV are. Slopes give directions, not lengths.