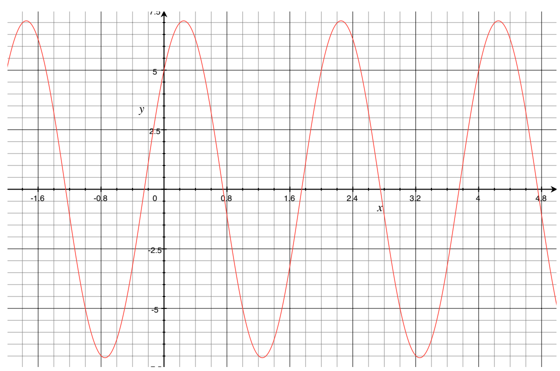
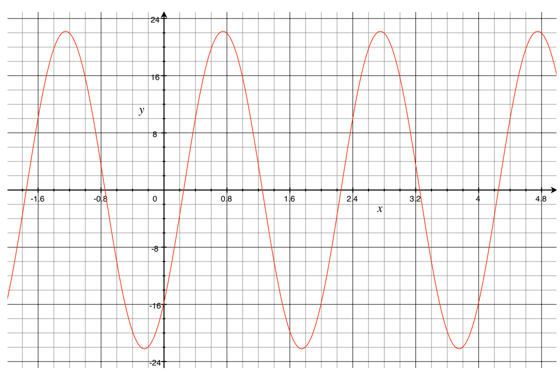
Group Work 11.A.2 Solution

A)

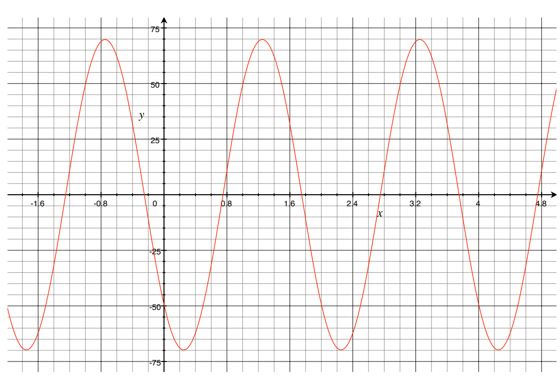
Plotting the graphs is straightforward, and can be done using your favorite graphing software! Here are my results:



Position



Velocity



Acceleration

B)

To begin this problem, we must use the angle addition identity for $\cos(\theta+\phi)$, i.e.:

$$\cos(\theta+\phi) = \cos(\theta)\cos(\phi) - \sin(\theta)\sin(\phi) \tag{1}$$

Applying equation one to the case at hand gives:

$$A\cos(\omega t+\phi) = \cos(\theta+\phi) = A\cos(\omega t)\cos(\phi) - A\sin(\omega t)\sin(\phi). \tag{2}$$

Since this must be equal to:

$$(5.0m)\cos(3.141t) + (5.0m)\sin(3.141t) \tag{3}$$

We can see that:

$$(5.0m)\cos(3.141t) = A\cos(\omega t)\cos(\phi), \tag{4}$$

and:

$$(5.0m)\sin(3.141t) = -A\sin(\omega t)\sin(\phi). \tag{5}$$

Thus, if these equalities are to hold for all times:

$$\omega = 3.141\frac{rad}{s}. \tag{6}$$

This allows us to get rid the t-dependent terms in equations 4 and 5, leaving:

$$5.0m = A\cos(\phi), \tag{7}$$

and:

$$5.0m = -A\sin(\phi). \tag{8}$$

Squaring and then adding equations 6 and 7 gives:

$$(5.0m)^2 + (5.0m)^2 = A^2(\cos^2(\phi) + \sin^2(\phi)) = A^2 \tag{9}$$

This implies that:

$$A = \sqrt{(2)(25m^2)} = 7.07m \tag{10}$$

Rearranging equation 7 gives:

$$\phi = \cos^{-1}\left(\frac{5.0m}{7.07m}\right) = \frac{\pi}{4} \tag{11}$$