Name — Ms. Kresovic

Adv Geo — 9.9: Introduction to Trigonometry — Monday, March 24, 2014

Objective

After studying this section, you will be able to

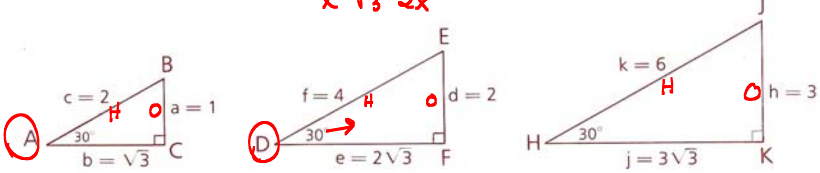
- Understand three basic trigonometric relationships

This section presents the three basic trigonometric ratios ***sine***, ***cosine***, and ***tangent***. The concept of similar triangles and the Pythagorean Theorem can be used to develop the ***trigonometry of right triangles.***

sin cos tan

Consider the following 30°-60°-90° triangles.

x $\sqrt{3}$ 2x



Compare the length of the leg opposite the 30° angle with the length of the hypotenuse in each triangle.

In $\triangle ABC$, $\frac{a}{c} = \frac{1}{2} = 0.5$. In $\triangle DEF$, $\frac{d}{f} = \frac{2}{4} = 0.5$. In $\triangle HJK$, $\frac{h}{k} = \frac{3}{6} = 0.5$.

$\sin 30° = \frac{1}{2}$ $\sin 30° = \frac{1}{2}$ $\sin 30° = \frac{1}{2}$

If you think about similar triangles, you will see that in every 30°-60°-90° triangle,

$$\frac{\text{leg opposite } 30° \angle}{\text{hypotenuse}} = \frac{1}{2}$$

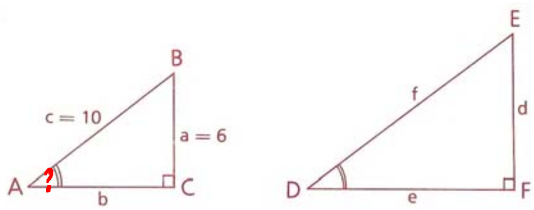
For each triangle shown, verify that $\frac{\text{leg adjacent to } 30° \angle}{\text{hypotenuse}} = \frac{\sqrt{3}}{2}$.

For each triangle shown, find the ratio $\frac{\text{leg opposite } 30° \angle}{\text{leg adjacent to } 30° \angle}$.

In $\triangle ABC$ and $\triangle DEF$,

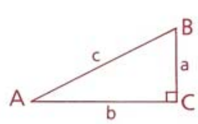
$$\frac{a}{c} = \frac{d}{f} = \frac{6}{10} = \frac{3}{5}$$

$\sin A = \frac{6}{10} = \frac{3}{5}$



Engineers and scientists have found it convenient to formalize these relationships by naming the ratios of sides. You should memorize these three basic ratios.

Definition **Three Trigonometric Ratios**



sine of $\angle A = \sin \angle A = \frac{\text{opposite leg}}{\text{hypotenuse}}$ $\sin \angle = \frac{O}{H}$ SOH

cosine of $\angle A = \cos \angle A = \frac{\text{adjacent leg}}{\text{hypotenuse}}$ $\cos \angle = \frac{A}{H}$ CAH

tangent of $\angle A = \tan \angle A = \frac{\text{opposite leg}}{\text{adjacent leg}}$ $\tan \angle = \frac{O}{A}$ TOA

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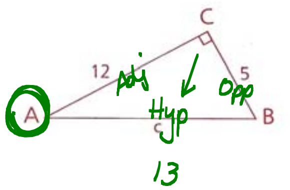
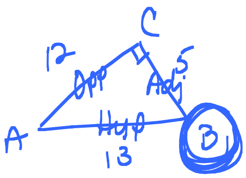
Class Examples

Problem 1 Find: **a** cos ∠A
b tan ∠B

CAH

$\cos\angle A = \frac{12}{13}$

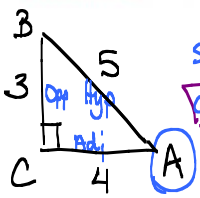




$\tan\angle B = \frac{12}{5}$

TOA

Problem 2 Find the three trigonometric ratios for ∠A and ∠B.



SOH $\sin\angle A = \frac{3}{5}$

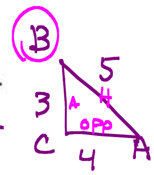
CAH $\cos\angle A = \frac{4}{5}$

TOA $\tan\angle A = \frac{3}{4}$

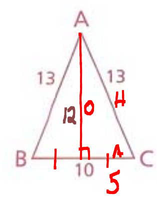
SOH $\sin\angle B = \frac{4}{5}$

$\cos\angle B = \frac{3}{5}$

$\tan\angle B = \frac{4}{3}$



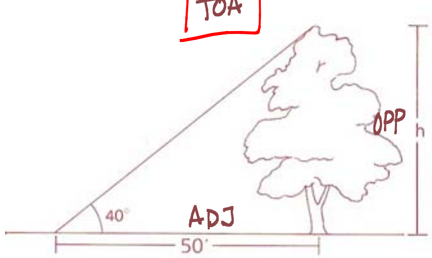
Problem 3 △ABC is an isosceles triangle as marked. Find sin ∠C.



$\sin\angle C = \frac{12}{13}$ SOH

Problem 4 *Use the fact that tan 40° ≈ 0.8391 to find the height of the tree to the nearest foot.*

TOA



$\tan 40° = \frac{h}{50}$

$.8391 = \frac{h}{50}$

$41.955 = h$

or about 42ft tall

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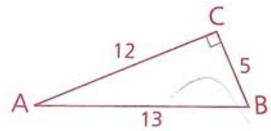
Homework

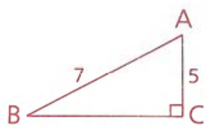
5 If $\tan \angle M = \frac{3}{4}$, find $\cos \angle M$. (Hint: Start by drawing the triangle.)

6 Using the figure as marked, name each missing angle.



a $\frac{5}{12} = \tan \angle$ __?__ **b** $\frac{12}{13} = \cos \angle$ __?__ **c** $\frac{5}{13} = \sin \angle$ __?__

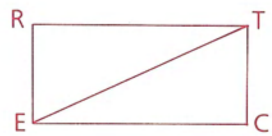
7 Find each quantity.



a BC **b** $\sin \angle A$ **c** $\tan \angle B$

8 Given: RECT is a rectangle.
ET = 26, RT = 24

Find: **a** $\sin \angle RET$ **b** $\cos \angle RET$



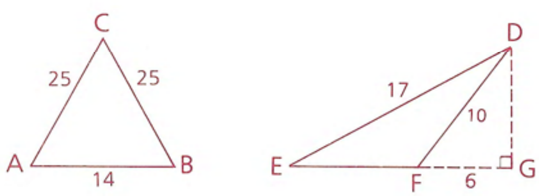
Problem Set B

9 Using the given figures, find

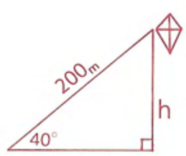
a $\cos \angle A$

b $\sin \angle E$

c $\sin \angle DFG$



10 Use the fact that $\sin 40° \approx 0.6428$ to find the height of the kite to the nearest meter.

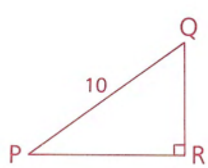


11 **a** If $\tan \angle A = 1$, find $m\angle A$.

b If $\sin \angle P = 0.5$, find $m\angle P$.

12 Given: $\sin \angle P = \frac{3}{5}$, PQ = 10

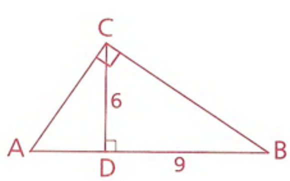
Find: $\cos \angle P$



13 Using the figure, find

a $\tan \angle ACD$

b $\sin \angle A$



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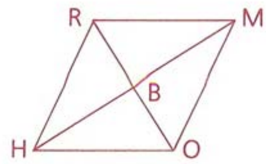
Problem Set B, *continued*

14 Given: RHOM is a rhombus.
RO = 18, HM = 24
Find: **a** cos ∠BRM **b** tan ∠BHO



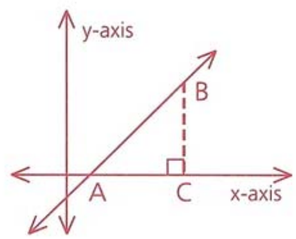
15 Given a trapezoid with sides 5, 10, 17, and 10, find the sine of one of the acute angles.

16 Given △ABC with ∠C = 90°, indicate whether each statement is true Always (A), Sometimes (S), or Never (N).

a sin ∠A = cos ∠B **b** sin ∠A = tan ∠A **c** sin ∠A = cos ∠

17 If △EQU is equilateral and △RAT is a right triangle with RA = 2, RT = 1, and ∠T = 90°, show that sin ∠E = cos ∠A.

18 If the slope of $\overleftrightarrow{AB}$ is $\frac{5}{8}$, find the tangent of ∠BAC.



Problem Set C C is for Challenge :)

19 Use the definitions of the trigonometric ratios to verify the following relationships, given △ABC in which ∠C = 90°.

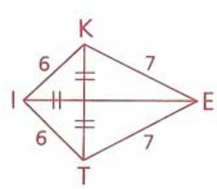
a $(\sin \angle A)^2 + (\cos \angle A)^2 = 1$

b $\dfrac{a}{\sin \angle A} = \dfrac{b}{\sin \angle B}$

c $\dfrac{\sin \angle A}{\cos \angle A} = \tan \angle A$

d $\sin \angle A = \cos (90° - \angle A)$

22 Given: KITE is a kite with sides as marked.
Find: tan ∠KEI



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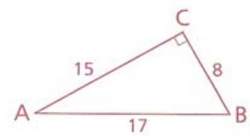
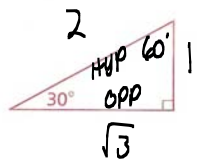
Classwork

1 Find each ratio.
- a sin ∠A
- b cos ∠A
- c tan ∠A
- d sin ∠B
- e cos ∠B
- f tan ∠B

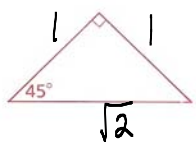


2 Find each ratio.
- a sin 30°
- b cos 30°
- c tan 30°
- d sin 60°
- e cos 60°
- f tan 60°

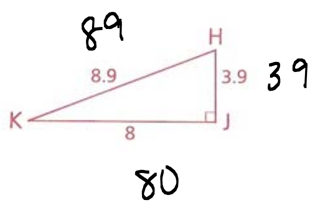


$\sin 60 = \frac{\cancel{1}\sqrt{3}}{\cancel{2}2} = \frac{\sqrt{3}}{2}$

3 Find each ratio.
- a sin 45°
- b cos 45°
- c tan 45°



4 Find each ratio.
- a cos ∠H
- b tan ∠K



1a	8/17
1b	15/17
1c	8/15
1d	15/17
1e	8/17
1f	15/8
2a	1/2
2b	√3/2
2c	√3/3
2d	√3/2
2e	1/2
2f	√3
3a	√2/2
3b	√2/2
3c	1
4a	39/89
4b	39/80