

# MYSTERY PICTURE



## 30-60-90 SPECIAL RIGHT TRIANGLES

### Which Side Is It?

30-60-90 triangles · 25 squares in words · the angles decide · a picture appears

FREE

|                                                                                                           |                                                                                                           |                                                                                                           |                                                                                                           |                                                                                                           |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 1<br>In triangle ABC, angle A is $30^\circ$ and angle C is $90^\circ$ .<br><b>Is BC the shorter leg?</b>  | 2<br>In triangle DEF, angle D is $60^\circ$ and angle F is $90^\circ$ .<br><b>Is EF the longer leg?</b>   | 3<br>In triangle GHJ, angle G is $30^\circ$ and angle H is $60^\circ$ .<br><b>Is GH the hypotenuse?</b>   | 4<br>In triangle KLM, angle L is $90^\circ$ and angle M is $30^\circ$ .<br><b>Is KL the shorter leg?</b>  | 5<br>In triangle PQR, angle P is $90^\circ$ and angle Q is $60^\circ$ .<br><b>Is PQ the shorter leg?</b>  |
| 6<br>In triangle STU, angle S is $30^\circ$ and angle U is $90^\circ$ .<br><b>Is SU the shorter leg?</b>  | 7<br>In triangle VWZ, angle V is $60^\circ$ and angle Z is $90^\circ$ .<br><b>Is VZ the longer leg?</b>   | 8<br>In triangle NPQ, angle N is $30^\circ$ and angle Q is $90^\circ$ .<br><b>Is NP the shorter leg?</b>  | 9<br>In triangle RST, angle R is $90^\circ$ and angle T is $60^\circ$ .<br><b>Is RS the longer leg?</b>   | 10<br>In triangle CDE, angle C is $30^\circ$ and angle D is $60^\circ$ .<br><b>Is CD the hypotenuse?</b>  |
| 11<br>In triangle FGH, angle F is $90^\circ$ and angle G is $30^\circ$ .<br><b>Is FG the hypotenuse?</b>  | 12<br>In triangle JKL, angle J is $60^\circ$ and angle K is $30^\circ$ .<br><b>Is JK the shorter leg?</b> | 13<br>In triangle MNP, angle M is $90^\circ$ and angle N is $60^\circ$ .<br><b>Is MN the longer leg?</b>  | 14<br>In triangle QRS, angle Q is $30^\circ$ and angle S is $90^\circ$ .<br><b>Is QS the longer leg?</b>  | 15<br>In triangle TUV, angle T is $60^\circ$ and angle V is $90^\circ$ .<br><b>Is UV the hypotenuse?</b>  |
| 16<br>In triangle ABD, angle A is $60^\circ$ and angle D is $90^\circ$ .<br><b>Is AB the shorter leg?</b> | 17<br>In triangle EFG, angle E is $30^\circ$ and angle G is $90^\circ$ .<br><b>Is EG the hypotenuse?</b>  | 18<br>In triangle HJK, angle H is $90^\circ$ and angle J is $30^\circ$ .<br><b>Is HJ the longer leg?</b>  | 19<br>In triangle LMN, angle L is $30^\circ$ and angle M is $60^\circ$ .<br><b>Is LN the shorter leg?</b> | 20<br>In triangle PRS, angle R is $90^\circ$ and angle S is $60^\circ$ .<br><b>Is PS the shorter leg?</b> |
| 21<br>In triangle TVW, angle T is $30^\circ$ and angle W is $90^\circ$ .<br><b>Is VW the hypotenuse?</b>  | 22<br>In triangle BCF, angle B is $60^\circ$ and angle C is $90^\circ$ .<br><b>Is BC the shorter leg?</b> | 23<br>In triangle DGH, angle D is $90^\circ$ and angle H is $30^\circ$ .<br><b>Is DH the shorter leg?</b> | 24<br>In triangle JLM, angle J is $30^\circ$ and angle M is $60^\circ$ .<br><b>Is JM the longer leg?</b>  | 25<br>In triangle KNP, angle N is $30^\circ$ and angle P is $90^\circ$ .<br><b>Is KN the longer leg?</b>  |

1. **Give each student page 3** and a pencil.
2. **Say this once:** *“Each square names a triangle and two of its angles. The shorter leg is across from the  $30^\circ$  angle. The longer leg is across from the  $60^\circ$  angle. The hypotenuse is across from the right angle. If the answer to the question is 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 sides named on a triangle.  
**Answers**            pages 4–5, for you.

**No square has a drawing.** Each square describes the triangle in words, so the student has to use the angles: the side across from the  $30^\circ$  angle is the shorter leg, wherever it stands.

**In fourteen squares the angle across from the side is not printed.** The student first finds the third angle: the three angles add to  $180^\circ$ . Then the side across from it can be named.

**Each white square tests a common mistake.** Some ask whether the leg that touches the  $30^\circ$  angle is the shorter leg. It is not: the shorter leg is across from the  $30^\circ$  angle. Some call the side across from the  $60^\circ$  angle the shorter leg, or call a leg the hypotenuse. Ten squares are filled.

If part of a student’s picture looks wrong, the mistake is in that square. Ask: *“Which angle is across from that side? How big is it?”* Guessing does not work. Every simple guessing rule, such as filling every square that asks about the shorter leg, gets at least nine 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.

**chooseyourlesson.com** — 135 free geometry lessons.

# Mystery Picture — which side is it?

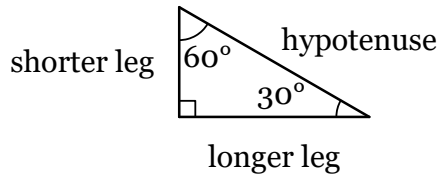
30-60-90 triangles

Name \_\_\_\_\_

Period \_\_\_\_\_

Date \_\_\_\_\_

Each square names a triangle and two of its angles. Use the angle across from the side. If you need the third angle, the three angles add to  $180^\circ$ . **If the answer is 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.



**Find the shorter leg first.** It is across from the  $30^\circ$  angle.  
 $\text{longer leg} = \text{shorter leg} \times \sqrt{3}$     $\text{hypotenuse} = \text{shorter leg} \times 2$   
 $\sqrt{3} \approx 1.73$ , so the longer leg is shorter than the hypotenuse.

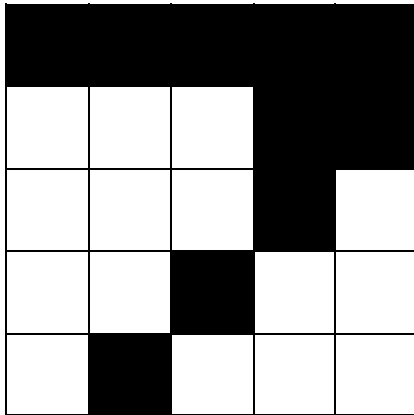
|                                                                                                           |                                                                                                           |                                                                                                           |                                                                                                           |                                                                                                           |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| 1<br>In triangle ABC, angle A is $30^\circ$ and angle C is $90^\circ$ .<br><b>Is BC the shorter leg?</b>  | 2<br>In triangle DEF, angle D is $60^\circ$ and angle F is $90^\circ$ .<br><b>Is EF the longer leg?</b>   | 3<br>In triangle GHJ, angle G is $30^\circ$ and angle H is $60^\circ$ .<br><b>Is GH the hypotenuse?</b>   | 4<br>In triangle KLM, angle L is $90^\circ$ and angle M is $30^\circ$ .<br><b>Is KL the shorter leg?</b>  | 5<br>In triangle PQR, angle P is $90^\circ$ and angle Q is $60^\circ$ .<br><b>Is PQ the shorter leg?</b>  |
| 6<br>In triangle STU, angle S is $30^\circ$ and angle U is $90^\circ$ .<br><b>Is SU the shorter leg?</b>  | 7<br>In triangle VWZ, angle V is $60^\circ$ and angle Z is $90^\circ$ .<br><b>Is VZ the longer leg?</b>   | 8<br>In triangle NPQ, angle N is $30^\circ$ and angle Q is $90^\circ$ .<br><b>Is NP the shorter leg?</b>  | 9<br>In triangle RST, angle R is $90^\circ$ and angle T is $60^\circ$ .<br><b>Is RS the longer leg?</b>   | 10<br>In triangle CDE, angle C is $30^\circ$ and angle D is $60^\circ$ .<br><b>Is CD the hypotenuse?</b>  |
| 11<br>In triangle FGH, angle F is $90^\circ$ and angle G is $30^\circ$ .<br><b>Is FG the hypotenuse?</b>  | 12<br>In triangle JKL, angle J is $60^\circ$ and angle K is $30^\circ$ .<br><b>Is JK the shorter leg?</b> | 13<br>In triangle MNP, angle M is $90^\circ$ and angle N is $60^\circ$ .<br><b>Is MN the longer leg?</b>  | 14<br>In triangle QRS, angle Q is $30^\circ$ and angle S is $90^\circ$ .<br><b>Is QS the longer leg?</b>  | 15<br>In triangle TUV, angle T is $60^\circ$ and angle V is $90^\circ$ .<br><b>Is UV the hypotenuse?</b>  |
| 16<br>In triangle ABD, angle A is $60^\circ$ and angle D is $90^\circ$ .<br><b>Is AB the shorter leg?</b> | 17<br>In triangle EFG, angle E is $30^\circ$ and angle G is $90^\circ$ .<br><b>Is EG the hypotenuse?</b>  | 18<br>In triangle HJK, angle H is $90^\circ$ and angle J is $30^\circ$ .<br><b>Is HJ the longer leg?</b>  | 19<br>In triangle LMN, angle L is $30^\circ$ and angle M is $60^\circ$ .<br><b>Is LN the shorter leg?</b> | 20<br>In triangle PRS, angle R is $90^\circ$ and angle S is $60^\circ$ .<br><b>Is PS the shorter leg?</b> |
| 21<br>In triangle TVW, angle T is $30^\circ$ and angle W is $90^\circ$ .<br><b>Is VW the hypotenuse?</b>  | 22<br>In triangle BCF, angle B is $60^\circ$ and angle C is $90^\circ$ .<br><b>Is BC the shorter leg?</b> | 23<br>In triangle DGH, angle D is $90^\circ$ and angle H is $30^\circ$ .<br><b>Is DH the shorter leg?</b> | 24<br>In triangle JLM, angle J is $30^\circ$ and angle M is $60^\circ$ .<br><b>Is JM the longer leg?</b>  | 25<br>In triangle KNP, angle N is $30^\circ$ and angle P is $90^\circ$ .<br><b>Is KN the longer leg?</b>  |



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# Mystery Picture — answers

For the teacher



The finished picture is **the number 7**. Ten squares are filled.

To check a square, find the angle across from the side named.  $30^\circ$  makes it the shorter leg,  $60^\circ$  the longer leg, and  $90^\circ$  the hypotenuse. The table gives the reason for every square. It goes on over the page.

|    | The square                                                                                | Answer | Why                                                                                                                                                                                                                    |
|----|-------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | In triangle ABC, angle A is $30^\circ$ and angle C is $90^\circ$ . Is BC the shorter leg? | fill   | BC is across from the $30^\circ$ angle at A, so it is the shorter leg.                                                                                                                                                 |
| 2  | In triangle DEF, angle D is $60^\circ$ and angle F is $90^\circ$ . Is EF the longer leg?  | fill   | EF is across from the $60^\circ$ angle at D, so it is the longer leg.                                                                                                                                                  |
| 3  | In triangle GHJ, angle G is $30^\circ$ and angle H is $60^\circ$ . Is GH the hypotenuse?  | fill   | The third angle, at J, is $180^\circ - 30^\circ - 60^\circ = 90^\circ$ . GH is across from the $90^\circ$ angle at J, so it is the hypotenuse.                                                                         |
| 4  | In triangle KLM, angle L is $90^\circ$ and angle M is $30^\circ$ . Is KL the shorter leg? | fill   | KL is across from the $30^\circ$ angle at M, so it is the shorter leg.                                                                                                                                                 |
| 5  | In triangle PQR, angle P is $90^\circ$ and angle Q is $60^\circ$ . Is PQ the shorter leg? | fill   | The third angle, at R, is $180^\circ - 90^\circ - 60^\circ = 30^\circ$ . PQ is across from the $30^\circ$ angle at R, so it is the shorter leg.                                                                        |
| 6  | In triangle STU, angle S is $30^\circ$ and angle U is $90^\circ$ . Is SU the shorter leg? | white  | The third angle, at T, is $180^\circ - 30^\circ - 90^\circ = 60^\circ$ . SU is across from the $60^\circ$ angle at T, so it is the longer leg. It touches the $30^\circ$ angle, but the shorter leg is across from it. |
| 7  | In triangle VWZ, angle V is $60^\circ$ and angle Z is $90^\circ$ . Is VZ the longer leg?  | white  | The third angle, at W, is $180^\circ - 60^\circ - 90^\circ = 30^\circ$ . VZ is across from the $30^\circ$ angle at W, so it is the shorter leg.                                                                        |
| 8  | In triangle NPQ, angle N is $30^\circ$ and angle Q is $90^\circ$ . Is NP the shorter leg? | white  | NP is across from the $90^\circ$ angle at Q, so it is the hypotenuse. It touches the $30^\circ$ angle, but the shorter leg is across from it.                                                                          |
| 9  | In triangle RST, angle R is $90^\circ$ and angle T is $60^\circ$ . Is RS the longer leg?  | fill   | RS is across from the $60^\circ$ angle at T, so it is the longer leg.                                                                                                                                                  |
| 10 | In triangle CDE, angle C is $30^\circ$ and angle D is $60^\circ$ . Is CD the hypotenuse?  | fill   | The third angle, at E, is $180^\circ - 30^\circ - 60^\circ = 90^\circ$ . CD is across from the $90^\circ$ angle at E, so it is the hypotenuse.                                                                         |
| 11 | In triangle FGH, angle F is $90^\circ$ and angle G is $30^\circ$ . Is FG the hypotenuse?  | white  | The third angle, at H, is $180^\circ - 90^\circ - 30^\circ = 60^\circ$ . FG is across from the $60^\circ$ angle at H, so it is the longer leg. The hypotenuse is across from the right angle.                          |
| 12 | In triangle JKL, angle J is $60^\circ$ and angle K is $30^\circ$ . Is JK the shorter leg? | white  | The third angle, at L, is $180^\circ - 60^\circ - 30^\circ = 90^\circ$ . JK is across from the $90^\circ$ angle at L, so it is the hypotenuse. It touches the $30^\circ$ angle, but the shorter leg is across from it. |

# Mystery Picture — answers, squares 13 to 25

For the teacher

|    | The square                                                                                | Answer | Why                                                                                                                                                                                                                    |
|----|-------------------------------------------------------------------------------------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | In triangle MNP, angle M is $90^\circ$ and angle N is $60^\circ$ . Is MN the longer leg?  | white  | The third angle, at P, is $180^\circ - 90^\circ - 60^\circ = 30^\circ$ . MN is across from the $30^\circ$ angle at P, so it is the shorter leg.                                                                        |
| 14 | In triangle QRS, angle Q is $30^\circ$ and angle S is $90^\circ$ . Is QS the longer leg?  | fill   | The third angle, at R, is $180^\circ - 30^\circ - 90^\circ = 60^\circ$ . QS is across from the $60^\circ$ angle at R, so it is the longer leg.                                                                         |
| 15 | In triangle TUV, angle T is $60^\circ$ and angle V is $90^\circ$ . Is UV the hypotenuse?  | white  | UV is across from the $60^\circ$ angle at T, so it is the longer leg. The hypotenuse is across from the right angle.                                                                                                   |
| 16 | In triangle ABD, angle A is $60^\circ$ and angle D is $90^\circ$ . Is AB the shorter leg? | white  | AB is across from the $90^\circ$ angle at D, so it is the hypotenuse. It is across from the right angle, so it is not a leg.                                                                                           |
| 17 | In triangle EFG, angle E is $30^\circ$ and angle G is $90^\circ$ . Is EG the hypotenuse?  | white  | The third angle, at F, is $180^\circ - 30^\circ - 90^\circ = 60^\circ$ . EG is across from the $60^\circ$ angle at F, so it is the longer leg. The hypotenuse is across from the right angle.                          |
| 18 | In triangle HJK, angle H is $90^\circ$ and angle J is $30^\circ$ . Is HJ the longer leg?  | fill   | The third angle, at K, is $180^\circ - 90^\circ - 30^\circ = 60^\circ$ . HJ is across from the $60^\circ$ angle at K, so it is the longer leg.                                                                         |
| 19 | In triangle LMN, angle L is $30^\circ$ and angle M is $60^\circ$ . Is LN the shorter leg? | white  | LN is across from the $60^\circ$ angle at M, so it is the longer leg. It touches the $30^\circ$ angle, but the shorter leg is across from it.                                                                          |
| 20 | In triangle PRS, angle R is $90^\circ$ and angle S is $60^\circ$ . Is PS the shorter leg? | white  | PS is across from the $90^\circ$ angle at R, so it is the hypotenuse. It is across from the right angle, so it is not a leg.                                                                                           |
| 21 | In triangle TVW, angle T is $30^\circ$ and angle W is $90^\circ$ . Is VW the hypotenuse?  | white  | VW is across from the $30^\circ$ angle at T, so it is the shorter leg. The hypotenuse is across from the right angle.                                                                                                  |
| 22 | In triangle BCF, angle B is $60^\circ$ and angle C is $90^\circ$ . Is BC the shorter leg? | fill   | The third angle, at F, is $180^\circ - 60^\circ - 90^\circ = 30^\circ$ . BC is across from the $30^\circ$ angle at F, so it is the shorter leg.                                                                        |
| 23 | In triangle DGH, angle D is $90^\circ$ and angle H is $30^\circ$ . Is DH the shorter leg? | white  | The third angle, at G, is $180^\circ - 90^\circ - 30^\circ = 60^\circ$ . DH is across from the $60^\circ$ angle at G, so it is the longer leg. It touches the $30^\circ$ angle, but the shorter leg is across from it. |
| 24 | In triangle JLM, angle J is $30^\circ$ and angle M is $60^\circ$ . Is JM the longer leg?  | white  | The third angle, at L, is $180^\circ - 30^\circ - 60^\circ = 90^\circ$ . JM is across from the $90^\circ$ angle at L, so it is the hypotenuse. It is across from the right angle, so it is not a leg.                  |
| 25 | In triangle KNP, angle N is $30^\circ$ and angle P is $90^\circ$ . Is KN the longer leg?  | white  | KN is across from the $90^\circ$ angle at P, so it is the hypotenuse. It is across from the right angle, so it is not a leg.                                                                                           |