Math 251

Trigonometry Problems Names:_____

Show all relevant work!

1. If a fireman leans a 24 foot ladder against a building at a 70° angle,
   (a) How far from the building is the base of the ladder?

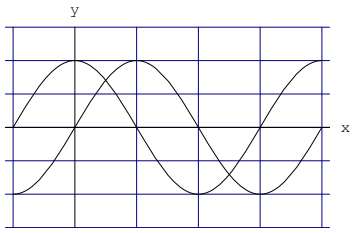
   (b) How high (above the ground) does the ladder reach on the building?

2. A merry-go-round with a 10 ft. diameter is spinning at 12rpm.
   (a) What is the angular velocity of the merry-go-round in radians per second?

   (b) How fast (in feet per second) is Raul travelling if he sits on the outer edge of the merry-go-round?

   (c) How fast is Klaus travelling (in feet per second) if he sits at the center of the merry-go-round?

3. The functions $\sin x$ and $\cos x$ are almost identical except for horizontal position (see below). That means you should be able to express $\sin x$ as a shift of $\cos x$ and similarly, $\cos x$ as a shift of $\sin x$. Specifically, find c so that $\sin x = \cos(x + c)$ and find c so that $\cos x = \sin(x + c)$.

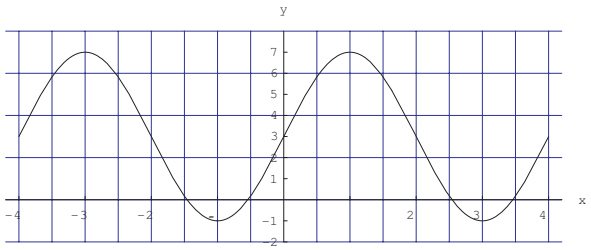


4. Solve the following for $x \in \mathbb{R}$.
   (a) $\sin x = 1$

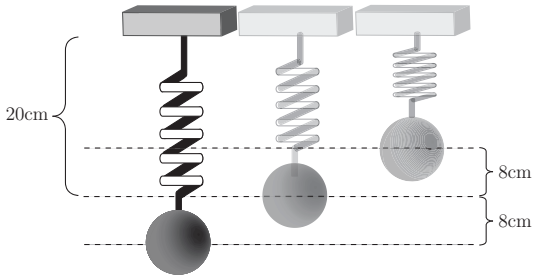
   (b) $\cos 3x = 1$

   (c) $\sin(x^2 - 1) = 1$

5. Find two different equations for the periodic function shown on the right. (One in terms of $\sin x$ and the other in terms of $\cos x$).



6. A mass is suspended at the end of a spring where it hangs 20cm from the ceiling. It is displaced 8cm below its rest position and released. It reaches the point closest to the ceiling (12cm) after 1 second. Write a periodic model for this situation giving the distance of the mass from the ceiling, y, as a function of time, t.



7. The table below shows the US average unemployment rate at the beginning of each year from 1993 – 2003. (Where 1993 is $t = 0$).

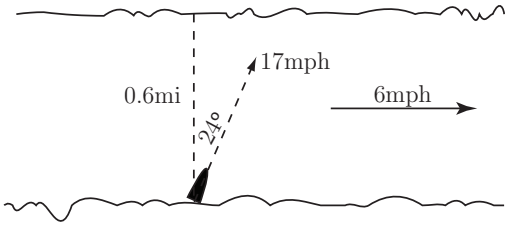
t (years)	0	1	2	3	4	5	6	7	8	9	10
$U(t)$ (% unemployment)	7.3	6.6	5.6	5.6	5.3	4.6	4.3	4.0	4.1	5.6	5.7

a) Write a periodic function that models these data using methods discussed in class.

b) Use your model to predict the unemployment rate for January of 2016.

8. A boat launches from one shore of a river at a heading 24° downstream. The river is 0.6 miles wide in most places. If the current moves at 6mph and the boat's speed, relative to the water, is 17mph,

(a) How far down the opposite shore will the boat arrive?



(b) How far will the boat have traveled getting there?

(c) How fast (relative to the shore) did the boat travel?

(d) How long will it take to get there?