1.11 High Tide

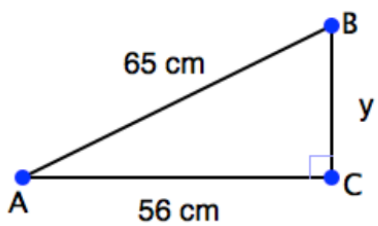
Practice

I. Tangents in right angle trigonometry.

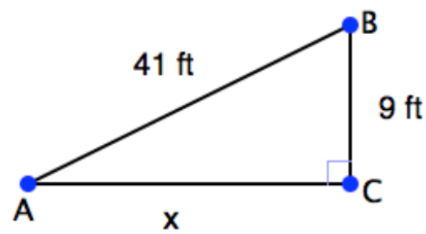
Recall that the right triangle definition of the tangent ratio is:

$$\tan A = \frac{opposite}{adjacent}$$

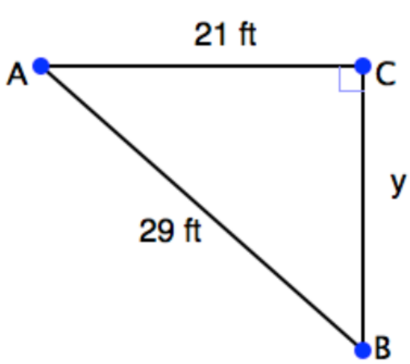
1. Find $\tan A$ *and* $\tan B$.



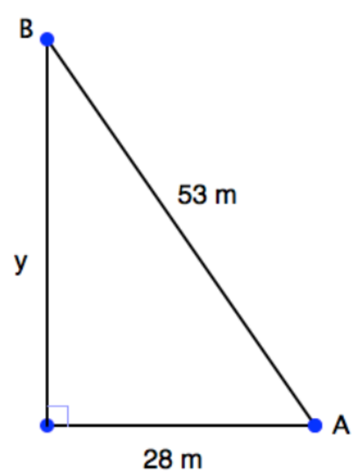
2. Find $\tan A$ *and* $\tan B$.



3. Find $\tan A$ *and* $\tan B$.



4. Find $\tan A$ *and* $\tan B$.



II. Mathematical Modeling Using Sine and Cosine Functions

Many real-life situations such as sound waves, weather patterns, and electrical currents can be modeled by sine and cosine functions. The table below shows the depth of water (in feet) at the end of a wharf as it varies with the tides at various times during the morning.

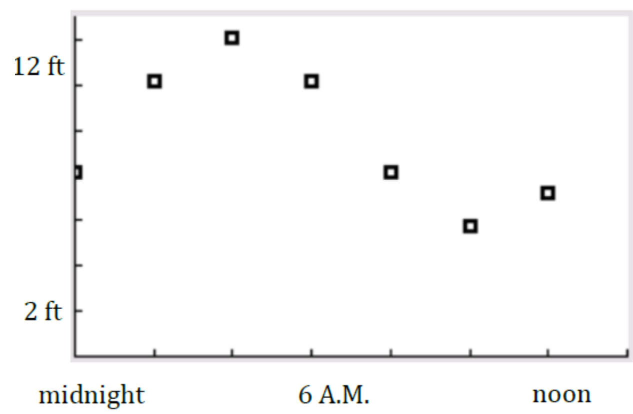
t (time)	midnight	2 A.M.	4 A.M.	6 A.M.	8 A.M.	10 A.M.	noon
d (depth)	8.16	12.16	14.08	12.16	8.16	5.76	7.26

You can use a trigonometric function to model the data. Suppose you choose cosine.

The *amplitude* will be the distance from the average of the highest and lowest values. This also known as the ***midline***.

This will be the average depth (d).

5. Sketch the midline that shows the average depth.



6. Find the amplitude $A = \frac{1}{2}(high - low)$

7. Find the period $p = 2|low\ time - high\ time|$. Since a normal period for sine is 2π. The new period for your model will be $\frac{2\pi}{p}$, so $b = \frac{2\pi}{p}$. (Use the p you calculated, divide and turn it into a decimal)

8. High tide occurred 4 hours after midnight. The formula for the displacement is $4 = \frac{c}{b}$. Use b and solve for c.

9. Now that you have your values for *A, b, c,* and *d*, you can put them into your equation

$$y = A\cos(bt - c) + d$$

10. Use your model to calculate the depth at 9 A.M. and 3 P.M.

11. A boat needs at least 10 feet of water to dock at the wharf. During what interval of time in the afternoon can it safely dock?

III. Using the Calculator to Find Angles of Rotation

Use your calculator and what you know about where sine and cosine are positive and negative in the unit circle to find the two angles that are solutions to the equation.

Make sure θ is always $\mathbf{0 \le \theta \le 2\pi}$. *(Your calculator should be set in radians.)*

Note: your calculator will sometimes give you a negative angle. That is because the calculator is programmed to restrict the angle of rotation so that the inverse of the function is also a function. Since the requested answers have been restricted to positive rotations, if the calculator gives you a negative angle of rotation, you will need to figure out the positive coterminal angle for the angle that your calculator has given you.

12. $\sin\theta = \frac{4}{5}$

13. $\sin\theta = \frac{2}{7}$

14. $\sin\theta = -\frac{1}{10}$

15. $\sin\theta = -\frac{13}{14}$

Note: When you ask your calculator for the angle, you are "undoing" the trig function. Finding the angle is finding the inverse trig function. When you see "**Find $\sin^{-1}\left(\frac{4}{5}\right)$, you are being asked to find the angle that has a sine ratio of $\frac{4}{5}$.**

16. $\sin^{-1}\left(\frac{3}{5}\right)$

17. $\sin^{-1}\left(\frac{\sqrt{2}}{2}\right)$

18. $\cos^{-1}\left(\frac{1}{4}\right)$

19. $\cos^{-1}(0)$

20. $\tan^{-1}\left(\frac{5}{4}\right)$

IV. Assessment – Khan Academy

1. Complete the following online worksheet in the Functions unit of Khan Academy's Algebra 2 course:
    a. https://www.khanacademy.org/math/algebra2/manipulating-functions/introduction-to-inverses-of-functions/a/intro-to-inverse-functions