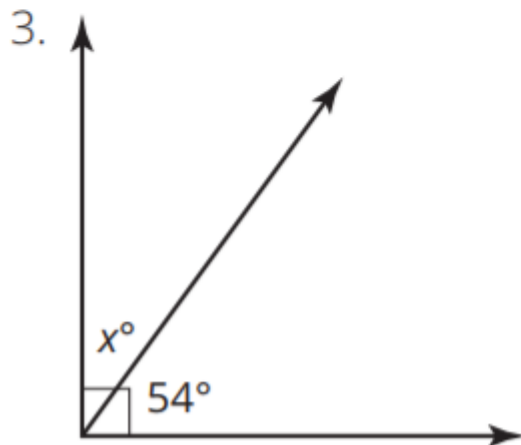
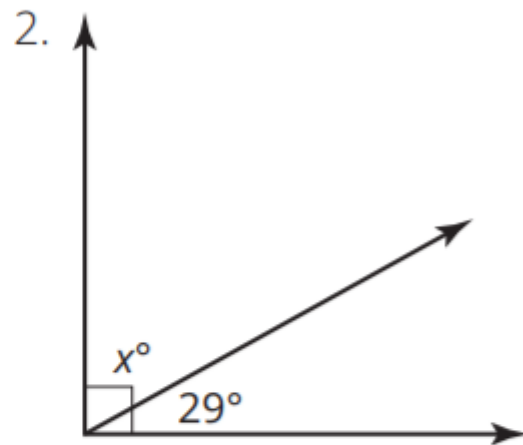
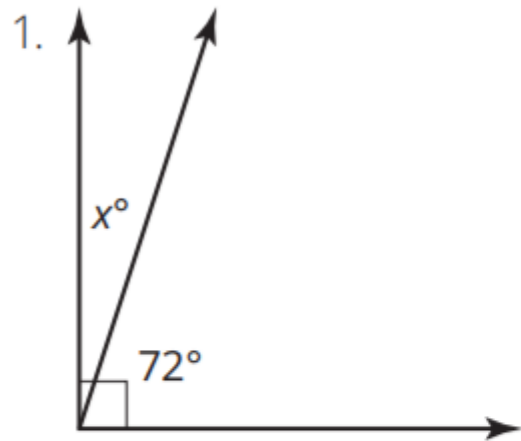
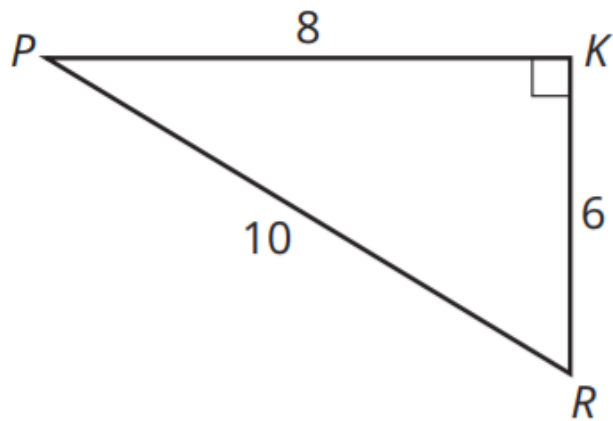


Warm Up

M2-187

Solve for each unknown angle measure.





Angle ABC and angle DEF are complementary angles. The two acute angles in a right triangle are always complementary angles. Consider $\triangle PKR$.

4. Explain how you know that $\angle P$ and $\angle R$ are complementary angles.

5. Write a ratio that represents $\sin \angle P$.

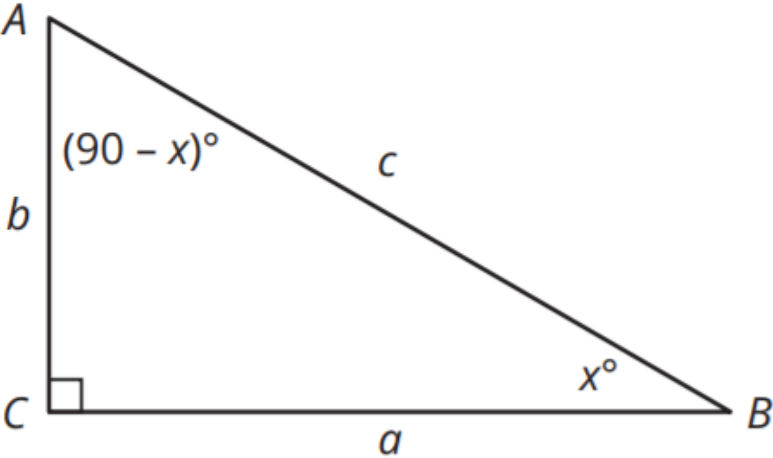
$$\frac{3}{5}$$

6. Write a ratio that represents $\cos \angle R$.

$$\frac{3}{5}$$

7. What do you notice about the ratios representing $\sin \angle P$ and $\cos \angle R$? **They are the same**

8. How does the ratio representing $\cos \angle P$ compare to the ratio representing the $\sin \angle R$? **They are the same**

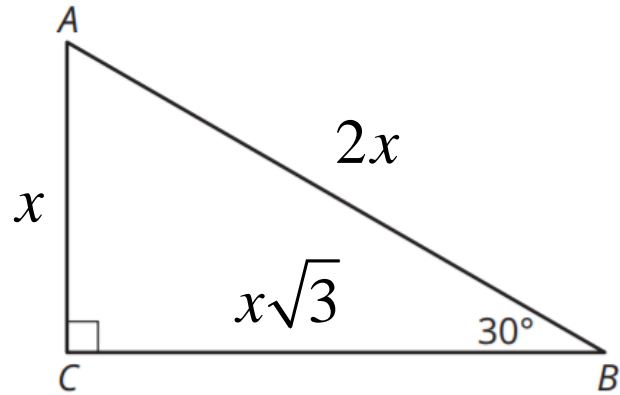


1. Use $\triangle ABC$ to complete the table.

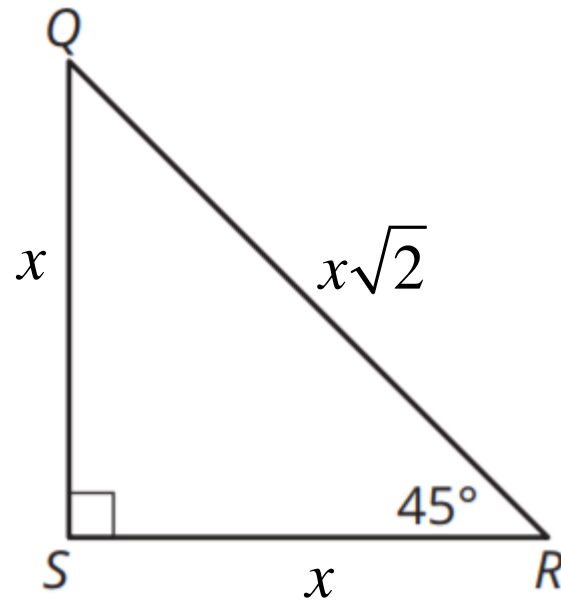
Reference Angle	sin	cos	tan	csc	sec	cot
A	$\frac{a}{c}$	$\frac{b}{c}$	$\frac{a}{b}$	$\frac{c}{a}$	$\frac{c}{b}$	$\frac{b}{a}$
B	$\frac{b}{c}$	$\frac{a}{c}$	$\frac{b}{a}$	$\frac{c}{b}$	$\frac{c}{a}$	$\frac{a}{b}$

1. Use the complementary angle relationships, your knowledge of the side relationships of special right triangles, and the Pythagorean Theorem to complete the chart with the numeric ratios for each triangle.

M2-191



Reference Angle	sin	cos	tan	csc	sec	cot
30°	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$	2	$\frac{2\sqrt{3}}{3}$	$\sqrt{3}$
60°	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	$\frac{2\sqrt{3}}{3}$	2	$\frac{\sqrt{3}}{3}$



Reference Angle	sin	cos	tan	csc	sec	cot
45°	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1	$\sqrt{2}$	$\sqrt{2}$	1

1. At an altitude of 1000 feet, a balloonist measures the angle of **depression** from the balloon to the landing zone. The measure of that angle is 15° . How far is the balloon from the landing zone?

M2-193

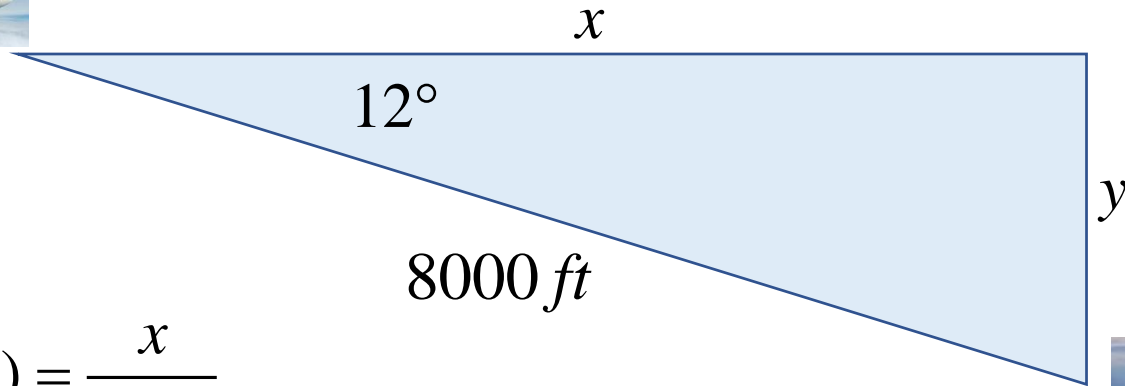


$$\sin(15^\circ) = \frac{1000}{x}$$
$$x = \frac{1000}{\sin(15^\circ)} \approx 3864 \text{ ft}$$



An angle of depression is an angle below horizontal.

2. An aircraft uses radar to spot another aircraft 8000 feet away at a 12° angle of depression. Sketch the situation and determine the vertical and horizontal separation between the two aircraft.



An angle of depression is an angle below horizontal.

$$\cos(12^\circ) = \frac{x}{8000}$$

$$8000 \cos(12^\circ) = x$$

$$x \approx 7825 \text{ ft}$$



$$\sin(12^\circ) = \frac{y}{8000}$$

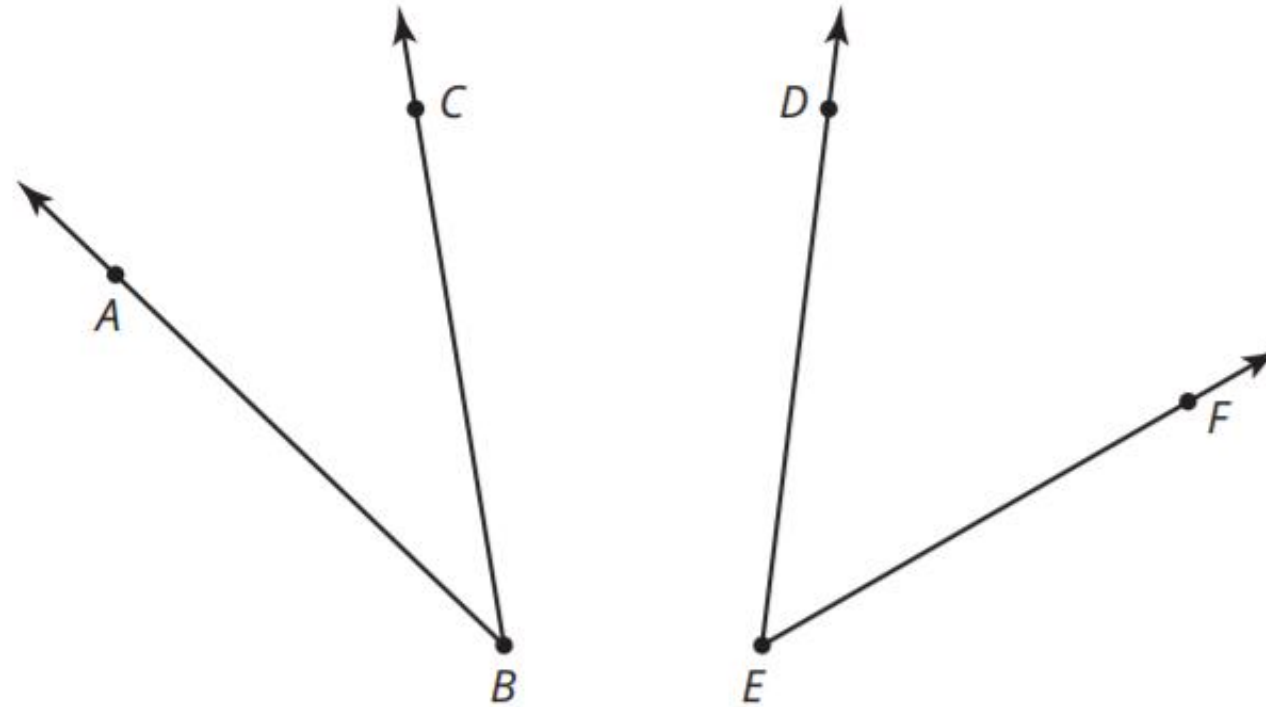
$$8000 \sin(12^\circ) = y$$

$$y \approx 1663 \text{ ft}$$

Angles Can Be Very Complementary!

M2-188

Consider $\angle ABC$ and $\angle DEF$.



1. Use a **protractor** to determine the measure of each angle.

2. Trace $\angle ABC$ on a sheet of patty paper. Align \overline{BC} and \overline{ED} and then trace the ray from point B to point F on your patty paper to create $\angle ABF$.

3. What type of angle is $\angle ABF$? Justify your answer.