

Sketch the graphs. For periodic functions, sketch at least 2 periods.

SCORE: \_\_\_\_ / 12 PTS

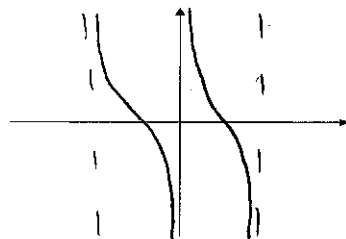
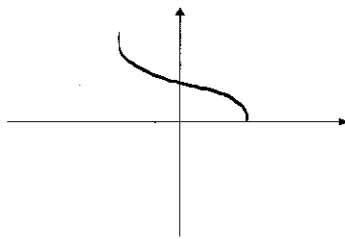
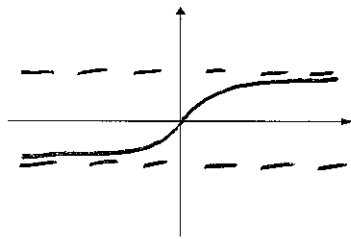
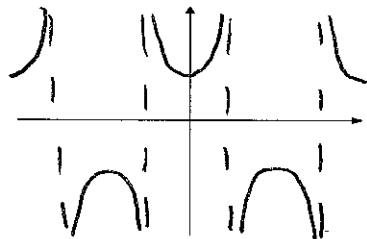
You only need to get the general position and shape correct. Do NOT plot points.

[a]  $y = \sec x$

[b]  $y = \tan^{-1} x$

[c]  $y = \arccos x$

[d]  $y = \cot x$



Fill in the blanks. Write "DNE" if the question has no answer.

SCORE: \_\_\_\_ / 28 PTS

The domain of  $f(x) = \arcsin x$  is  $[-1, 1]$

The range of  $f(x) = \cos^{-1} x$  is  $[0, \pi]$

The range of  $f(x) = \csc x$  is  $(-\infty, -1] \cup [1, \infty)$

The domain of  $f(x) = \tan x$  is  $x \neq \frac{\pi}{2} + n\pi, n \in \mathbb{Z}$

The equations of the asymptotes of  $f(x) = \cot x$  are

The equations of the asymptotes of  $f(x) = \tan^{-1} x$  are

$$\underline{x = n\pi, n \in \mathbb{Z}}$$

$$\underline{y = \pm \frac{\pi}{2}}$$

As  $x \rightarrow \frac{\pi}{2}^+$ ,  $\tan x \rightarrow$   $-\infty$

$\arcsin(-\frac{\sqrt{2}}{2}) =$   $-\frac{\pi}{4}$

$\cos^{-1}(-\frac{1}{2}) =$   $\frac{2\pi}{3}$

$\arctan \frac{\sqrt{3}}{3} =$   $\frac{\pi}{6}$

$\cos(\arccos \frac{4}{3}) =$  DNE

$\sin^{-1}(\sin(-\frac{\pi}{3})) =$   $-\frac{\pi}{3}$

$\tan(\arctan 3) =$  3

$\tan^{-1}(\tan \frac{5\pi}{6}) =$   $-\frac{\pi}{6}$

Simplify the following expressions completely. Show proper reasoning to justify your answer.

SCORE: \_\_\_\_ / 14 PTS

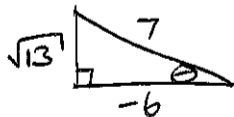
[a]  $\tan(\arccos(-\frac{6}{7})) = \tan \theta = -\frac{\sqrt{13}}{6}$

$$\theta = \arccos(-\frac{6}{7})$$

$$\cos \theta = -\frac{6}{7}, \theta \in [0, \pi]$$

i.e.  $\theta$  in  $Q_1$  or  $Q_2$

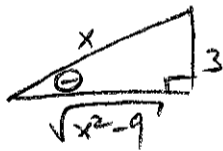
$\cos \theta < 0 \rightarrow \theta$  in  $Q_2$



[b]  $\sec(\sin^{-1} \frac{3}{x})$ , where  $x > 0$

$$\theta = \sin^{-1} \frac{3}{x}$$

$$\sin \theta = \frac{3}{x}$$



$$\begin{aligned} \sec(\sin^{-1} \frac{3}{x}) &= \sec \theta = \frac{x}{\sqrt{x^2 - 9}} \\ &= \frac{x \sqrt{x^2 - 9}}{x^2 - 9} \end{aligned}$$

Graph 2 periods of the function  $y = -5\cos(\frac{5}{3}x + \frac{13\pi}{6}) + 2$ .



Find the coordinates of the 9 points discussed in lecture, corresponding to 2 complete periods, starting at the phase shift.

Label all  $x$ - and  $y$ - values for the 9 points on the appropriate axes, using a consistent scale for each axis.

MID = 2

AMP =  $| -5 | = 5$

MAX =  $2 + 5 = 7$

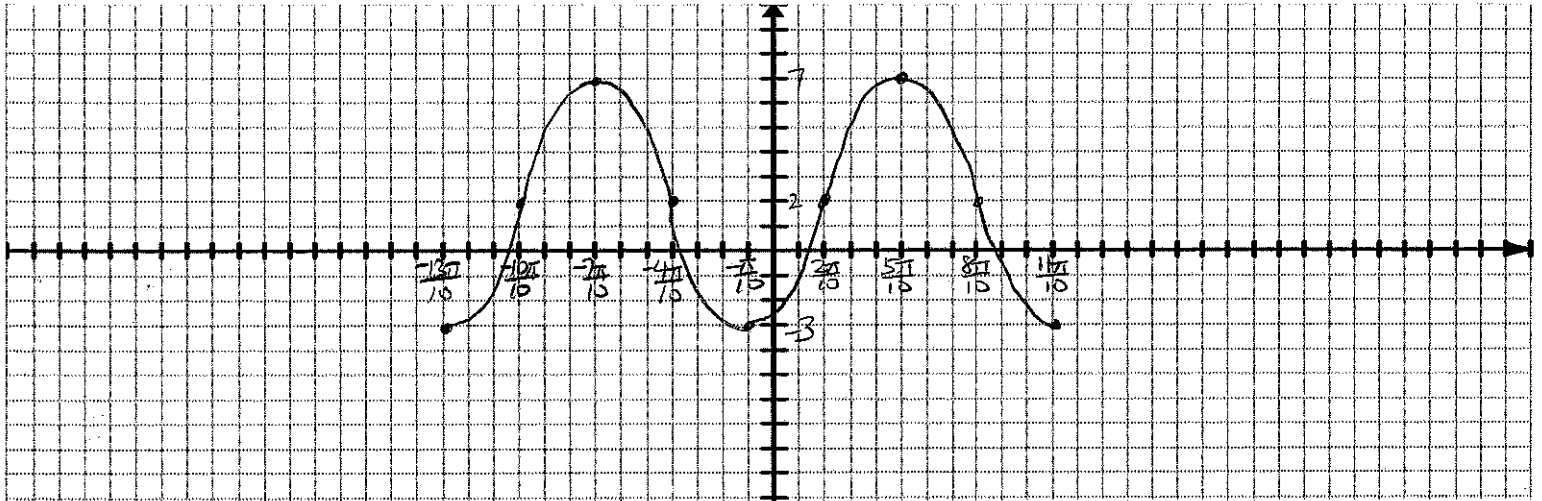
MIN =  $2 - 5 = -3$

PERIOD =  $\frac{2\pi}{\frac{5}{3}} = 2\pi \cdot \frac{3}{5} = \frac{6\pi}{5}$

$\frac{1}{4}$  PERIOD =  $\frac{1}{4} \cdot \frac{6\pi}{5} = \frac{3\pi}{10}$

START  $\frac{5}{3}x + \frac{13\pi}{6} = 0 \rightarrow \frac{5}{3}x = -\frac{13\pi}{6} \rightarrow x = -\frac{13\pi}{6} \cdot \frac{3}{5} = -\frac{13\pi}{10}$

- POINTS:  $(-\frac{13\pi}{10}, -3)$      $(-\frac{10\pi}{10}, 2)$      $(-\frac{7\pi}{10}, 7)$      $(-\frac{4\pi}{10}, 2)$      $(-\frac{\pi}{10}, -3)$   
 $(\frac{2\pi}{10}, 2)$      $(\frac{5\pi}{10}, 7)$      $(\frac{8\pi}{10}, 2)$      $(\frac{11\pi}{10}, -3)$



BJ has unhealthy eating habits, which causes his weight to fluctuate up and down.

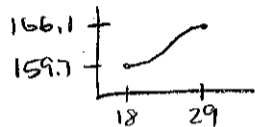
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On Jan 19<sup>th</sup>, his weight reached a low of 159.7 pounds, then increased until it reached a high of 166.1 pounds on Jan 30<sup>th</sup>.

Assuming that BJ's weight corresponds to a sinusoidal function, find an equation for BJ's weight on the  $t^{\text{th}}$  day after Jan 1<sup>st</sup>.

$$\text{MID} = \frac{166.1 + 159.7}{2} = 162.9$$

$$\text{AMP} = \frac{166.1 - 159.7}{2} = 3.2$$



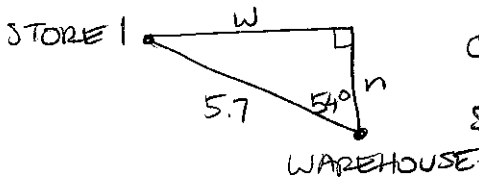
$$-3.2 \cos \frac{\pi}{11}(t-18) + 162.9$$

START  $t=18$  (DAYS AFTER JAN 1)

$$\text{PERIOD} \quad 2(29-18) = 22 = \frac{2\pi}{B} \rightarrow B = \frac{2\pi}{22} = \frac{\pi}{11}$$

A truck travels 5.7 miles from a warehouse to a store on a bearing of N  $54^\circ$  W, then changes direction and travels another 4.6 miles on a bearing of S  $17^\circ$  E to a second store.

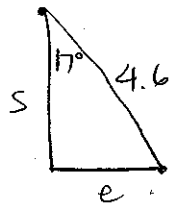
- [a] Find the straight-line distance from the warehouse to the second store. **You may only use techniques covered in lecture so far.** Round your answers to 1 decimal place. **You may need to calculate other information that is not explicitly requested.**



$$\cos 54^\circ = \frac{n}{5.7} \rightarrow n = 5.7 \cos 54^\circ = 3.4$$

$$\sin 54^\circ = \frac{w}{5.7} \rightarrow w = 5.7 \sin 54^\circ = 4.6$$

STORE 1

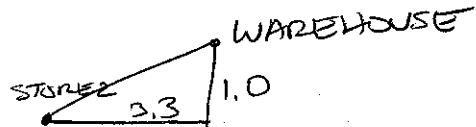


$$\cos 17^\circ = \frac{s}{4.6} \rightarrow s = 4.6 \cos 17^\circ = 4.4$$

$$\sin 17^\circ = \frac{e}{4.6} \rightarrow e = 4.6 \sin 17^\circ = 1.3$$

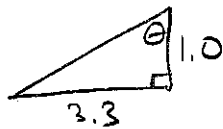
$$\text{TOTAL SOUTH } 4.4 - 3.4 = 1.0$$

$$\text{WEST } 4.6 - 1.3 = 3.3$$



- [b] Find the bearing of the second store from the warehouse. Use the same format for bearing as in the question. Round your answer to the nearest integer.

$$\text{DISTANCE} = \sqrt{3.3^2 + 1.0^2} = 3.4 \text{ mi}$$



$$\tan \theta = \frac{3.3}{1.0} \rightarrow \theta = \tan^{-1} 3.3 = 73^\circ$$

FINAL BEARING S  $73^\circ$  W