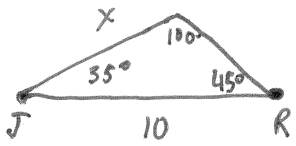
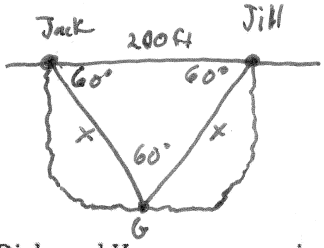
Lesson 18: Trig Review Week Day 3

1. Juan and Romella are standing at the seashore 10 miles apart. The coastline is a straight line between them. Both can see the same ship in the water. The angle between the coastline and the line between the ship and Juan is 35 degrees. The angle between the coastline and the line between the ship and Romella is 45 degrees. How far is the ship from Juan?



$\frac{10}{\sin(100°)} = \frac{x}{\sin(45°)}$ $\boxed{7.18 \text{ miles} = x}$

2. Jack is on one side of a 200-foot-wide canyon and Jill is on the other. Jack and Jill can both see the trail guide at an angle of depression of 60 degrees. How far are they from the trail guide?

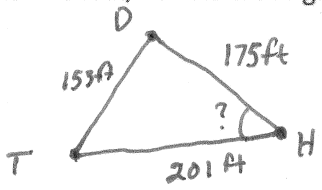


All sides must be 200 ft.

OR

use LOS $\frac{200}{\sin(60)} = \frac{x}{\sin(60)}$ $\boxed{x = 200 \text{ ft}}$

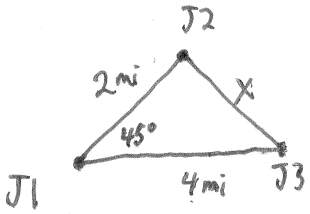
3. Tom, Dick, and Harry are camping in their tents. If the distance between Tom and Dick is 153 feet, the distance between Tom and Harry is 201 feet, and the distance between Dick and Harry is 175 feet, what is the angle between Dick, Harry, and Tom?



$153^2 = 175^2 + 201^2 - 2(175)(201)\cos(?)$

$\frac{153^2 - 175^2 - 201^2}{-2(175)(201)} = \cos(?)$ $\boxed{? = 47.401°}$

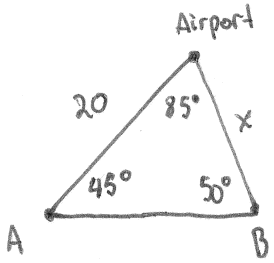
4. Three boats are at sea: Jenny one (J1), Jenny two (J2), and Jenny three (J3). The crew of J1 can see both J2 and J3. The angle between the line of sight to J2 and the line of sight to J3 is 45 degrees. If the distance between J1 and J2 is 2 miles and the distance between J1 and J3 is 4 miles, what is the distance between J2 and J3?



$x^2 = 2^2 + 4^2 - 2 \cdot 2 \cdot 4 \cdot \cos(45°)$

$x = \sqrt{4 + 16 - 16\cos(45)}$ $= \boxed{2.947 \text{ mi}}$

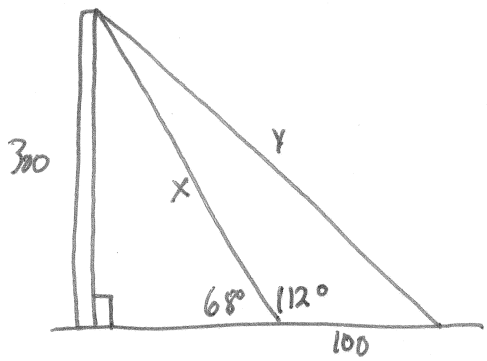
5. Airplane A is flying directly toward the airport which is 20 miles away. The pilot notices airplane B 45 degrees to her right. Airplane B is also flying directly toward the airport. The pilot of airplane B calculates that airplane A is 50 degrees to his left. Based on that information, how far is airplane B from the airport?



$$\frac{20}{\sin(50)} = \frac{x}{\sin(45)}$$

$x = 18.461$ mi

1. A 300-foot high tower stands on level ground, anchored by two cables on the west side. The end of the cable closest to the tower makes and angle of 68° with the horizontal. The two cables are 100 feet apart. How long are the cables?



$$\sin(68) = \frac{300}{x}$$

$$x = \frac{300}{\sin(68)} = 323.56 \text{ ft}$$

$$y^2 = (323.56)^2 + 100^2 - 2\cdot(323.56)(100)\cos(112)$$

$y = 372.747$ ft

$E(t)$ models the daily amount of energy (in kilojoules, kJ) that a solar panel in Pago Pago generates, t days after the autumn equinox. Here, t is entered in radians.

$$E(t) = 624\sin\left(\frac{2\pi}{365}t\right) + 8736$$

What is the first day after the autumn equinox that the solar panel generates 8400 kJ?

$8400 = 624\sin\left(\frac{2\pi}{365}t\right)+8736$

$-336 = 624\sin\left(\frac{2\pi}{365}t\right)$

$\frac{-336}{624} = \sin\left(\frac{2\pi}{365}t\right)$

$\frac{2\pi t}{365} = \sin^{-1}\left(\frac{-336}{624}\right)$

$\frac{2\pi t}{365} = -0.569$

uh oh! Principal is negative

Let's find the 3rd quadrant location

$\pi - (P)$

$\pi - (-0.5686103003)$

$\frac{2\pi t}{365} = 3.710$

$t = 3.710 \cdot \frac{365}{2\pi} = 215.52$

The 216th day

$I(t)$ models the daily solar irradiance, measured in $\frac{\text{kWh}}{\text{m}^2\text{-day}}$, on a farm, t days after the summer solstice. Here, t is entered in radians.

$$I(t) = 1.5\cos\left(\frac{2\pi}{365}t\right) + 4.3$$

What is the second time after the summer solstice that the solar irradiance is $5.2\frac{\text{kWh}}{\text{m}^2\text{-day}}$?

$5.2 = 1.5\cos\left(\frac{2\pi}{365}t\right)+4.3$

$0.9 = 1.5\cos\left(\frac{2\pi}{365}t\right)$

$0.6 = \cos\left(\frac{2\pi}{365}t\right)$

$\frac{2\pi}{365}t = 0.927$ second time

$2\pi - 0.927295218$

$\frac{2\pi}{365}t = 5.356$

$t = 311.13$ The 311th day

Find the first TWO solutions to the equation for x>0. All answers should be in radians.

1. $7\sin(x) = 5$

$\sin(x) = \frac{5}{7}$

$x = 0.796$ or $\pi - 0.796$
2.346

2. $8\cos(x) - 1 = 2$

$8\cos(x) = 3$
$\cos(x) = \frac{3}{8}$

$x = 1.186$ or $2\pi - 1.186$
5.097

3. $4\cos(x) - 2 = -3.1$

$4\cos(x) = -1.1$
$\cos(x) = \frac{-1.1}{4}$

$x = 1.849$ or $2\pi - 1.849$
4.434

4. $10\sin(x) + \sqrt{7} = 8$

$10\sin(x) = 8 - \sqrt{7}$
$\sin(x) = \frac{(8-\sqrt{7})}{10}$

$x = 0.565$ or $\pi - 0.565$
2.577

5. $20\sin(3x) - 4 = 5$

$20\sin(3x) = 9$
$\sin(3x) = \frac{9}{20}$

$3x = 0.467$ or $\pi - 0.467$
$3x = 2.675$

$x = 0.156$ or $x = 0.892$

6. $118\cos\left(\frac{1}{2}x\right) + 2 = 17$

$118\cos(\frac{1}{2}x) = 15$
$\cos(\frac{1}{2}x) = \frac{15}{118}$

$\frac{1}{2}x = 1.443$ or $2\pi - 1.443$
$\frac{1}{2}x = 4.840$

$x = 2.887$ or $x = 9.680$

7. $8\cos(4x) - 3 = -1$

$8\cos(4x) = 2$
$\cos(4x) = \frac{1}{4}$

$4x = 1.318$ OR $4x = 4.965$
$x = 0.330$ or $x = 1.241$

8. $1100\sin(5x) + 110 = 160$

$1100\sin(5x) = 50$
$\sin(5x) = \frac{50}{1100}$

$5x = 0.045$ OR $5x = 3.096$
$x = 0.009$ or $x = 0.619$

Challenge: Use the Laws of Sines and Cosines and the area formula we learned (below) to find the area of each triangle.

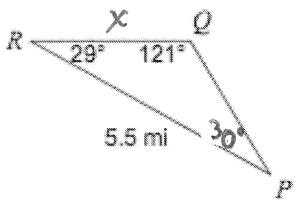
$A = \frac{1}{2}ab\ sin\ C$

Need two sides and angle between.

Find the area of ΔABC if a = 15 ft., b = 18 ft. and $m\angle C = 100°$.

$A = \frac{1}{2}(15)(18)\sin(100) = 132.949\ ft^2$

3)



$\frac{5.5}{\sin(121)} = \frac{x}{\sin(30)}$

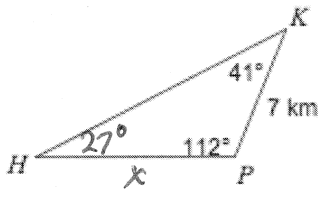
$x = 3.208$

Now we have 2 sides and angle between.

$A = \frac{1}{2}(3.208)(5.5)\sin(29)$

$A = 4.277\ mi^2$

4)



$\frac{7}{\sin(27)} = \frac{x}{\sin(41)}$

$x = 10.116$

$A = \frac{1}{2}(10.116)7\sin(112)$

$A = 32.828\ km^2$