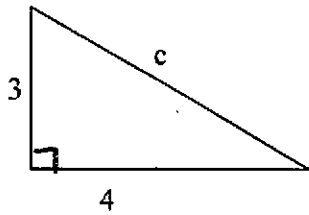


The Pythagorean Theorem:

For all right triangles: $a^2 + b^2 = c^2$ (where c is the hypotenuse)



$$a=3 \quad b=4 \quad c=?$$

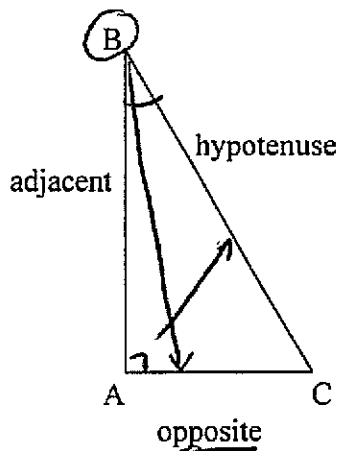
$$\begin{aligned} 3^2 + 4^2 &= c^2 \\ 9 + 16 &= c^2 \\ 25 &= c^2 \\ \sqrt{25} &= \sqrt{c^2} \\ 5 &= c \end{aligned}$$

Pythagorean Triples

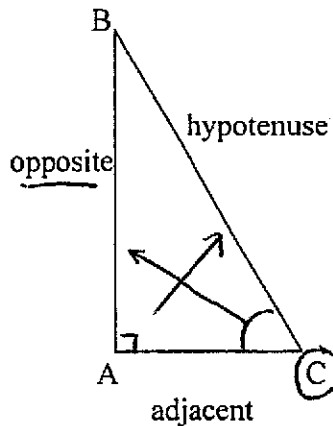
3,4,5
5,12,13
7,24,25
8,15,17
9,40,41

Right Triangle Trigonometry: SOH-CAH-TOA

SOH: $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$ CAH: $\cos = \frac{\text{adjacent}}{\text{hypotenuse}}$ TOA: $\tan = \frac{\text{opposite}}{\text{adjacent}}$



Based on angle B



Based on angle C

The hypotenuse is always the side opposite the right angle. The opposite and adjacent depend on which angle you are looking at.

opposite: The side directly across from the angle (does not touch the angle).

adjacent: (Next to) The side that touches the angle, but is not the hypotenuse.

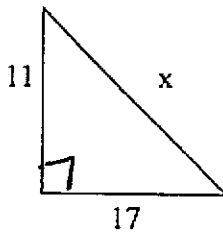
When deciding when to use the Pythagorean Theorem or Trigonometry, the rule of thumb is that if there is an angle involved in the problem, use the trigonometry. If you are dealing only with missing sides (no angles), use the Pythagorean Theorem.

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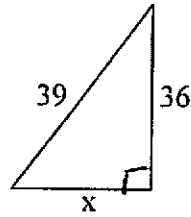
Intro to Trigonometry
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Use the Pythagorean Theorem to solve for the missing side:

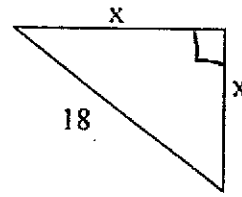
1)



2)

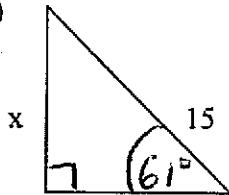


3)

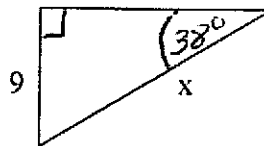


Use the SIN to find the missing side:

4)



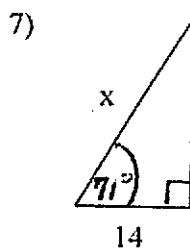
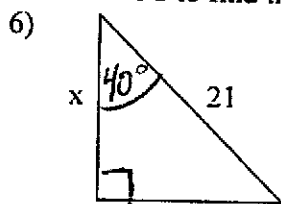
5)



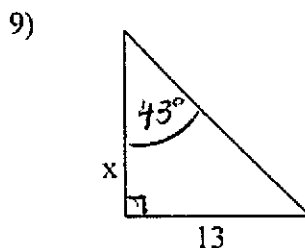
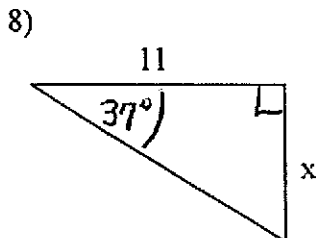
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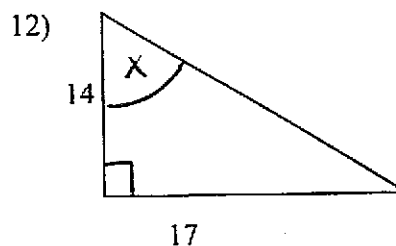
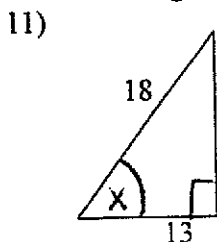
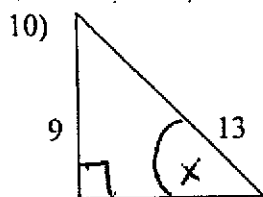
Use the COS to find the missing side:



Use the TAN to find the missing side:

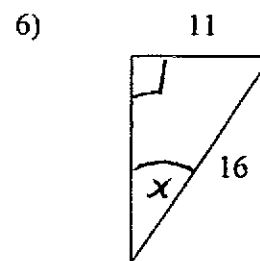
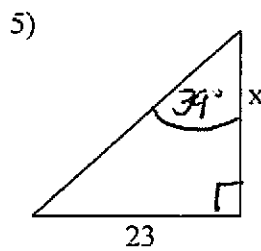
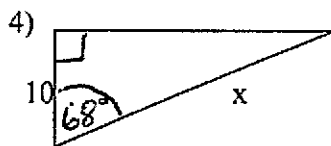
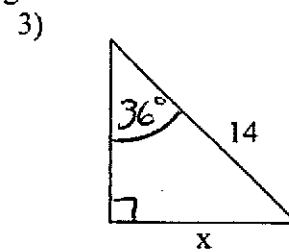
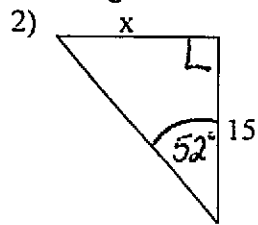
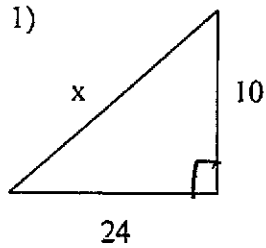


Use SIN, COS, and TAN to find the missing angle:



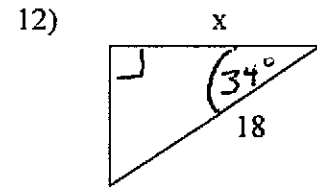
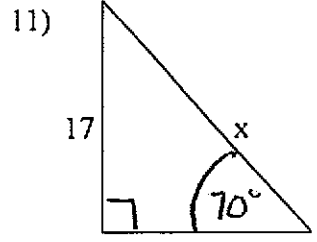
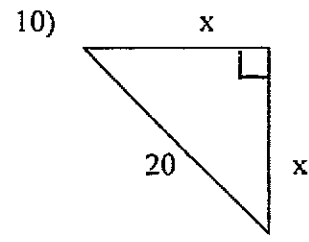
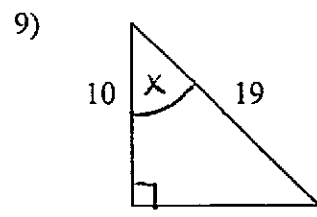
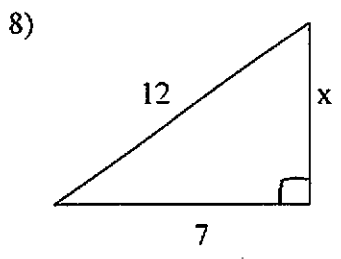
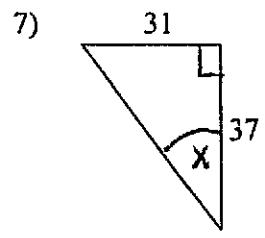
Mixed Problems: Find x (You will have to choose whether to use Pythagorean Theorem or trig.).

Round all sides to the nearest tenth and all angles to the nearest degree:



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1) A 25-foot ladder is leaning against a building. The base of the ladder is 7 feet away from the base of the building. How far up the building is the top of the ladder resting?

2) A bird is perched in a tree. It is 35 feet off the ground. It sees a piece of bread on the ground 15 feet from the base of the tree. How far will the bird have to fly to get the bread (round to the nearest hundredth)?

3) The dimensions of a rectangle are 12m and 4m. Find the length of the diagonal to the nearest tenth.

4) A boy is sitting on the floor flying a kite. He has 260 feet of string. If the kite is 195 feet high, find the angle of elevation.

1) A 25-foot ladder is leaning against a building. The base of the ladder is 7 feet away from the base of the building. How far up the building is the top of the ladder resting?

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3) The dimensions of a rectangle are 12m and 4m. Find the length of the diagonal to the nearest tenth.

4) A boy is sitting on the floor flying a kite. He has 260 feet of string. If the kite is 195 feet high, find the angle of elevation.

5) A ladder is leaning against a building. If the angle of depression is 58° and the base of the ladder is 9 feet from the base of the building, how long is the ladder?

6) A boy is sitting on the floor flying a kite. He has 450 feet of string. The angle of elevation is 64° . How high is the kite?

7) An apple tree casts a 23-foot shadow. If the angle of depression is 36° , how tall is the tree?

8) A bird is perched on top of a 22-foot oak tree. It sees a piece of bread on the ground, 45 feet from the base of the tree. How far will the bird have to fly to get the piece of bread?

9) A 15-foot ladder is leaning against a building. The base of the ladder is 4 feet away from the base of the building. Find the angle of elevation created by the ladder.

10) An eagle flies 16 miles north and then 12 miles west. How far is the bird from the starting point?

11) The area of a square is 100 cm^2 . Find the length of the square's diagonal.

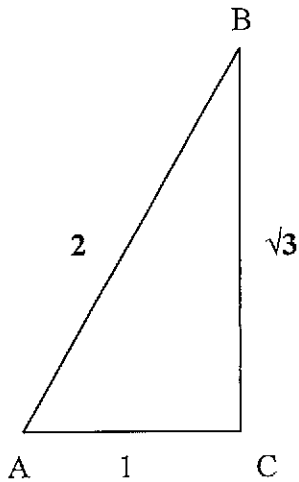
12) The diagonal of a square is $14\sqrt{2}$. Find the perimeter of the square.

Answer Key: 1) 24ft 2) 38.08 ft 3) 12.65m 4) 48.59°
 5) 16.98 ft 6) 404.46ft 7) 16.71 ft 8) 50.09 ft
 9) 74.53° 10) 20 miles 11) 14.14cm 12) side= 14 perimeter = 56

Special Right Triangles

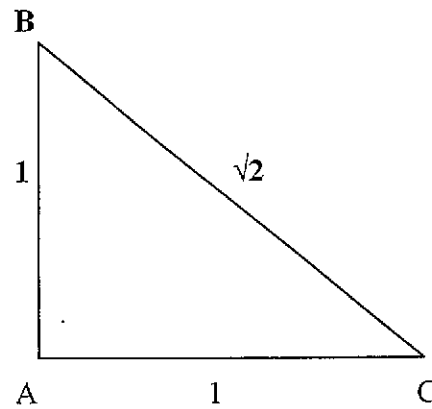
$30^\circ - 60^\circ - 90^\circ$

Angle A = 60° and Angle B = 30°



$45^\circ - 45^\circ - 90^\circ$

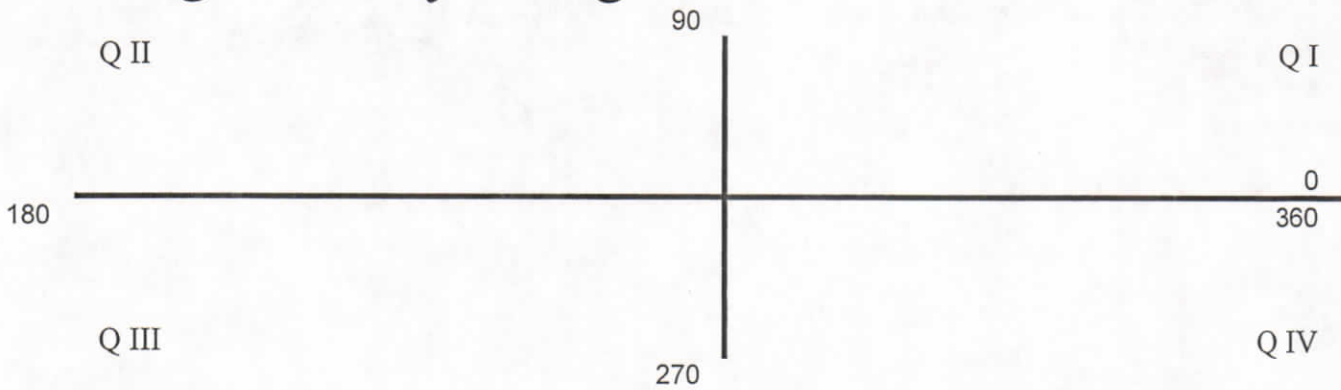
Angle B and Angle C both = 45°



	30	60
sin		
cos		
tan		

45

Trigonometry Using the Unit Circle:



We will use the diagram above to figure out what sign (positive or negative) the sin, cos, and tan are in each quadrant. Use the space below for notes:

Find the cos of 240°

Step 1: Find the reference angle:

240 is between 180 and 270 so it will be in the 3rd quadrant. So we will subtract 180 from 240.

$$240 - 180 = 60^\circ.$$

Step 2: Choosing the sign:

Choosing the sign (positive or negative) is strictly based on the quadrant. Since we are in the 3rd quadrant, we have to decide what sign the cosine is in the 3rd quadrant. Remember, "All Students Take Calculus" - the 3rd q is "Take". "T" for tangent is positive in the 3rd quadrant so cosine will be negative.

Step 3: Changing the problem reflecting your work in steps 1 and 2.

$\cos 240^\circ$ will change to $-\cos 60^\circ$ (60° comes from step 1 and the negative comes from step 2).

Step 4: Finish

$-\cos 60^\circ =$ Well, $\cos 60^\circ$ equals $\frac{1}{2}$, so $-\cos 60^\circ$ will be $-\frac{1}{2}$.

$$\cos 240^\circ = -\cos 60^\circ = -\frac{1}{2}$$

Examples:

1) $\sin 30^\circ =$

2) $\cos 60^\circ =$

3) $\tan 45^\circ =$

4) $\tan 120^\circ =$

5) $\cos 150^\circ =$

6) $\sin 135^\circ =$

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7) $\cos 225^\circ =$

8) $\tan 210^\circ =$

9) $\sin 240^\circ =$

10) $\sin 330^\circ =$

11) $\tan 300^\circ =$

12) $\cos 315^\circ =$

13) $\cos 300^\circ =$

14) $\tan 150^\circ =$

15) $\sin 210^\circ =$

16) $\sin 120^\circ =$

17) $\tan 225^\circ =$

18) $\cos 135^\circ =$

Solving $\cos x = -\sqrt{2}/2$

Step 1: Find the angle where the $\cos = \sqrt{2}/2$ **45°**

Step 2: Since it was $-\sqrt{2}/2$, you have to find in what two quadrants is the cosine negative. **II and III**

Step 3: Find the angle that gives you a reference angle of 45°. **135° and 225°**

1) $\tan x = 1$

2) $\sin x = -\frac{1}{2}$

3) $\cos x = -\frac{1}{2}$

4) $\sin x = \sqrt{2}/2$

5) $\tan x = -\sqrt{3}$

6) $\cos x = \sqrt{3}/2$

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7) $\cos x = -\sqrt{2} / 2$

8) $\sin x = -\sqrt{3} / 2$

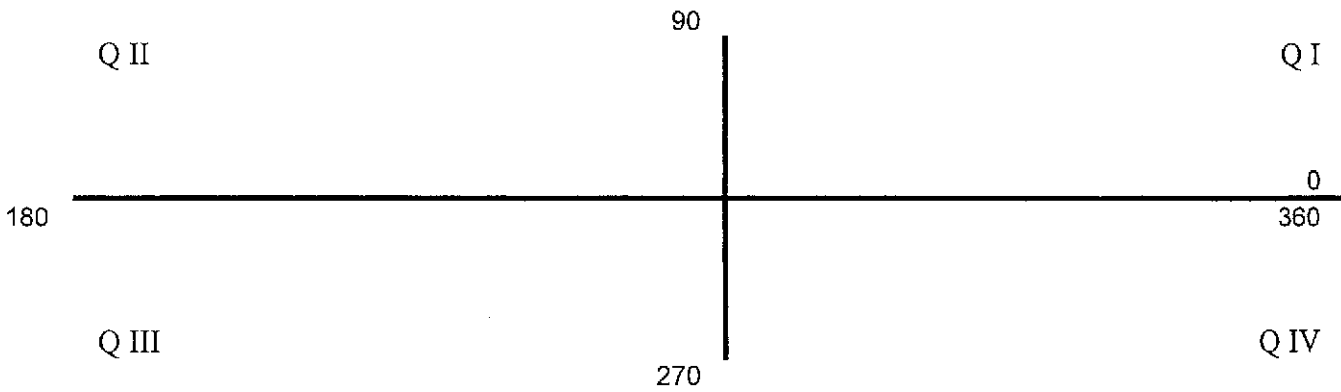
9) $\tan x = \sqrt{3} / 3$

10) $\tan x = -1$

11) $\sin x = \frac{1}{2}$

12) $\cos x = \frac{1}{2}$

	0	90	180	270	360
sin					
cos					
tan					



Angle
0°

90°

180°

270°

x =

x =

x =

x =

y =

y =

y =

y =

sin =

sin =

sin =

sin =

cos =

cos =

cos =

cos =

tan =

tan =

tan =

tan =

	30	60
sin		
cos		
tan		

45

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Do in NB or on LL:

Part I:

1) $\cos 180^\circ =$

2) $\tan x = -1$

3) $\sin 240^\circ =$

4) $\tan 150^\circ =$

5) $\sin x = -1$

6) $\cos x = -\frac{1}{2}$

7) $\cos 150^\circ =$

8) $\tan x = 0$

9) $\sin 180^\circ =$

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10) $\tan 240^\circ =$

11) $\sin x = -\frac{1}{2}$

12) $\cos x = 0$

13) $\cos 90^\circ =$

14) $\tan x = \text{undefined}$

15) $\sin x = 1$

16) $\cos 315^\circ =$

17) $\tan x = \frac{\sqrt{3}}{3}$

18) $\sin 315^\circ =$

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Part II:

1) $\cos 270^\circ =$

2) $\tan x = -\sqrt{3}$

3) $\sin 0^\circ =$

4) $\tan 90^\circ =$

5) $\sin x = \sqrt{3}/2$

6) $\cos x = -\sqrt{2}/2$

7) $\cos 300^\circ =$

8) $\tan x = 0$

9) $\sin 225^\circ =$

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10) $\tan 135^\circ =$

11) $\sin x = 1$

12) $\cos x = 1$

13) $\cos 0^\circ =$

14) $\tan x = \sqrt{3}/3$

15) $\sin 150^\circ =$

16) $\sin x = \sqrt{2}/2$

17) $\cos = -\sqrt{3}/2$

18) $\tan x = \text{undefined}$

	0	90	180	270
sin				
cos				
tan				

	30	60
sin		
cos		
tan		

45

Given the angle,
finding the exact value:

- 1) Find quadrant.
- 2) Find reference angle.
- 3) Choose sign (pos. or neg.)
*based on quadrant
- 4) Use chart.

Given the exact value:
finding the angle or angles:

- 1) Find reference angle (use chart)
- 2) Pick quadrants:
*based on sign (pos. or neg.)
- 3) Use quadrant rules to find the angle(s).

- When solving problems involving the quadrantal angles, there is much less work because there is no use of reference angles.

Solve:

1) $\tan 180^\circ =$

Solve:

3) $\sin x = -1$

2) $\cos 315^\circ =$

4) $\tan x = -\sqrt{3}$

What to do if the angle is greater than 360° :

Example: $\sin 480^\circ =$

First you must change the problem so the angle you are working with $0^\circ \leq \theta < 360^\circ$:

This can be done by subtracting 360 from the angle:

$$480 - 360 = 120 \quad \text{So, } \sin 480^\circ = \sin 120^\circ.$$

Follow the steps of finding the $\sin 120^\circ$.

QII: $180 - 120 = 60$ and \sin is positive in QII.

$$\sin 60^\circ = \sqrt{3}/2$$

$$\sin 480^\circ = \sqrt{3}/2$$

1) $\tan 690^\circ =$

2) $\sin 600^\circ =$

3) $\cos 855^\circ =$

What to do if the angle is stated as a negative angle:

Example: $\tan -225^\circ =$

First you must change the problem so its stated as an angle $0^\circ \leq \theta < 360^\circ$ (positive):

This can be done by adding 360 to the angle,

$$-225 + 360 = 135 \quad \text{So, } \tan -225^\circ = \tan 135^\circ$$

Follow the steps of finding $\tan 135^\circ$.

QII: $180 - 135 = 45$ and \tan is negative in QII

$$-\tan 45^\circ = -1$$

$$\tan -225^\circ = -1$$

1) $\cos -60^\circ =$

2) $\sin -210^\circ =$

3) $\tan -300^\circ =$

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1) $\sin 0^\circ =$

2) $\cos x = 0$

3) $\tan x = \text{undefined}$

4) $\tan -225^\circ =$

5) $\cos -180^\circ =$

6) $\sin x = -1$

7) $\cos 495^\circ =$

8) $\tan 180^\circ =$

9) $\sin x = 0$

10) $\sin 600^\circ =$

11) $\tan x = -\sqrt{3}/3$

12) $\cos -315^\circ =$

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13) $\sin 225^\circ =$

14) $\cos x = \frac{1}{2}$

15) $\tan x = 270^\circ$

16) $\tan 510^\circ =$

17) $\cos 0^\circ =$

18) $\sin x = \sqrt{3}/2$

19) $\cos 570^\circ =$

20) $\tan -135^\circ =$

21) $\sin x = -\frac{1}{2}$

22) $\sin -300^\circ =$

23) $\tan x = 0$

24) $\cos x = 1$