

MYSTERY PICTURE



INDIRECT MEASUREMENT WITH SIMILAR TRIANGLES

Which Lengths Match?

25 scenes in words · no drawings, no numbers · a picture appears

FREE

1 Sun: Mia and the tree Mia's height and the tree's height	2 Mirror: Nora and the chimney From the mirror to Nora's feet and from the mirror to the chimney's base	3 Ruler: Eli and the flagpole The ruler's length and the flagpole's height	4 Sun: Tom and the building Tom's shadow and the building's shadow	5 Mirror: Leo and the tower Leo's height and the tower's height
6 Mirror: Joe and the tower Joe's eye height and the tower's height	7 Sun: Sam and the flagpole Sam's height and the flagpole's shadow	8 Ruler: Ana and the post The ruler's length and from Ana's eye to the post	9 Sun: Ivy and the tree The distance from Ivy to the tree and the tree's shadow	10 Ruler: Raj and the tree From Raj's eye to the ruler and from Raj's eye to the tree
11 Sun: Leah and the tree The tree's shadow and Leah's shadow	12 Mirror: Kim and the tower Kim's height and the tower's height	13 Sun: Gus and the tree Gus's shadow and the tree's height	14 Mirror: Bea and the chimney From the mirror to Bea's eyes and from the mirror to the chimney's base	15 Mirror: Ola and the flagpole From the mirror to the flagpole's base and from the mirror to Ola's feet
16 Sun: Pia and the building The building's height and Pia's height	17 Mirror: Uma and the mast The mast's height and Uma's eye height	18 Ruler: Wes and the tree The tree's height and the ruler's length	19 Sun: Lou and the tree Lou's shadow and the tree's shadow	20 Ruler: Fay and the post From Fay's eye to the ruler and the post's height
21 Mirror: Vic and the water tower Vic's eye height and the water tower's height	22 Sun: Hal and the flagpole The flagpole's height and Hal's shadow	23 Mirror: Ned and the clock tower The clock tower's height and Ned's height	24 Ruler: Cy and the tower From the ruler to the tower and from Cy's eye to the ruler	25 Mirror: Dee and the tower From the mirror to Dee's feet and the tower's height

1. **Give each student page 3** and a pencil.
2. **Say this once:** *“Each square names two lengths. Picture the two triangles. Do the two lengths match, like a height with a height? If yes, fill the square with slanted lines. If no, 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 strip at the top shows the three set-ups as plain drawings.
Answers	pages 4–5, for you.

No square has a drawing and no square has a number. Each square names a scene, a person, a tall object and two lengths. In each scene there are two similar triangles. One is made by the person, and one by the tall object. Two lengths match when they are in matching places in the two triangles. Only the pairs below match.

Three scenes, and the pairs that match. In the sun: the person’s height with the tall object’s height, and the person’s shadow with the object’s shadow. With a mirror on the ground: the person’s eye height with the tall object’s height, and the distance from the mirror to the person’s feet with the distance from the mirror to the object’s base. With a ruler held up: the ruler with the tall object, and the distance from the eye to the ruler with the distance from the eye to the object. Any other pair, such as the distance from the person to the tree and the tree’s shadow, does not match.

Each white square tests a common mistake. Some pair a height with a shadow. Three pair the person’s height with the tower’s height in the mirror scene. That is wrong because the line of sight starts at the eye, not at the top of the head. Some use a distance measured to the wrong place, such as from the mirror to the person’s eyes. Thirteen squares are filled.

If part of a student’s picture looks wrong, the mistake is in that square. Ask: *“Draw the two triangles. Where is each length in your drawing?”* Guessing does not work. Every simple guessing rule, such as filling every square where both lengths say “height”, gets at least eight 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 — which lengths match?

Indirect measurement

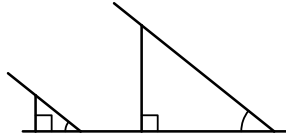
Name _____

Period _____

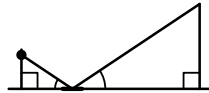
Date _____

Each square names a scene and two lengths. Picture the two similar triangles. **Do the two lengths match, like a height with a height? If yes, fill the square with slanted lines. If no, leave it white.** A picture appears. If part of it is missing, or one square does not fit, check that square again.

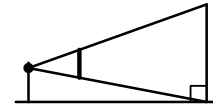
Three ways to make two similar triangles. The drawings are not to scale.



Sun: the rays are parallel. Both stand straight up.



Mirror: flat on the ground. The dot is the eye.



Ruler: held straight up. It just covers the post.

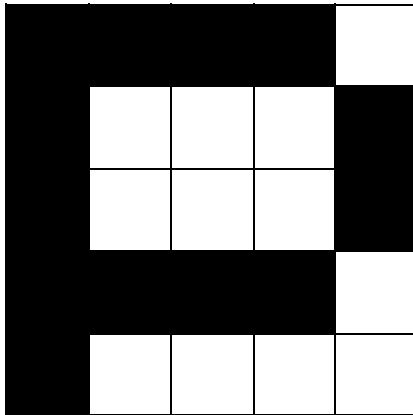
1 Sun: Mia and the tree Mia's height and the tree's height	2 Mirror: Nora and the chimney From the mirror to Nora's feet and from the mirror to the chimney's base	3 Ruler: Eli and the flagpole The ruler's length and the flagpole's height	4 Sun: Tom and the building Tom's shadow and the building's shadow	5 Mirror: Leo and the tower Leo's height and the tower's height
6 Mirror: Joe and the tower Joe's eye height and the tower's height	7 Sun: Sam and the flagpole Sam's height and the flagpole's shadow	8 Ruler: Ana and the post The ruler's length and from Ana's eye to the post	9 Sun: Ivy and the tree The distance from Ivy to the tree and the tree's shadow	10 Ruler: Raj and the tree From Raj's eye to the ruler and from Raj's eye to the tree
11 Sun: Leah and the tree The tree's shadow and Leah's shadow	12 Mirror: Kim and the tower Kim's height and the tower's height	13 Sun: Gus and the tree Gus's shadow and the tree's height	14 Mirror: Bea and the chimney From the mirror to Bea's eyes and from the mirror to the chimney's base	15 Mirror: Ola and the flagpole From the mirror to the flagpole's base and from the mirror to Ola's feet
16 Sun: Pia and the building The building's height and Pia's height	17 Mirror: Uma and the mast The mast's height and Uma's eye height	18 Ruler: Wes and the tree The tree's height and the ruler's length	19 Sun: Lou and the tree Lou's shadow and the tree's shadow	20 Ruler: Fay and the post From Fay's eye to the ruler and the post's height
21 Mirror: Vic and the water tower Vic's eye height and the water tower's height	22 Sun: Hal and the flagpole The flagpole's height and Hal's shadow	23 Mirror: Ned and the clock tower The clock tower's height and Ned's height	24 Ruler: Cy and the tower From the ruler to the tower and from Cy's eye to the ruler	25 Mirror: Dee and the tower From the mirror to Dee's feet and the tower's height



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Mystery Picture — answers

For the teacher



The finished picture is **the letter P**. Thirteen squares are filled.

To check a square, draw the scene and its two triangles. A length matches another when it is in the matching place in the other triangle. The table gives the reason for every square. It goes on over the page.

	The square	Answer	Why
1	Sun: Mia and the tree. Mia's height and the tree's height.	fill	Both are heights, one in each triangle.
2	Mirror: Nora and the chimney. From the mirror to Nora's feet and from the mirror to the chimney's base.	fill	Both run along the ground from the mirror, one on each side.
3	Ruler: Eli and the flagpole. The ruler's length and the flagpole's height.	fill	The ruler just covers the flagpole, so the two match.
4	Sun: Tom and the building. Tom's shadow and the building's shadow.	fill	Both are shadows, one in each triangle.
5	Mirror: Leo and the tower. Leo's height and the tower's height.	white	The line of sight starts at the eye, not the top of the head. The eye height is the side.
6	Mirror: Joe and the tower. Joe's eye height and the tower's height.	fill	The line of sight starts at the eye. So the eye height matches the tall object's height.
7	Sun: Sam and the flagpole. Sam's height and the flagpole's shadow.	white	A height matches a height, not a shadow.
8	Ruler: Ana and the post. The ruler's length and from Ana's eye to the post.	white	One runs up and down. The other runs along the ground.
9	Sun: Ivy and the tree. The distance from Ivy to the tree and the tree's shadow.	white	The distance from Ivy to the tree is not a side of either triangle.
10	Ruler: Raj and the tree. From Raj's eye to the ruler and from Raj's eye to the tree.	fill	Both are distances out from the eye, one to the ruler and one to the object.
11	Sun: Leah and the tree. The tree's shadow and Leah's shadow.	fill	Both are shadows, one in each triangle.
12	Mirror: Kim and the tower. Kim's height and the tower's height.	white	The line of sight starts at the eye, not the top of the head. The eye height is the side.

Mystery Picture — answers, squares 13 to 25

For the teacher

	The square	Answer	Why
13	Sun: Gus and the tree. Gus's shadow and the tree's height.	white	A height matches a height, not a shadow.
14	Mirror: Bea and the chimney. From the mirror to Bea's eyes and from the mirror to the chimney's base.	white	From the mirror to Bea's eyes is the slanted line of sight. It does not match a distance along the ground.
15	Mirror: Ola and the flagpole. From the mirror to the flagpole's base and from the mirror to Ola's feet.	fill	Both run along the ground from the mirror, one on each side.
16	Sun: Pia and the building. The building's height and Pia's height.	fill	Both are heights, one in each triangle.
17	Mirror: Uma and the mast. The mast's height and Uma's eye height.	fill	The line of sight starts at the eye. So the eye height matches the tall object's height.
18	Ruler: Wes and the tree. The tree's height and the ruler's length.	fill	The ruler just covers the tree, so the two match.
19	Sun: Lou and the tree. Lou's shadow and the tree's shadow.	fill	Both are shadows, one in each triangle.
20	Ruler: Fay and the post. From Fay's eye to the ruler and the post's height.	white	One runs up and down. The other runs along the ground.
21	Mirror: Vic and the water tower. Vic's eye height and the water tower's height.	fill	The line of sight starts at the eye. So the eye height matches the tall object's height.
22	Sun: Hal and the flagpole. The flagpole's height and Hal's shadow.	white	A height matches a height, not a shadow.
23	Mirror: Ned and the clock tower. The clock tower's height and Ned's height.	white	The line of sight starts at the eye, not the top of the head. The eye height is the side.
24	Ruler: Cy and the tower. From the ruler to the tower and from Cy's eye to the ruler.	white	From the ruler to the tower leaves out the part from the eye to the ruler. The matching distances start at the eye.
25	Mirror: Dee and the tower. From the mirror to Dee's feet and the tower's height.	white	One runs up and down. The other runs along the ground.