8.4 and 8.3 Notes Trigonometry and special Right Triangles Monday 12/3/18

rigonometry: Comes from the two Greek terms, trigon-meaning triangle and metron-meaning measure

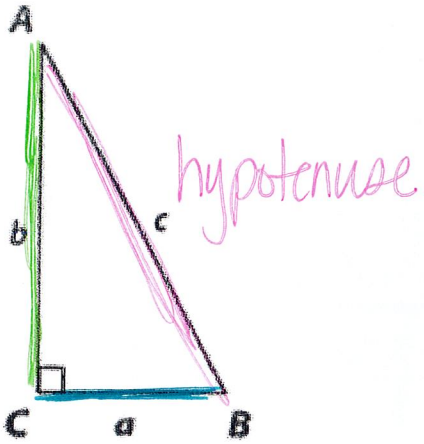
Trigonometric Ratio: Is a ratio of the lengths of 2 sides of a right triangle.

SOH CAH TOA

↑ opp / hyp

KeyConcept Trigonometric Ratios

Words	
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the sine of $\angle A$ (written sin A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the hypotenuse (hyp).	$\sin A = \frac{opp}{hyp} = \frac{a}{c}$
	$\sin B = \frac{opp}{hyp} = \frac{b}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the cosine of $\angle A$ (written cos A) is the ratio of the length of the leg adjacent $\angle A$ (adj) to the length of the hypotenuse (hyp).	$\cos A = \frac{adj}{hyp} = \frac{b}{c}$
	$\cos B = \frac{adj}{hyp} = \frac{a}{c}$
If $\triangle ABC$ is a right triangle with acute $\angle A$, then the tangent of $\angle A$ (written tan A) is the ratio of the length of the leg opposite $\angle A$ (opp) to the length of the leg adjacent $\angle A$ (adj).	$\tan A = \frac{opp}{adj} = \frac{a}{b}$
	$\tan B = \frac{opp}{adj} = \frac{b}{a}$



Example 1:

a. Sin P $\frac{15}{17}$

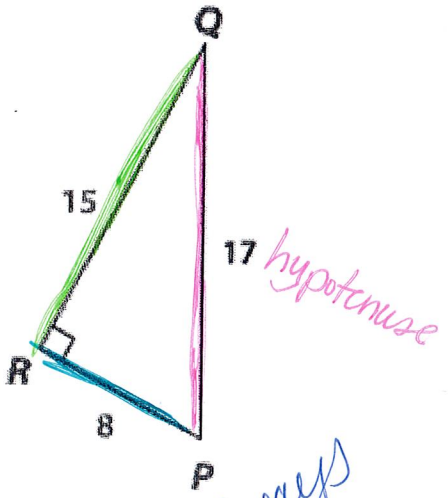
b. Cos P $\frac{8}{17}$

c. Tan P $\frac{15}{8}$

d. Sin Q $\frac{8}{17}$

e. Cos Q $\frac{15}{17}$

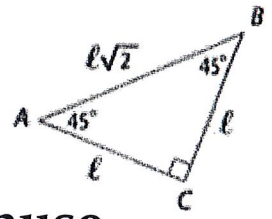
f. Tan Q $\frac{8}{15}$



Theorem 8.8 45°-45°-90° Triangle Theorem

In a 45°-45°-90° triangle, the legs ℓ are congruent and the length of the hypotenuse h is $\sqrt{2}$ times the length of a leg.

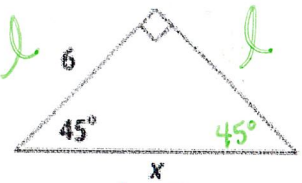
Symbols In a 45°-45°-90° triangle, $\ell = \ell$ and $h = \ell\sqrt{2}$.



Example 2: Find the hypotenuse

Find x.

a.



$\ell\sqrt{2}$

$\ell = 6$

So hypotenuse = $6\sqrt{2}$

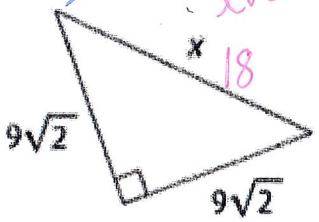
$6^2 + 6^2 = x^2$

$36 + 36 = x^2$

$72 = x^2$

$\sqrt{36}\sqrt{2}$

b.



$\ell = 9\sqrt{2}$

$9\sqrt{2}\sqrt{2}$

$9 \cdot 2$

18

can always check w/ $a^2 + b^2 = c^2$

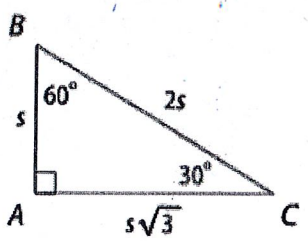
$\ell\sqrt{2}$

8.4 and 8.3 Notes Trigonometry and special Right Triangles Make Sure Calc is in degrees

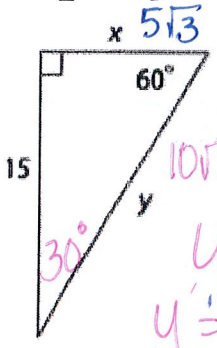
Theorem 8.9 30°-60°-90° Triangle Theorem

In a 30°-60°-90° triangle, the length of the hypotenuse h is 2 times the length of the shorter leg s, and the length of the longer leg ℓ is $\sqrt{3}$ times the length of the shorter leg.

Symbols In a 30°-60°-90° triangle, $h = 2s$ and $\ell = s\sqrt{3}$.



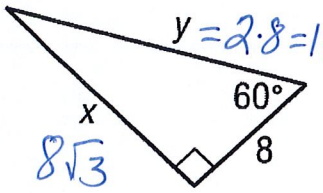
Example 3 Find x and y



Side across 30° = S
Side across 60° = S√3
hypotenuse = 2S

$y = 2x$
$y = 2 \cdot 5\sqrt{3}$
$y = 10\sqrt{3}$

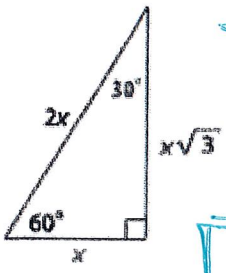
$\frac{15}{\sqrt{3}} = \frac{S\sqrt{3}}{\sqrt{3}}$
$\frac{15\sqrt{3}}{3} = S$
$5\sqrt{3} = S$



$S = 8$
$y = 16$
$x = 8\sqrt{3}$

SOH CAH TOA

Use special right triangles to express the tangent of 30° as a decimal

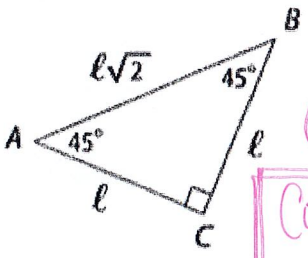


$\tan 30° = \frac{x}{x\sqrt{3}}$

$\tan 30 = \frac{1}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\tan 30 = \frac{\sqrt{3}}{3} = .577$

Express cosine of 45° as a fraction

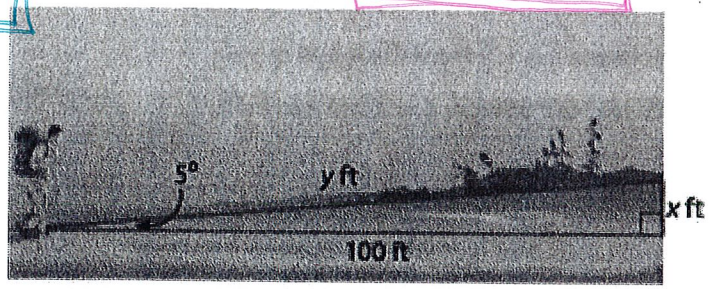


$\cos 45 = \frac{\ell}{\ell\sqrt{2}}$

$\cos 45 = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

$\cos 45 = \frac{\sqrt{2}}{2} = .707$

HIKING A certain part of a hiking trail slopes upward at about a 5° angle. After traveling a horizontal distance of 100 feet along this part of the trail, what would be the change in a hiker's vertical position? What distance has the hiker traveled along the path?



The change in vertical height is 8.75 ft
The hiker walked a total of 100.38 ft.

$\frac{\tan 5}{1} = \frac{x}{100}$

$x = 100 \cdot \tan 5$

$x = 8.75$

$\cos 5 = \frac{100}{y}$

$\frac{y \cdot \cos 5}{\cos 5} = \frac{100}{\cos 5}$

$y = 100.38$

8.4 and 8.3 Notes Trigonometry and special Right Triangles

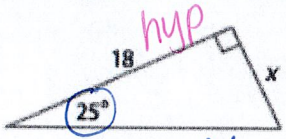
GuidedPractice

SOH CAH TOA

Make sure Calc is in Degrees

Find x to the nearest hundredth.

3A.



hyp, opp

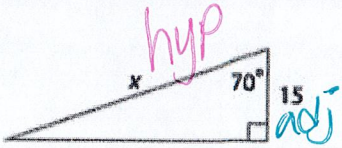
7.61

$\frac{\sin 25}{1} = \frac{X}{18}$

$X = 18 \cdot \sin 25$

$X = 7.61$

3B.



hyp, adj

43.86

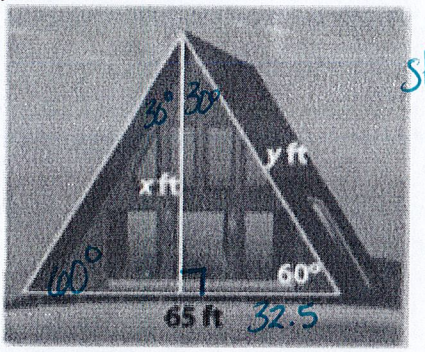
$\frac{\cos 70}{1} = \frac{15}{X}$

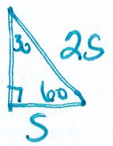
$X = 43.86$

$15 = X \cdot \cos 70$

$\cos 76 \quad \cos 70$

3C. ARCHITECTURE The front of the vacation cottage shown is an isosceles triangle. What is the height x of the cottage above its foundation? What is the length y of the roof? Explain your reasoning.





30-60-90 or equilateral

$S = 32.5$

$y = 2(32.5) = 65$ ft

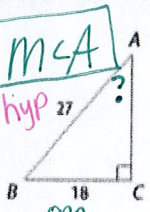
△ all angles 60° of big △ so all sides = 65 ft

KeyConcept Inverse Trigonometric Ratios

Words	If $\angle A$ is an acute angle and the sine of A is x, then the inverse sine of x is the measure of $\angle A$.
Symbols	If $\sin A = x$, then $\sin^{-1} x = m\angle A$. (2nd Sin on calc)
Words	If $\angle A$ is an acute angle and the cosine of A is x, then the inverse cosine of x is the measure of $\angle A$.
Symbols	If $\cos A = x$, then $\cos^{-1} x = m\angle A$. (2nd Cos on calc)
Words	If $\angle A$ is an acute angle and the tangent of A is x, then the inverse tangent of x is the measure of $\angle A$.
Symbols	If $\tan A = x$, then $\tan^{-1} x = m\angle A$. (2nd tan on calc)

Example 4 Find Angle Measures Using Inverse Trigonometric

Use a calculator to find the measure of $\angle A$ to the nearest tenth.



$41.8° = m\angle A$

$\sin A = \frac{18}{27}$

to get A by itself take Inverse Sin of Both sides

$A = \sin^{-1}\left(\frac{18}{27}\right) = 41.8°$

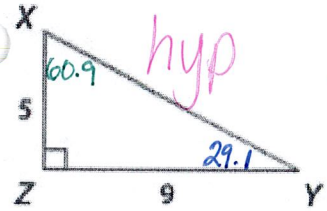
to find the angle you are going to have to take the Inverse Sin Cos tan

Second button on Calc

Example 5 Solve a Right Triangle

Solve the right triangle. Round side measures to the nearest tenth and angle measures to the nearest degree.

find all missing measures



$\tan Y = \frac{5}{9}$

$\tan^{-1}\left(\frac{5}{9}\right) = y$

$= y$

$m\angle Y = 29.1°$

$m\angle X = 60.9°$

$hyp = \sqrt{106} = 10.3$

Either way to find hypotenuse

or $\frac{\sin 29.1}{1} = \frac{5}{X}$

$X \cdot \sin 29.1 = 5$

$X = 10.3$

$c^2 = 5^2 + 9^2$

$c^2 = 25 + 81$

$\sqrt{c^2} = \sqrt{106}$

$c = 10.3$