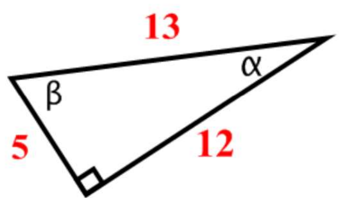
Find the value of the trig functions indicated.

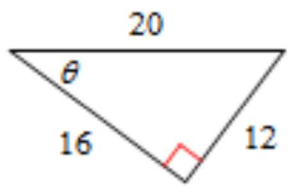
1.



$\sin\alpha = \frac{5}{13}$

$\tan\beta = \frac{12}{5}$

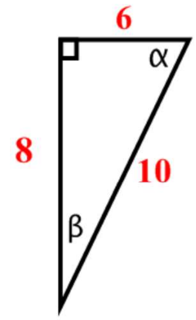
2.



$\cos\theta = \frac{16}{20}$

$\tan\theta = \frac{12}{16}$

3.



$\sin\alpha = \frac{8}{10}$

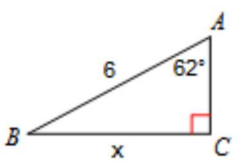
$\sin\beta = \frac{6}{10}$

$\tan\alpha = \frac{8}{6}$

$\cos\beta = \frac{8}{6}$

Find the measure of the indicated side. Round to the nearest hundredth.

4.

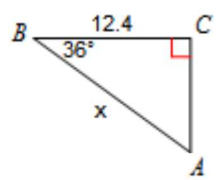


$\sin 62° = \frac{x}{6}$

$6 \sin 62° = x$

$5.30 \approx x$

5.



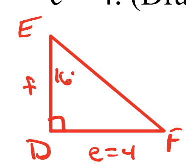
$\cos 36° = \frac{12.4}{x}$

$x \cdot \cos 36° = 12.4$

$x = \frac{12.4}{\cos 36°}$

$x \approx 15.33$

6. Given ΔDEF where $\angle D$ is a right angle. Find f if $m\angle E = 16°$ and $e = 4$. (Draw a picture!)



$\tan 16° = \frac{4}{f}$

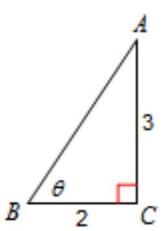
$f \tan 16° = 4$

$f = \frac{4}{\tan 16°}$

$f \approx 13.95$

Find the measure of the indicated angle. Round to the nearest hundredth.

7.

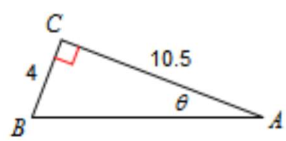


$\tan\theta = \frac{3}{2}$

$\theta = \tan^{-1}\left(\frac{3}{2}\right)$

$\theta \approx 56.31°$

8.

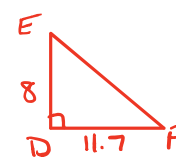


$\tan\theta = \frac{4}{10.5}$

$\theta = \tan^{-1}\left(\frac{4}{10.5}\right)$

$\theta \approx 20.85°$

9. Given ΔDEF where $\angle D$ is a right angle. Find $m\angle E$ if $e = 11.7$ and $f = 8$. (Draw a picture!)



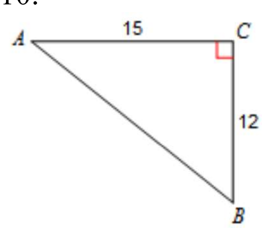
$\tan(m\angle E) = \frac{11.7}{8}$

$m\angle E = \tan^{-1}\left(\frac{11.7}{8}\right)$

$m\angle E \approx 55.64°$

Solve each triangle. Round to the nearest hundredth.

10.



$a^2 + b^2 = c^2$

$(15)^2 + (12)^2 = c^2$

$225 + 144 = c^2$

$369 = c^2$

$\pm\sqrt{369} = c$

$19.21 \approx c$

$\tan(m\angle A) = \frac{12}{15}$

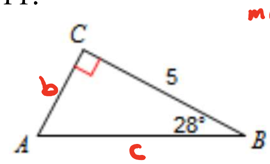
$m\angle A = \tan^{-1}\left(\frac{12}{15}\right)$

$m\angle A \approx 38.66°$

$38.66° + m\angle B = 90°$

$m\angle B = 51.34°$

11.



$m\angle A + 28° = 90°$

$m\angle A = 62°$

$\cos(28°) = \frac{5}{c}$

$c \cdot \cos(28°) = 5$

$c = \frac{5}{\cos(28°)}$

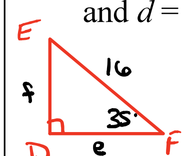
$c \approx 5.66$

$\tan 28° = \frac{b}{5}$

$5 \cdot \tan 28° = b$

$2.66 \approx b$

12. Given ΔDEF where $\angle D$ is a right angle and $m\angle F = 35°$ and $d = 16$. (Draw a picture!)



$\sin(35°) = \frac{f}{16}$

$16 \sin(35°) = f$

$9.18 \approx f$

$\cos(35°) = \frac{e}{16}$

$16 \cos(35°) = e$

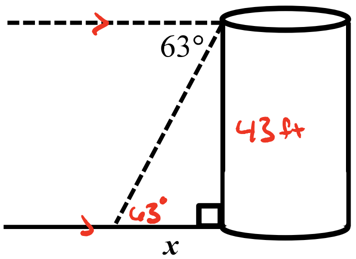
$13.11 \approx e$

$35° + m\angle E = 90°$

$m\angle E = 55°$

Label the picture given and then solve it. If no picture is given, draw your own and solve!

13. The angle of depression is measured from the top of a 43 ft tower to a reference point on the ground. Its value is found to be $63°$. How far is the base of the tower from the point on the ground?



$\tan(63°) = \frac{43}{x}$

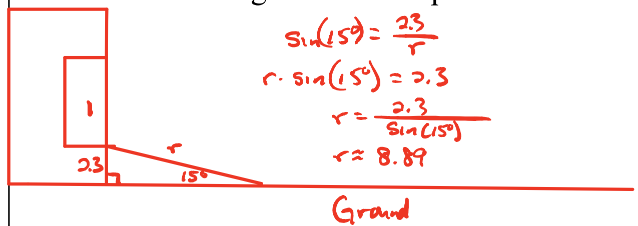
$x \cdot \tan(63°) = 43$

$x = \frac{43}{\tan(63°)}$

$x = 21.91$

The base of the tower is 21.91 feet from the point.

14. The entrance of the old town library is 2.3 ft above ground level. A ramp from the ground level to the library entrance is scheduled to be built. The angle of elevation form the base of the ramp to its top is to be $15°$. Find the length of the ramp



$\sin(15°) = \frac{2.3}{r}$

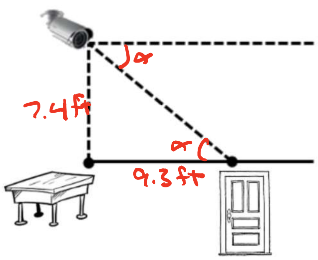
$r \cdot \sin(15°) = 2.3$

$r = \frac{2.3}{\sin(15°)}$

$r \approx 8.89$

The ramp needs to be 8.89 feet long.

15. A closed circuit TV camera is mounted on a wall 7.4 ft above a security desk in an office building. It is used to view an entrance door 9.3 ft from the desk. Find the angle of depression from the camera lens to the entrance door.



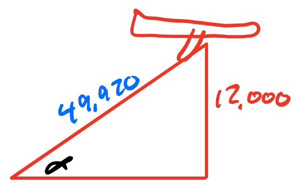
$\tan \alpha = \frac{7.4}{9.3}$

$\alpha = \tan^{-1}\left(\frac{7.4}{9.3}\right)$

$\alpha \approx 38.51°$

The angle of depression is 38.51°.

16. A jet took off at a rate of 260 ft/s and climbed in a straight path for 3.2 min. What was the angle of ele vation of its path if its final altitude was 12,000 ft?



$\boxed{\frac{3.2\text{ min}}{1} \cdot \frac{60\text{ sec}}{1\text{ min}} = 192\text{ sec}}$

$d = rt$

$d = (260)(192)$

$d = 49920$

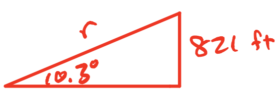
$\sin \alpha = \frac{12{,}000}{49{,}920}$

$\alpha = \sin^{-1}\left(\frac{12{,}000}{49{,}920}\right)$

$\alpha = 13.91°$

The angle of elevation is 13.91°

17. The angle of elevation from the bottom of the world's largest slide located in Peru, Vermont, is approximately $10.3°$. The slide has a vertical drop of 821 ft. Find the length of the slide.



$\sin(10.3°) = \frac{821}{r}$

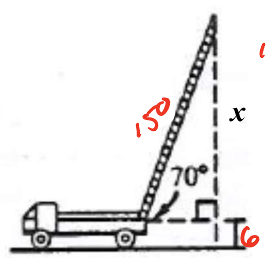
$r \cdot \sin(10.3°) = 821$

$r = \frac{821}{\sin(10.3°)}$

$r \approx 4591.67$

The length of the slide is 4591.67 feet.

18. The extension ladder on top of a 6 ft high hook and ladder truck is 150 ft long. If the angle of elevation of the ladder is $70°$, to what height on a building will the ladder reach?



$\sin 70° = \frac{x}{150}$

$150 \sin(70°) = x$

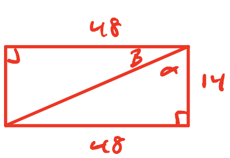
$140.954 \approx x$

height $= 6 + 140.95$

$= 146.95$

The ladder will reach 146.954 feet.

19. A rectangle is 14 cm wide and 48 cm long. Find the measure of the angles on either side of the diagonals.



$\tan \alpha = \frac{48}{14}$

$\alpha = \tan^{-1}\left(\frac{48}{14}\right)$

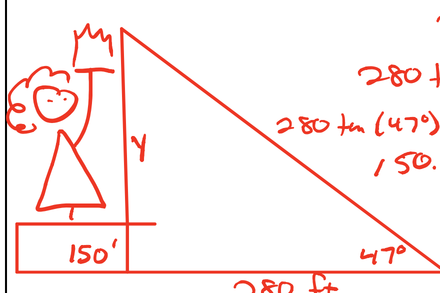
$\alpha \approx 73.74°$

$73.740 + B = 90°$

$B = 16.26°$

The angles are 73.74° and 16.26°.

20. The Statue of Liberty stands on a 150 ft pedestal. From a point 280 ft from the base of the pedestal, the angle of elevation to the top of Liberty's torch is $47°$. Find the height of the statue.



$\tan(47°) = \frac{y+150}{280}$

$280 \tan(47°) = y + 150$

$280 \tan(47°) - 150 = y$

$150.26\text{ ft} \approx y$

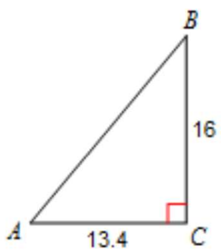
The Statue is 150.26 feet tall.

Skillz Review Simplify the following.			
1. $\dfrac{\frac{2}{5}}{\frac{3}{4}}\dfrac{\cdot 5\cdot 4}{\cdot 5\cdot 4}=\dfrac{8}{15}$	2. $\dfrac{\frac{5}{8}}{\frac{\sqrt{3}}{8}}\dfrac{\cdot 8}{\cdot 8}=\dfrac{5}{\sqrt{3}}=\dfrac{5\sqrt{3}}{3}$	3. $\dfrac{1}{\left(\frac{\sqrt{3}}{2}\right)}\dfrac{\cdot 2}{\cdot 2}=\dfrac{2}{\sqrt{3}}$ $=\dfrac{2\sqrt{3}}{3}$	4. $\dfrac{\left(\frac{\sqrt{3}}{4}\right)}{2\sqrt{2}}\dfrac{\cdot 4}{\cdot 4}=\dfrac{\sqrt{3}\cdot\sqrt{2}}{8\sqrt{2}\cdot\sqrt{2}}$ $=\dfrac{\sqrt{6}}{8\cdot 2}$ $=\dfrac{\sqrt{6}}{16}$

8.4 Basic Trigonometric Functions

APPLICATION

1. Solve the triangle. Round to the nearest hundredth.



$a^2+b^2=c^2$

$(13.4)^2+(16)^2=c^2$

$179.56+256=c^2$

$435.56=c^2$

$20.87\approx c$

$\tan(m\angle A)=\frac{16}{13.4}$

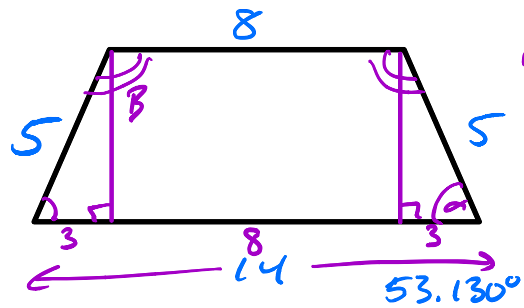
$m\angle A=\tan^{-1}\left(\frac{16}{13.4}\right)$

$m\angle A=50.054°$

$m\angle B+50.054°=90°$

$m\angle B=39.946°$

2. An isosceles trapezoid has sides whose lengths are 5, 5,8, and 14. Find all four angles of the trapezoid.



$\cos\alpha=\frac{3}{5}$

$\alpha=\cos^{-1}\left(\frac{3}{5}\right)$

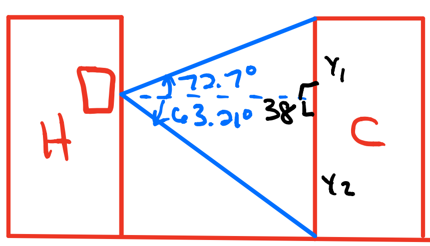
$\alpha=53.130°$

$53.130°+\beta=180°$

$\beta=126.870°$

The angles are $53°, 53°, 127°, 127°$

3. The Hersch Building and the County Hospital are 38 meters apart. From a window in the Hersch Building, the angle of elevation of the top of the hospital is 72.7°. From the same window the angle of depression to the ground at the base of the hospital is 63.21°. Find the height of the hospital.



$\tan(72.7°)=\frac{y_1}{38}$

$38\tan(72.7°)=y_1$

$122.004\approx y_1$

$\tan(63.21°)=\frac{y_2}{38}$

$38\tan(63.21°)=y_2$

$75.260\approx y_2$

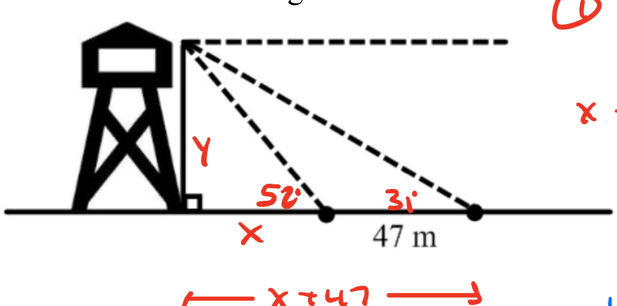
height $=y_1+y_2$

$=122.004+75.260$

$=197.264$

The building is about 197 feet tall.

4. An engineer determines that the angle of elevation from her position to the top of a tower is 52°. She measures the angle of elevation again from a point 47 m farther from the tower and finds it to be 31°. Both positions are due east of the tower. Find the height of the tower.



① $\tan(52°)=\frac{y}{x}$

$x\tan(52°)=y$

② $\tan(31°)=\frac{y}{x+47}$

$\tan(31°)=\frac{x\tan(52°)}{x+47}$

$(x+47)\tan(31°)=x\tan(52°)$

$x\tan(31°)+47\tan(31°)=x\tan(52°)$

$47\tan(31°)=x\tan(52°)-x\tan(31°)$

$47\tan(31°)=x\left[\tan(52°)-\tan(31°)\right]$

$\frac{47\tan(31°)}{\left[\tan(52°)-\tan(31°)\right]}=x$

$41.156\approx x$

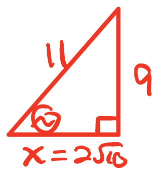
③ $y=41.156\tan(52°)$

$y\approx 53.2$

The tower is about 53 meters tall.

5. Given the trig ratio, draw a right triangle, label all sides, find the other 2 trig ratios. DO NOT FIND θ!

$\sin\theta = \dfrac{9}{11}$

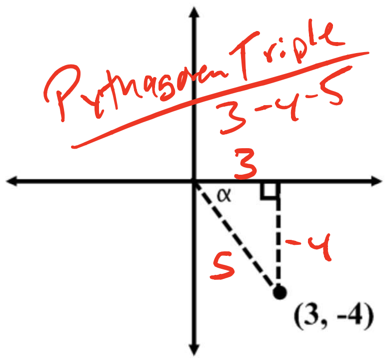


$x^2+y^2=r^2$
$x^2+(9)^2=(11)^2$
$x^2+81=121$
$x^2=40$
$x=\pm\sqrt{40}$
$x=2\sqrt{10}$

$\cos\theta = \dfrac{2\sqrt{10}}{11}$

$\tan\theta = \dfrac{9}{2\sqrt{10}} = \dfrac{9\sqrt{10}}{20}$

6. Given the right triangle that connects the origin and the coordinate point (3, -4) shown below, find sin α.

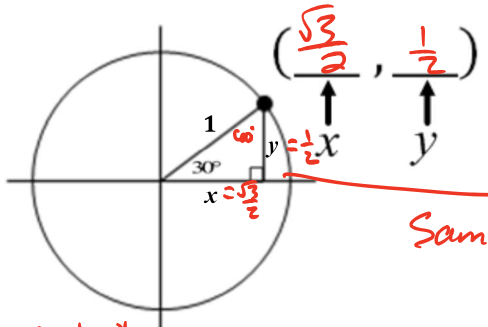


$\sin\alpha = \dfrac{-4}{5}$

7. Use a combination of trig and Pythagorean Theorem to find the exact value of the x and y coordinate for the circles below whose centers are the origin of the coordinate plane and radii are equal to one.

(Answers must be expressed as exact value fractions, do not give approximate decimal values!)

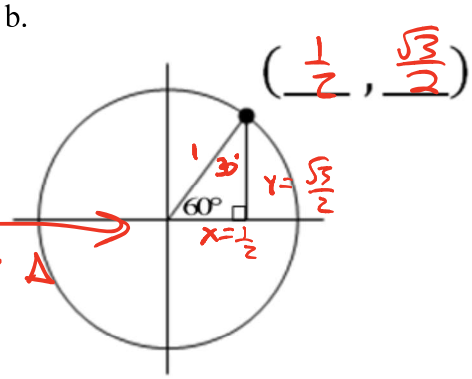
a.



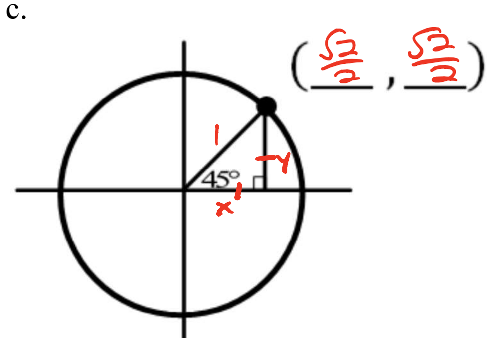
$\sin(30°)=\frac{y}{1}$
$\sin(30°)=y$
$\frac{1}{2}=y$ (calculator)

$x^2+y^2=r^2$
$x^2+(\frac{1}{2})^2=(1)^2$
$x^2+\frac{1}{4}=\frac{4}{4}$
$x^2=\frac{3}{4}$
$x=\pm\sqrt{\frac{3}{4}}=\frac{\sqrt{3}}{2}$

b.



c.



$x^2+y^2=r^2$
$x^2+x^2=(1)^2$
$2x^2=1$
$x^2=\frac{1}{2}$
$x=\pm\sqrt{\frac{1}{2}}=\frac{1}{\sqrt{2}}=\frac{\sqrt{2}}{2}$

8. The population of grasshoppers after t weeks where $0 \le t \le 12$ is estimated by $P(t) = 7500 + 3000\sin(90t)$.

a. Find $P(5)$. What does it mean in this situation?

$P(5) = 7500 + 3000\sin(90(5)°) = 7500 + 3000\sin(450°) = 7500 + 3000(1)$
$= 10{,}500$

In 5 weeks, the # of grasshoppers is 10,500.

b. What is the initial estimate?

$P(0) = 7500 + 3000\sin(90°\cdot 0) = 7500 + 3000\sin(0°)$
$= 7500 + 3000(0)$
$= 7500$