

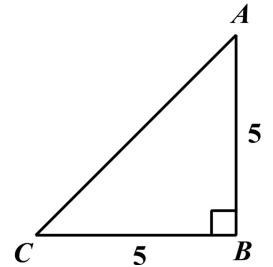
THE SPECIAL RIGHT TRIANGLES
N-GEN MATH® GEOMETRY



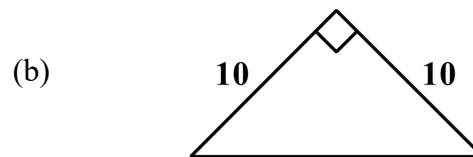
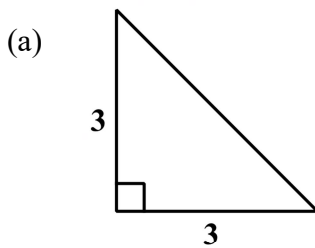
There are two right triangles that arise frequently enough that they require specific study. We begin first with an *isosceles right triangle*, also known as a *45-45* right triangle.

Exercise #1: An isosceles right triangle is shown below whose legs have lengths of 5.

- (a) Why must the two acute angles both have measures of 45° ?
- (b) Use the Pythagorean Theorem to determine the length of the hypotenuse in simplest radical form.

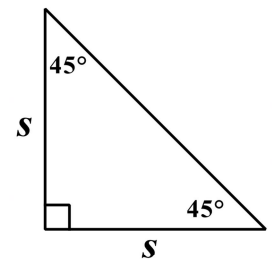


Exercise #2: For each 45–45 right triangle shown below, determine the length of its hypotenuse in simplest radical form.



Exercise #3: Given the 45–45 right triangle shown with legs of length of s , do the following:

- (a) Using the Pythagorean Theorem, show that the hypotenuse must be equal to $s\sqrt{2}$.
- (b) Using (a), state the value of both the sine and cosine of 45° .
Verify with your calculator.



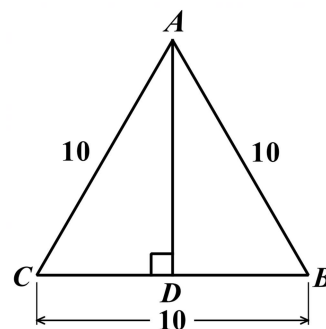
Exercise #4: A square has a perimeter equal to 32 cm. What is the length of its diagonal in centimeters?



Our second special right triangle comes from examining the properties of an **equilateral triangle**.

Exercise #5: Equilateral triangle ABC is shown with sides of length 10. The altitude from A to \overline{BC} has been drawn, forming congruent right triangles ACD and ABD . It is these triangles we want to examine.

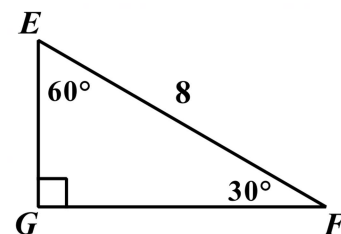
- Sketch $\triangle ACD$ to the right and fill in the measures of its angles.
- What must be the length of \overline{CD} ? Label on the diagram.
- Use the Pythagorean Theorem to find the length of \overline{AD} . Label it as well on the diagram.



In the diagram above, the two right triangles are known as 30-60 right triangles because of their angle measures.

Exercise #6: For the 30-60 right triangle EFG shown below, do the following:

- Which leg length is equal to 4? Fill it in on the diagram.
- Use the Pythagorean Theorem to find the length of the other leg. Compare your answer to your results from *Exercise #5* to see a pattern.

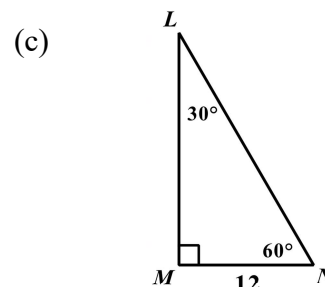
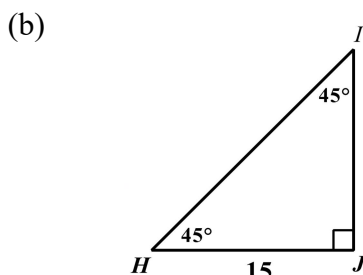
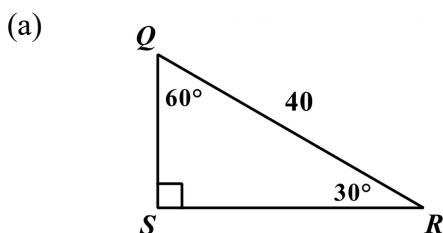


Special Right Triangle Patterns

1. The 45-45 Right Triangle

2. The 30-60 Right Triangle

Exercise #7: Fill in the missing sides of each right triangle shown below.

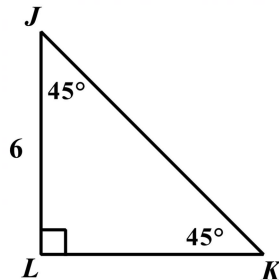


THE SPECIAL RIGHT TRIANGLES
N-GEN MATH[®] GEOMETRY HOMEWORK

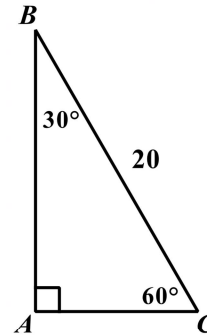
FLUENCY

1. For each special right triangle shown below, fill in the lengths of each missing side using the patterns developed in the lesson for 45-45 and 30-60 right triangles.

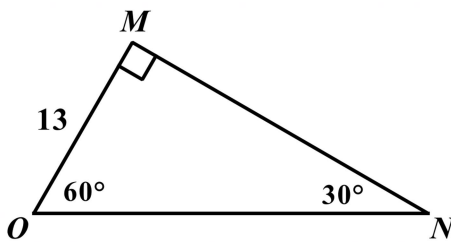
(a)



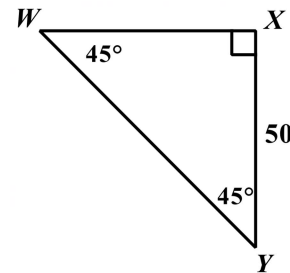
(b)



(c)



(d)



2. In $\triangle EFG$, $\overline{EF} \perp \overline{FG}$ and $m\angle G = 45^\circ$. If $FG = 10$, then which of the following is the length of \overline{EG} ?

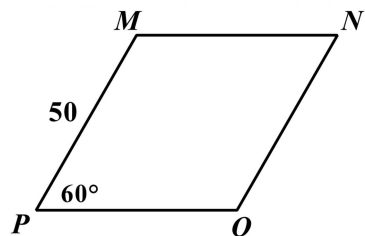
- (1) 5
 (2) $5\sqrt{3}$
 (3) 10
 (4) $10\sqrt{2}$

3. In $\triangle ABC$, $m\angle A = 90^\circ$ and $m\angle C = 60^\circ$. If $AB = 12\sqrt{3}$, then which of the following is the length of \overline{AC} ?

- (1) 6
 (2) 12
 (3) 24
 (4) $24\sqrt{3}$

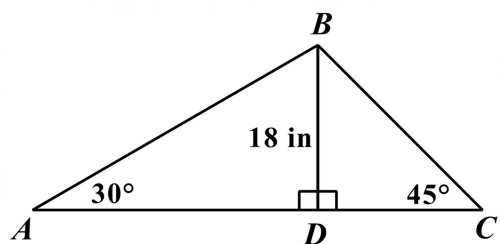


4. In a 30-60 right triangle, the hypotenuse has a length of 50 inches. Which of the following is closest to the perimeter of this triangle, in inches?
- (1) 118
 (2) 125
 (3) 131
 (4) 138 _____
5. A square has an area of 64 square inches. Which of the following is the length of its diagonal, to the nearest hundredth?
- (1) 10.34
 (2) 10.98
 (3) 11.31
 (4) 11.56 _____
6. In rhombus $MNOP$ shown below, $MP = 50$ and $m\angle P = 60^\circ$. What is the length of the longer diagonal of $MNOP$ in exact form? Show or explain how you arrived at your answer.



APPLICATIONS

7. Dea is designing a structure shown below for the roof of her shed. She plans to use wood for all the line segments shown. She knows she wants the structure to have a height of 18 inches as shown. If there is no waste, would a 10-foot-long board be enough to make the structure? Justify your answer with appropriate calculations.

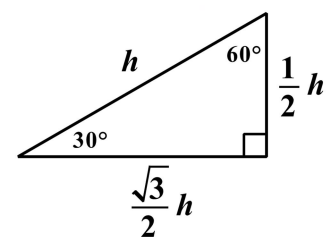


REASONING

8. The general pattern for a 30-60 right triangle is shown to the right.
- (a) State the exact values for each of the following:

$$\cos(30^\circ) =$$

$$\sin(30^\circ) =$$



- (b) Verify these using your calculator.

