Expanded Mathematics
SOHCAHTOA Notes

Name Key
Date_____ **Period**_____

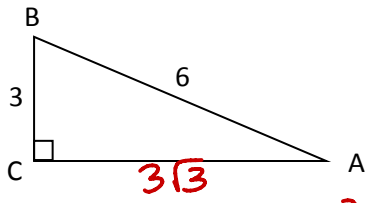
Sine (sin) / Cosine (cos) / Tangent (tan)

To remember the trigonometric ratio we can use the following saying:

SOH-CAH-TOA

Sin = $\frac{\text{opposite}}{\text{hypotenuse}}$ Cos = $\frac{\text{adjacent}}{\text{hypotenuse}}$ Tan = $\frac{\text{opposite}}{\text{adjacent}}$

1. Using the triangle below express sine-cosine-tangent.



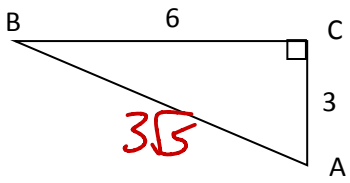
$3^2+b^2=6^2$
$9+b^2=36$
$b^2=27$
$b=\sqrt{27}$
$b=3\sqrt{3}$

$\sin A = \frac{3}{6} = \frac{1}{2}$ $\sin B = \frac{3\sqrt{3}}{6} = \frac{\sqrt{3}}{2}$

$\cos A = \frac{3\sqrt{3}}{6} = \frac{\sqrt{3}}{2}$ $\cos B = \frac{3}{6} = \frac{1}{2}$

$\tan A = \frac{3}{3\sqrt{3}} = \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$ $\tan B = \frac{3\sqrt{3}}{3} = \sqrt{3}$

2. Using the triangle below express sine-cosine-tangent. NO DECIMALS!



$3^2+6^2=c^2$
$45=c^2$
$\sqrt{45}=c \rightarrow c=3\sqrt{5}$

$\sin A = \frac{6}{3\sqrt{5}} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$ $\sin B = \frac{3}{3\sqrt{5}} = \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5}$

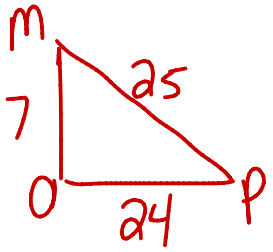
$\cos A = \frac{3}{3\sqrt{5}} = \frac{1}{\sqrt{5}} = \frac{\sqrt{5}}{5}$ $\cos B = \frac{6}{3\sqrt{5}} = \frac{2}{\sqrt{5}} = \frac{2\sqrt{5}}{5}$

$\tan A = \frac{6}{3} = 2$ $\tan B = \frac{3}{6} = \frac{1}{2}$

3. The cos 60° is 1/2 . What does this mean? Your explanation should include something about the sides of a right triangle.

The side adjacent to the 60° angle is 1 and the hypotenuse is 2.

4. In ΔMOP, $\angle O$ is the right angle. Suppose $\sin P = \frac{7}{25}$. Find $\sin M$ and cos P.



$7^2 + b^2 = 25^2$

$b^2 = 576$

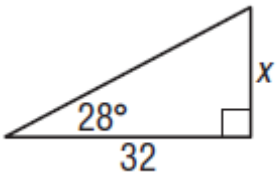
$b = 24$

$\sin M = \frac{24}{25}$

$\cos P = \frac{24}{25}$

Examples: Find the missing side lengths.

10.

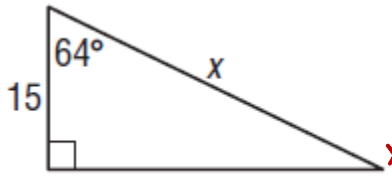


$\frac{\sin 28}{1} = \frac{x}{32}$

$x = 32\sin 28$

$x = 15.0$

11.



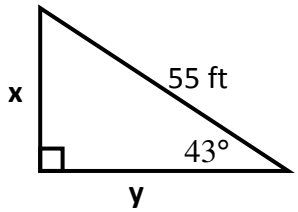
$\frac{\cos 64}{1} = \frac{15}{x}$

$x\cos 64 = 15$

$x = \frac{15}{\cos 64}$

$x = 34.2$

12.



$\frac{\sin 43}{1} = \frac{x}{55}$

$55\sin 43 = x$

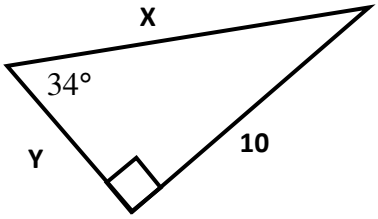
$37.51 = x$ ft

$\frac{\cos 43}{1} = \frac{y}{55}$

$55\cos 43 = y$

$40.22 = y$ ft

13.



$\frac{\sin 34}{1} = \frac{10}{x}$

$x\sin 34 = 10$

$x = \frac{10}{\sin 34} = 17.9$

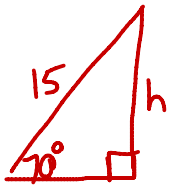
$\frac{\tan 34}{1} = \frac{10}{y}$

$y\tan 34 = 10$

$y = \frac{10}{\tan 34}$

$y = 14.8$

15. A 15-foot ladder leans against a wall. The **angle of elevation** (the angle between the ladder and ground) is 70°. How far up the wall does the ladder reach?



$\frac{\sin 70}{1} = \frac{h}{15}$

$15\sin 70 = h \rightarrow h = 14.1$ ft

Expanded Mathematics
SOHCAHTOA Homework

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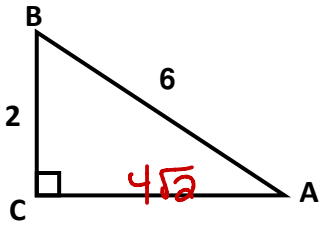
Find sin, cos, and tan for each angle in the triangle.

1.



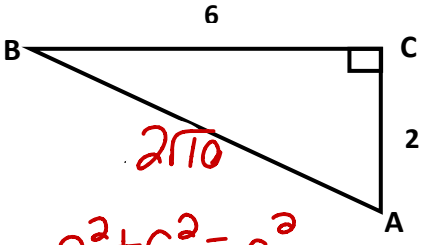
$a^2+b^2=6^2$
$4+b^2=36$
$b^2=32$
$b=4\sqrt{2}$

sin A = $\frac{2}{6}=\frac{1}{3}$ sin B = $\frac{4\sqrt{2}}{6}=\frac{2\sqrt{2}}{3}$

cos A = $\frac{4\sqrt{2}}{6}=\frac{2\sqrt{2}}{3}$ cos B = $\frac{2}{6}=\frac{1}{3}$

tan A = $\frac{2}{4\sqrt{2}}=\frac{1}{2\sqrt{2}}=\frac{\sqrt{2}}{4}$ tan B = $\frac{4\sqrt{2}}{2}=2\sqrt{2}$

2.



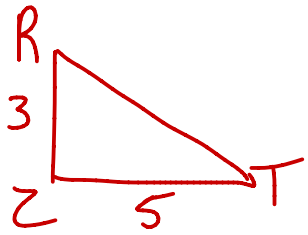
$a^2+6^2=c^2$
$40=c^2$
$2\sqrt{10}=c$

sin A = $\frac{6}{2\sqrt{10}}=\frac{3}{\sqrt{10}}=\frac{3\sqrt{10}}{10}$ sin B = $\frac{2}{2\sqrt{10}}=\frac{1}{\sqrt{10}}=\frac{\sqrt{10}}{10}$

cos A = $\frac{2}{2\sqrt{10}}=\frac{1}{\sqrt{10}}=\frac{\sqrt{10}}{10}$ cos B = $\frac{6}{2\sqrt{10}}=\frac{3}{\sqrt{10}}=\frac{3\sqrt{10}}{10}$

tan A = $\frac{6}{2}=3$ tan B = $\frac{2}{6}=\frac{1}{3}$

3. In ΔRTZ, $\angle Z$ is the right angle. Suppose $\tan R=\frac{5}{3}$. Find $\cos T$ and $\sin R$.



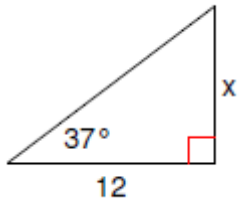
$5^2+3^2=c^2$
$34=c^2$
$\sqrt{34}=c$

$\cos T=\frac{5}{\sqrt{34}}=\frac{5\sqrt{34}}{34}$

$\sin R=\frac{5}{\sqrt{34}}=\frac{5\sqrt{34}}{34}$

Find the missing side lengths.

4.

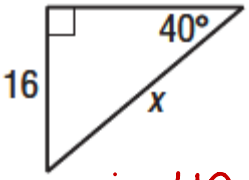


$\frac{\tan 37}{1}=\frac{x}{12}$

$12\tan 37=x$

$9.04=x$

5.



$\frac{\sin 40}{1}=\frac{16}{x}$

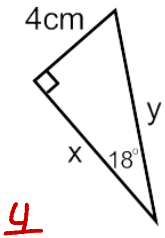
$x\sin 40=16$

$x=\frac{16}{\sin 40}$

$x=24.9$

Find the missing side lengths.

6.



$\tan 18 = \frac{4}{x}$

$x \tan 18 = 4$

$x = \frac{4}{\tan 18}$

$x = 12.31\text{cm}$

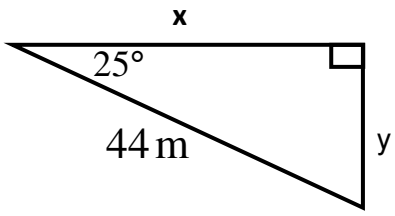
$\sin 18 = \frac{4}{y}$

$y \sin 18 = 4$

$y = \frac{4}{\sin 18}$

$y = 12.94\text{cm}$

7.



$\frac{\sin 25}{1} = \frac{y}{44}$

$44 \sin 25 = y$

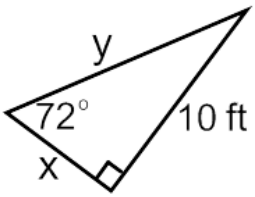
$18.60 = y$ m

$\frac{\cos 25}{1} = \frac{x}{44}$

$44 \cos 25 = x$

$39.88 = x$ m

8.



$\frac{\tan 72}{1} = \frac{10}{x}$

$x \tan 72 = 10$

$x = \frac{10}{\tan 72}$

$x = 3.25$ ft

$\frac{\sin 72}{1} = \frac{10}{y}$

$y \sin 72 = 10$

$y = \frac{10}{\sin 72}$

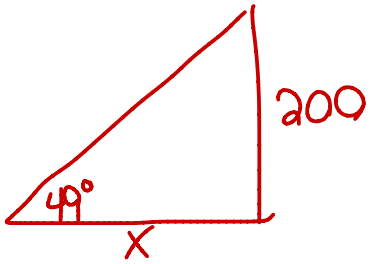
$y = 10.51$ ft

9. A 60-foot ramp rises from the first floor to the second floor of a parking garage and makes a $15°$ angle of elevation with the ground. How high above the first floor is the second floor?

$\frac{\sin 15}{1} = \frac{x}{60}$

$60 \sin 15 = x \rightarrow x = 15.53$ ft

10. Sadie is having trouble getting a signal for her cell phone during class, so she decides to leave the class and stand near a 200 foot high cell phone tower. If the angle of elevation from the ground where Sadie is standing to the top of the cell phone tower is $49°$, how far from the tower is she standing?



$\frac{\tan 49}{1} = \frac{200}{x}$

$x \tan 49 = 200$

$x = \frac{200}{\tan 49}$

$x = 173.86$ ft