Written work: Need a multi-plage PDF.

Printer/scanner, library, Learning commons, ...

Home-made pictures not good. (cell-phone pictures suck).

Need a clear white background.

Clear, dark writing.

Check your e-mail.

RocketBook works well.

ANY decent printer/scanner will do it.

1. 0/1 points LarTrig10 2.1.029. [3882437]

Factor the expression. Use the fundamental identities to simplify, if necessary. (There is more than one correct form of each answer.)

$5\sin^2(x) - 8\sin(x) - 4$

$(\sin(x) - 2)(5\sin(x) + 2)$

SLEDGE HAMMER

$a=5, b=-8, c=-4$

$b^2-4ac = (-8)^2 - 4(5)(-4)$

$= 64 + 80 = 144 \rightsquigarrow \sqrt{144} = 12$

$u = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$= \frac{8 \pm \sqrt{144}}{2(5)} = \frac{8 \pm 12}{10}$ $\frac{20}{10} = 2$, $\frac{-4}{10} = -\frac{2}{5}$

So we have this

$5(u-2)(u+\frac{2}{5})$

$(u-2)(5u+2)$

Let $u = \sin(x)$, then

$5u^2 - 8u - 4 = 0$

different signs

Factors of $(5)(-4)$:

5 24

2

$5u^2 - 10u + 2u - 4$

$= 5u(u-2) + 2(u-2)$

$= (u-2)(5u+2)$

$= (\sin(x)-2)(5\sin(x)+2)$

$\frac{2}{5} \cdot 5 = 2$

144

2 | 144
2 | 72
2 | 36
2 | 18
3 | 9
3

$\sqrt{144} = \sqrt{2^4 \cdot 3^2} = 2^2 3^1 = 12$

$5u^2 - 8u - 4$

Magic # is $(5)(-4) = -20$

$-8 = -9 + 1$ $\quad -9$

$= -10 + 2$ $\quad -20$ sweet! Magic!

$5u^2 - 10u + 2u - 4$ etc

**23.** 0/4 points LarTrig10 1.8.052. [3882204]

For the simple harmonic motion described by the trigonometric function, find the maximum displacement, the frequency, the value of $d$ when $t = 5$ and the least positive value of $t$ for which $d = 0$. Use a graphing utility to verify your results.

$d = \frac{1}{4}\cos(16\pi t)$

(a) Find the maximum displacement. Amplitude

1/4

(b) Find the frequency.

8 cycles per unit of time

(c) Find the value of $d$ when $t = 5$.

$d =$ 1/4

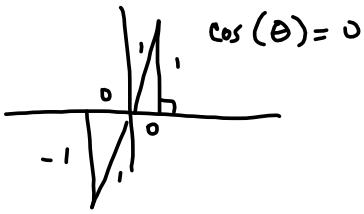
(d) Find the least positive value of $t$ for which $d = 0$.

$t =$ 1/32

$d = \frac{1}{4}\cos(16\pi t) = 0$

$\Rightarrow \cos(16\pi t) = 0$

$\Rightarrow 16\pi t = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \ldots$




$\cos(\theta) = 0$

Frequency $= \frac{1}{\text{period}}$

$16\pi t = 2\pi$ when?

$t = \frac{2\pi}{16\pi} = \frac{1}{8} = T = \text{period} \Rightarrow$

freq $= 8$

$d(5) = \frac{1}{4}\cos(16\pi(5))$

$= \frac{1}{4}\cos(80\pi)$

$= \frac{1}{4}\cos(2\pi \cdot 40)$

$= \frac{1}{4}\cos(0) = \frac{1}{4}\cos(2\pi)$

$= \frac{1}{4}(1) = \frac{1}{4}$

Least positive value:

$16\pi t = \frac{\pi}{2}$

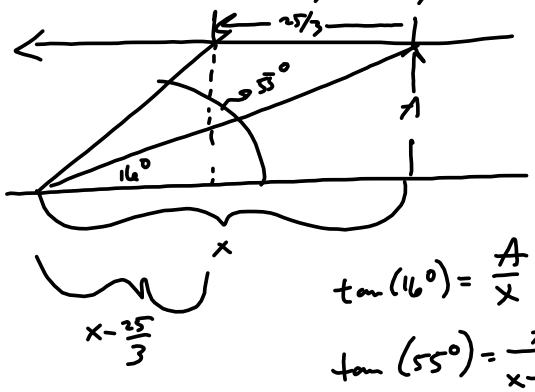
$t = \frac{\pi}{2} \cdot \frac{1}{16\pi} = \frac{1}{32}$

16. 0/1 points LarTrig10 1.8.029. [3882172]

You observe a plane approaching overhead and assume that its speed is 500 miles per hour. The angle of elevation of the plane is 16° at one time and 55° one minute later. Approximate the altitude of the plane. (Round your answer to two decimal places.)

2.99 mi

$\left(500\frac{mi}{hr}\right)\left(1\,min\right)\left(\frac{1\,hr}{60\,min}\right)=\frac{25}{3}\,mi$




$\tan(16^\circ)=\frac{A}{x}=a$

$\tan(55^\circ)=\frac{A}{x-\frac{25}{3}}=b$

$A=A$, etc.

$ax=A$

$b\left(x-\frac{25}{3}\right)=A$

$ax=bx-\frac{25b}{3}$

$\Rightarrow ax-bx=-\frac{25b}{3}$

$\Rightarrow (a-b)x=-\frac{25b}{3}$

$x=\frac{-25b}{3(a-b)}\approx 10.42684954$

& $\frac{A}{x}=\tan(16^\circ)$

$A=(10.4\ldots)\tan(16^\circ)$

$\approx 2.989850993$

$\approx 2.99$

21. 0/1 points LarTrig10 1.8.047.

Find a model for simple harmonic motion satisfying the specified conditions.

| Displacement, $d$ ($t = 0$) | Amplitude, $a$ | Period |
|---|---|---|
| 8 inches | 8 inches | 1.5 seconds |

$d =$ $8\cos\left(\frac{4\pi t}{3}\right)$

sine/cosine

$f(t) = 8$

$T = 1.5\ s$ = Period

Want

$bt = 2\pi$, when $t = 1.5$

$1.5b = 2\pi$

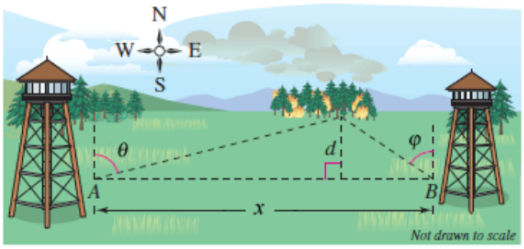
$b = \frac{2\pi}{1.5} = \frac{2\pi}{\frac{3}{2}} = \frac{4\pi}{3}$

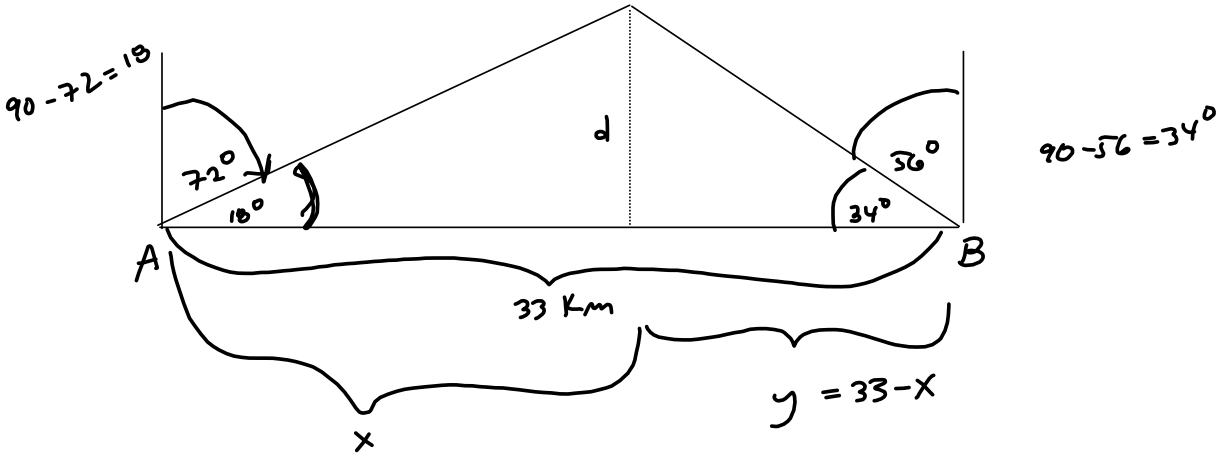
$f(t) = 8\cos\left(\frac{4\pi}{3}t\right)$

19. 0/1 points LarTrig10 1.8.040.MI. [3882407]

Fire tower $A$ is $x = 33$ kilometers due west of fire tower $B$. A fire is spotted from the towers, and the bearings from $A$ and $B$ are $\theta$ = N 72° E and $\varphi$ = N 56° W, respectively (see figure). Find the distance $d$ of the fire from the line segment $AB$. (Round your answer to two decimal places.)

$d$ = 7.24 km




$\frac{d}{x} = \tan 18^\circ$ $\qquad$ $\frac{d}{y} = \frac{d}{33-x} = \tan 34^\circ$

$d = x \tan 18^\circ$ $\qquad$ $d = (33-x)\tan 34^\circ$

$x \tan 18^\circ = (33-x)\tan(34^\circ)$

Solve for $x$

Then use

$d = x \tan(18^\circ)$

## Evaluating Trigonometric Functions

**In Exercises 23–32, find the exact values of the remaining trigonometric functions of $\theta$ satisfying the given conditions.**

**23.** $\tan\theta = \frac{15}{8}$, $\sin\theta > 0$

**24.** $\cos\theta = \frac{8}{17}$, $\tan\theta < 0$

**25.** $\sin\theta = 0.6$, $\theta$ lies in Quadrant II.

**26.** $\cos\theta = -0.8$, $\theta$ lies in Quadrant III.

**27.** $\cot\theta = -3$, $\cos\theta > 0$

**28.** $\csc\theta = 4$, $\cot\theta < 0$

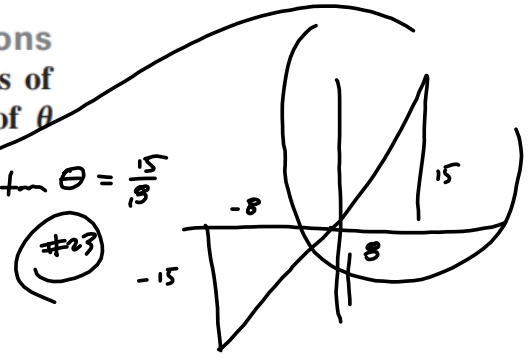
**29.** $\cos\theta = 0$, $\csc\theta = 1$

**30.** $\sin\theta = 0$, $\sec\theta = -1$

**31.** $\cot\theta$ is undefined, $\frac{\pi}{2} \le \theta \le \frac{3\pi}{2}$

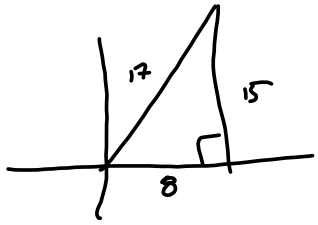
#23

$\tan\theta = \frac{15}{8}$




$r^2 = 15^2 + 8^2 = 225 + 64 = 289$

$= 17^2 \Rightarrow r = 17$ (positive)




$\sin\theta = \frac{15}{17}$ $\quad \csc\theta = \frac{17}{15}$

$\cos\theta = \frac{8}{17}$ $\quad \sec\theta = \frac{17}{8}$

$\tan\theta = \frac{15}{8}$ $\quad \cot\theta = \frac{8}{15}$

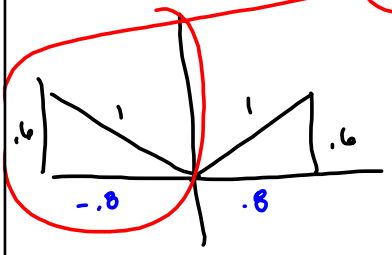
#25

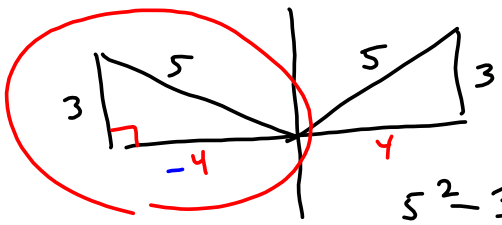
$\sin\theta = .6$, $\theta \in QII$

$.6 = \frac{6}{10} = \frac{3}{5} = \sin\theta$

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

$c^2 - 3^2 = b^2$




$5^2 - 3^2 = 25 - 9 = 16 = 4^2$

$\Rightarrow 4$

$1^2 - .6^2 = 1 - .36 = .64 = b^2$

$\Rightarrow b = -\sqrt{.64} = -.8$

QII!

$b = \pm\sqrt{.64} = \pm .8 \rightarrow$ Take $-.8$

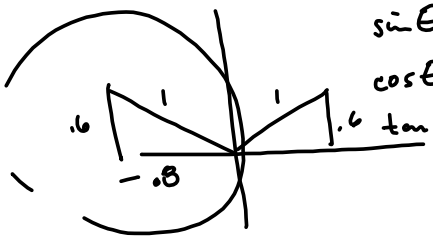
$\sin\theta = .6 = \frac{3}{5}$

$\cos\theta = -.8 = \frac{-4}{5}$

$\tan\theta = \frac{.6}{-.8} = -.75 = -\frac{3}{4}$

The decimals, here, are exact.
They won't always be.

$\sin\theta = .6$, $\theta \in$ QII




$\sin\theta = 0.6$

$\cos\theta = -0.8$

$\tan\theta = -0.75$

$\frac{.6}{-.8} = -.75$

$1^2 - .6^2 = 1 - .36 = .64 = .8^2$

$\csc\theta = \frac{1}{.6} = \frac{1}{\frac{6}{10}} = \frac{10}{6} = \frac{5}{3} = 1.\overline{66}$

$\sec\theta = -\frac{1}{.8} = -\frac{10}{8} = -\frac{5}{4} = -1.2$

$\cot\theta = -\frac{1}{.75} = -\frac{4}{3} = -1.\overline{3}$

**Finding a Reference Angle** **In Exercises 47–54, find the reference angle $\theta'$. Sketch $\theta$ in standard position and label $\theta'$.**

**47.** $\theta = 160°$ **48.** $\theta = 309°$

**49.** $\theta = -125°$ **50.** $\theta = -215°$

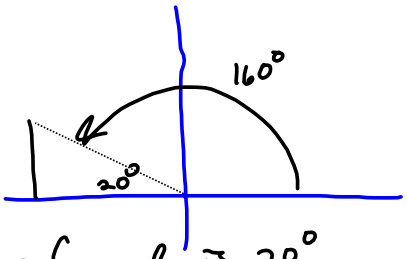
**51.** $\theta = \frac{2\pi}{3}$ **52.** $\theta = \frac{7\pi}{6}$

**53.** $\theta = 4.8$ **54.** $\theta = 12.9$

**Using a Reference Angle** **In Exercises 55–68, evaluate the sine, cosine, and tangent of the angle without using a calculator.**

**55.** 225° **56.** 300°

**57.** 750° **58.** 675°




ref angle is $20°$

$\theta = 12.9$

$2\pi \approx 6.28$

$\frac{12.9}{2\pi} \approx 2.05\ldots$ revs

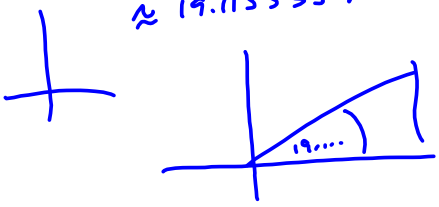
subtract of full revs

$.053\ldots$

convert to radians:

$.3336293856$

$\approx 19.11555572°$




```
      2.053098766
Ans-2
      .0530987659
Ans*2π
      .3336293856
Ans*180/π
      19.11555572
```

**Solving for $\theta$** **In Exercises 91–96, find two solutions of each equation. Give your answers in degrees ($0° \le \theta < 360°$) and in radians ($0 \le \theta < 2\pi$). Do not use a calculator.**

**91.** (a) $\sin\theta = \frac{1}{2}$ (b) $\sin\theta = -\frac{1}{2}$

**92.** (a) $\cos\theta = \frac{\sqrt{2}}{2}$ (b) $\cos\theta = -\frac{\sqrt{2}}{2}$

**93.** (a) $\cos\theta = \frac{1}{2}$ (b) $\sec\theta = 2$

**94.** (a) $\sin\theta = \frac{\sqrt{3}}{2}$ (b) $\csc\theta = \frac{2\sqrt{3}}{3}$

**95.** (a) $\tan\theta = 1$ (b) $\cot\theta = -\sqrt{3}$

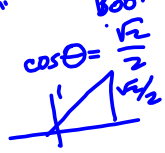
**96.** (a) $\cot\theta = 0$ (b) $\sec\theta = -\sqrt{2}$

$\frac{\sqrt{2}}{2}\cdot\frac{\sqrt{2}}{\sqrt{2}} = \frac{2}{2\sqrt{2}} = \frac{1}{\sqrt{2}}$ $= \cos\theta$

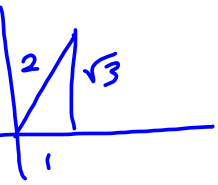

hard to "see" the 30-60 triangle

Book

$\cos\theta = \frac{\sqrt{2}}{2}$




$\frac{2\sqrt{3}}{3} = \frac{2\sqrt{3}}{3}\cdot\frac{\sqrt{3}}{\sqrt{3}} = \frac{2\cdot 3}{3\sqrt{3}} = \frac{2}{\sqrt{3}}$



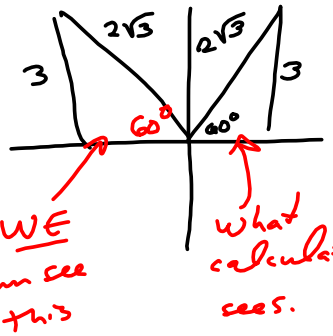

$\csc\theta = \frac{2\sqrt{3}}{3}$ means $\sin\theta = \frac{3}{2\sqrt{3}} = \frac{3\sqrt{3}}{2\sqrt{3}\sqrt{3}} = \frac{3\sqrt{3}}{2\cdot 3}$

$= \frac{\sqrt{3}}{2}$ etc.

$\csc\theta = \frac{2\sqrt{3}}{3} \Rightarrow \sin\theta = \frac{3}{2\sqrt{3}}$

$\Rightarrow \sin^{-1}(\sin\theta) = \theta = \sin^{-1}\left(\frac{3}{2\sqrt{3}}\right) = 60°$

Not quite. Need to interpret.




WE can see this

What calculator sees.

So, $\theta = 120°, 60°$

$\theta \in \{60°, 120°\}$

$= \left\{\frac{\pi}{3}, \frac{2\pi}{3}\right\}$

8. Sketch the graph of $g(x) = -4\csc\left(3x - \frac{\pi}{2}\right)$. Show and clearly label the max/min points and all asymptotes.

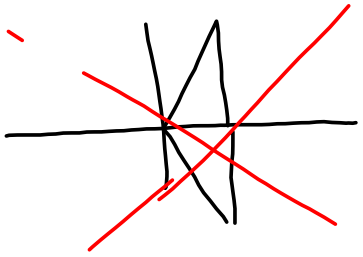
9. Consider the equation $\tan(2x) = \sqrt{3}$.

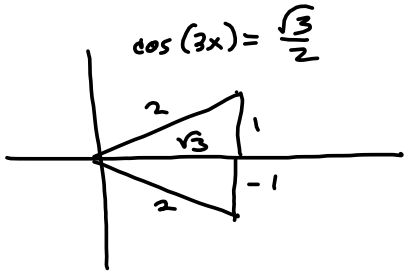
   a. Find all solutions $x \in [-2\pi, 2\pi]$. Answers must be exact.

   b. Find all solutions $x \in (-\infty, \infty)$. Report your solutions as a *set*.

10. Write an algebraic expression that is equivalent to $\cos(\arcsin(3x))$.

(2) Find all $x \in [-2\pi, 2\pi]$ ∋ $\cos(3x) = \frac{\sqrt{3}}{2}$






So $3x = \frac{\pi}{6}, \frac{11\pi}{6}, -\frac{\pi}{6}, -\frac{11\pi}{6}$

$\Rightarrow x = -\frac{11\pi}{18}, -\frac{\pi}{18}, \frac{\pi}{18}, \frac{11\pi}{18}$

NOT a complete list!

To find ALL $x \in [-2\pi, 2\pi]$

I need ALL $3x \in [-6\pi, 6\pi]$

$-2\pi \le x \le 2\pi \Rightarrow$

$-6\pi \le 3x \le 6\pi$

$3x =$

$\frac{\pi}{6}, \frac{13\pi}{6}, \frac{25\pi}{6}, \frac{37\pi}{6}$ Too fahhh.

$-\frac{11\pi}{6}, -\frac{23\pi}{6}, -\frac{35\pi}{6}$

$\frac{11\pi}{6} \pm 2\pi \rightarrow \frac{23\pi}{6}, -\frac{\pi}{6}$

$\frac{11\pi}{6} \pm 4\pi \rightarrow \frac{35\pi}{6}, -\frac{13\pi}{6}$

$\frac{11\pi}{6} \pm 6\pi \rightarrow \frac{47\pi}{6}$ Nope, $-\frac{25\pi}{6}$

$\frac{\pi}{6} + 2\pi = \frac{\pi + 12\pi}{6} = \frac{13\pi}{6}$

$\frac{13\pi}{6} + \frac{12\pi}{6} = \frac{25\pi}{6}$

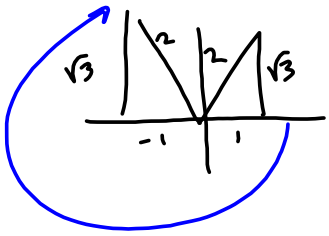
$\frac{25\pi}{6} + \frac{12\pi}{6} = \frac{37\pi}{6} > 6\pi$ went too far?

List of values/solns

$\frac{\pi}{6}, \frac{11\pi}{6} \rightsquigarrow \frac{\pi}{18}, \frac{11\pi}{18}$

If it works, then so does it $\pm 2\pi$.

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




$2x = -\frac{5\pi}{3}, -\frac{4\pi}{3}, \frac{\pi}{3}, \frac{2\pi}{3}, -\frac{11\pi}{3}, -\frac{10\pi}{3}, \frac{7\pi}{3}, \frac{8\pi}{3}$

$-2\pi + \frac{\pi}{3} = -\frac{5\pi}{3}$

Wait: $-2\pi \le x \le 2\pi \Rightarrow$

$-4\pi \le 2x \le 4\pi$

$-\frac{5\pi}{3} - 2\pi = -\frac{5\pi}{3} - \frac{6\pi}{3} = -\frac{11\pi}{3}$

$-\frac{4\pi}{3} - \frac{6\pi}{3} = -\frac{10\pi}{3}$

$\Rightarrow$ (a) $x \in \left\{-\frac{11\pi}{6}, -\frac{5\pi}{3}, -\frac{5\pi}{6}, -\frac{2\pi}{3}, \frac{\pi}{6}, \frac{\pi}{3}, \frac{5\pi}{6}, \frac{4\pi}{3}\right\} \equiv A$

$2x = -\frac{5\pi}{3}, -\frac{4\pi}{3}, \frac{\pi}{3}, \frac{2\pi}{3}, -\frac{11\pi}{3}, -\frac{10\pi}{3}, \frac{7\pi}{3}, \frac{8\pi}{3}$

(b) Then $2x = -\frac{5\pi}{3} + 2n\pi \Rightarrow \quad (n \in \mathbb{Z})$

$x = -\frac{5\pi}{6} + n\pi$

WebAssign wants a list.

$-\frac{11\pi}{6} + n\pi, -\frac{5\pi}{3} + n\pi$, etc.

I LIKE $x \in \{y + n\pi \mid y \text{ is ans. from (a)}\}$

$x \in \{y + n\pi \mid y \in A\}$

$= \{\text{☺} + n\pi \mid \text{☺} \in A\}$