**Nipissing University Senior Mathematics Competition**

Problem Set 1 – Trigonometry – May 7, 2010

1. a) Use at least 8 values from $0\leq t\leq 4$ to create a table of values for the Lissajous figure comprised of the two functions:

$$x=\sin(\left(πt\right))$$

$$y=\cos(\left(πt\right))$$

b) Graph the Lissajous figure. Be sure to indicate the direction of rotation.

1. Create the Lissajous figure from the parametric equations below. Be sure to indicate the direction of rotation.

$$x=\sin(\left(πt\right))$$

$$y=\cos(\left(2πt-\frac{π}{3}\right))$$

***HINT: Use*** $0\leq t\leq 2$ ***and increase your values of t by 0.25***

1. a) Graph the function $f\left(x\right)=2\sin(\left(x-\frac{π}{6}\right))$ on the domain $-2π\leq x\leq 2π$.

b) Graph the inverse. Given that the inverse is not a function, how would you restrict the domain so that the inverse relation is an inverse function?

c) What is the equation of the inverse relation?

1. On the same grid, graph the functions, where $-3\leq x\leq 3$.
2. $y=\frac{3}{4}x$
3. $y=\cos(\left(2πx\right))$
4. $y=\frac{3}{4}x+\cos(\left(2πx\right))$
5. a) On the same axis plot the curves:

 $A\left(x\right)=2\sin(\left(πx\right))$

$$B\left(x\right)=2\cos(\left[π\left(x-3\right)\right])$$

Choose a scale for the *x* axis which will fit two periods of both graphs.

b) On the same graph, plot the function $D\left(x\right)=A\left(x\right)+B\left(x\right)$.

1. A pier needs to be elevated so that waves do not reach the deck. Engineers have studied the waves that come in and determined that their peak heights in metres can be modelled by the equations

$$N\left(x\right)=2\sin(x)$$

$M\left(x\right)=\frac{1}{2}\cos(\left(πx-π\right))$, and

$$L\left(x\right)=3\cos(\left(\frac{π}{2}x\right))$$

What is the lowest the pier can be so that it can sustain a combination of all three waves simultaneously?