7.5-7.6 Trig Ratios
Pre-AP Geometry

Name _____
Period _____ Date _____

ENGAGE

In order to complete this activity, some vocabulary specific to triangles must be introduced. All triangles have three sides. In right triangles, as you know, the side directly across from the 90° angle, side AB, is called the hypotenuse. If you are asked to find the side opposite the ∠A, you look for the side directly across from the 35° angle, which is BC (see Fig. 24). The side adjacent to ∠A is the third side, AC, the one that's touching the 35° angle (but is not the hypotenuse).

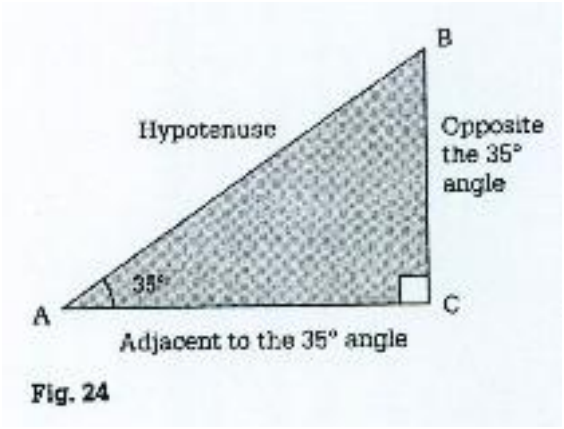
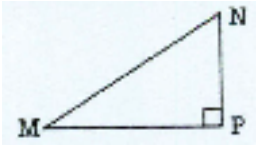


Fig. 24

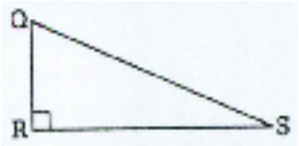
Of course, opposite and adjacent are relative terms. In the exact same diagram above, if you are asked to find the side opposite ∠B, the answer is now side AC, because AC is across from ∠B. The side adjacent to ∠B becomes side BC, but the hypotenuse stays side AB because it is still across from the right angle.

Remember:
Opposite *means the side directly across from the angle*
Adjacent *means the side next to the angle that's not the hypotenuse*

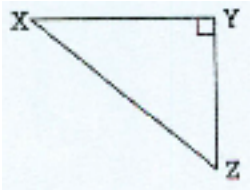
EXERCISES:
Working with a partner, determine which side or relationship is being asked for.



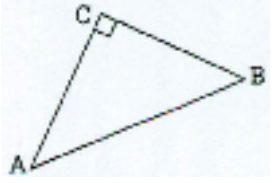
1. a) Which side is *opposite* ∠M? _____
   b) Which side is the *hypotenuse*? _____
   c) Which side is *adjacent* to ∠N? _____



2. a) Which side is *opposite* ∠Q? _____
   b) Which side is *adjacent* to ∠Q? _____
   c) Which side is the *hypotenuse*? _____



3. a) $\overline{YZ}$ is _____ ∠Z
   b) $\overline{XY}$ is _____ ∠X



4. a) $\overline{CB}$ is _____ ∠A
   b) $\overline{CB}$ is _____ ∠B

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EXPLORE/EXPLAIN

Working with your partner, measure each side of the right triangles (using centimeters) in Fig. 25 and record the lengths of the sides.
Be as accurate as you can.

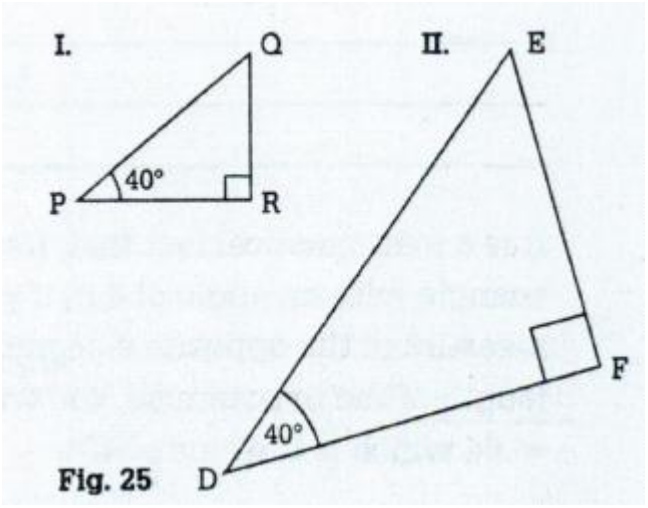


Fig. 25

In ΔPQR:

PQ = _____

QR = _____

PR = _____

In ΔDEF:

DE = _____

EF = _____

DF = _____

Now calculate the following ratios for the **triangle PQR** (round your decimal three places).

		Fill in the letters of the sides		Fill in the lengths of the sides		Use calculator to get a decimal
$\frac{\text{side opposite } 40^\circ\angle}{\text{hypotenuse}}$	=	$\frac{\text{side}\_\_\_\_}{\text{side}}$	=	_____	=	_____
$\frac{\text{side adjacent } 40^\circ\angle}{\text{hypotenuse}}$	=	$\frac{\text{side}\_\_\_\_}{\text{side}}$	=	_____	=	_____
$\frac{\text{side opposite } 40^\circ\angle}{\text{side adjacent } 40^\circ\angle}$	=	$\frac{\text{side}\_\_\_\_}{\text{side}}$	=	_____	=	_____

Do the same thing for **triangle DEF**.

		Fill in the letters of the sides		Fill in the lengths of the sides		Use calculator to get a decimal
$\frac{\text{side opposite } 40^\circ\angle}{\text{hypotenuse}}$	=	$\frac{\text{side}\_\_\_\_}{\text{side}}$	=	_____	=	_____
$\frac{\text{side adjacent } 40^\circ\angle}{\text{hypotenuse}}$	=	$\frac{\text{side}\_\_\_\_}{\text{side}}$	=	_____	=	_____
$\frac{\text{side opposite } 40^\circ\angle}{\text{side adjacent } 40^\circ\angle}$	=	$\frac{\text{side}\_\_\_\_}{\text{side}}$	=	_____	=	_____

Are the ratios in the Triangle PQR column pretty close to the ratios in the Triangle DEF column? (a little bit of round off error is to be expected). Take two minutes and discuss with your partner why you think this happened, then write your explanation here.

Using your calculator determine the values of sin 40°, cos 40°, and tan 40° (Always make sure the calculator is in DEGREE mode).

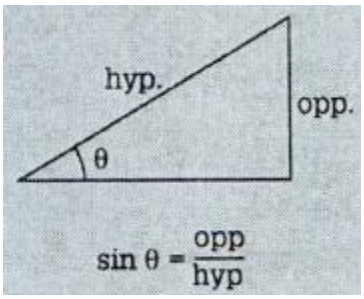
sin 40° = _____ cos 40° = _____ tan 40° = _____

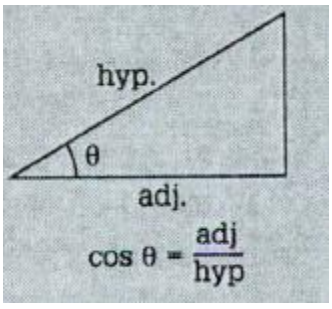
How do these values compare with those you obtained on the preceding page?

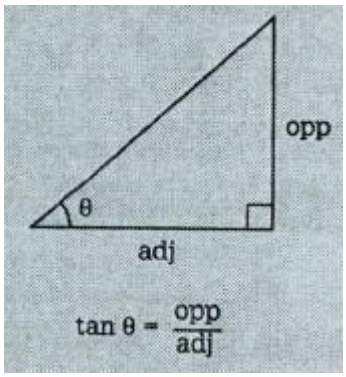
It is a mathematical fact that, for any right triangle with an angle of 40°, if you take the measure of the **opposite** side and divide by the length of the **hypotenuse** you will get $\approx .64$ which is the **sine** of 40°.
Also, for any right triangle with an angle of 40°, if you take the measure of the **adjacent** side and divide by the length of the **hypotenuse** you will get $\approx .77$ which is the **cosine** of 40°.
Similarly, for any right triangle with an angle of 40°, if you take the measure of the **opposite** side and divide by the measure of the **adjacent** side you will get $\approx .84$ which is the **tangent** of 40°.

Mathematical Definitions of Sine, Cosine and Tangent

sin = _____ cos = _____ tan = _____







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ELABORATE

The Rescue:
Prince Charming is planning to rescue the fair Rapunzel from the tower of her evil stepmother, the witch. Unfortunately, the witch has given Rapunzel a Mohawk, so Charming needs to bring a ladder to rescue her from the tower. It is 150 ft from the ground to the bottom of her window, and he plans on leaning the ladder up against the tower at a 70° angle so he won't fall over. How long of a ladder should he bring if he needs it to reach her windowsill?

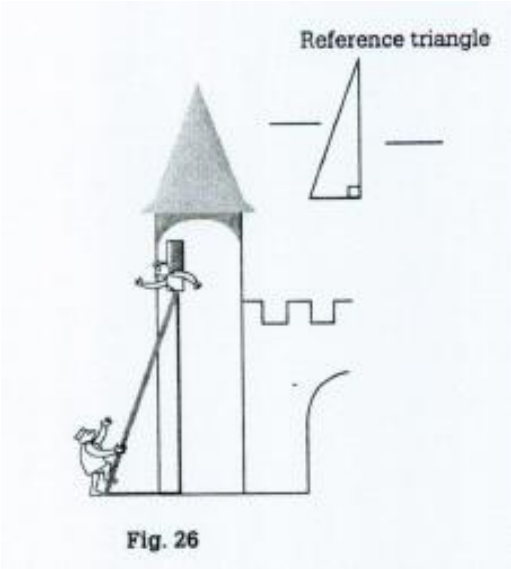
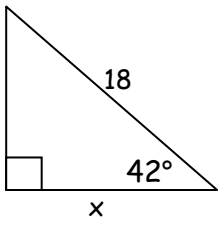


Fig. 26

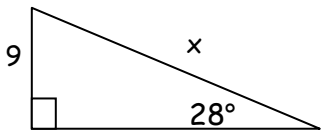
Exercises:
Discuss with a partner whether the triangles below require you to use **sin, cos,** or **tan**. Circle the response you agree on.

a)



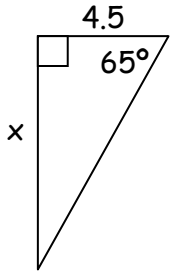
Sin
Cos
Tan

b)



Sin
Cos
Tan

c)



Sin
Cos
Tan

Using the same triangles and the trig ratios you selected, set up each equation and solve for the missing side, x.

a) b) c)