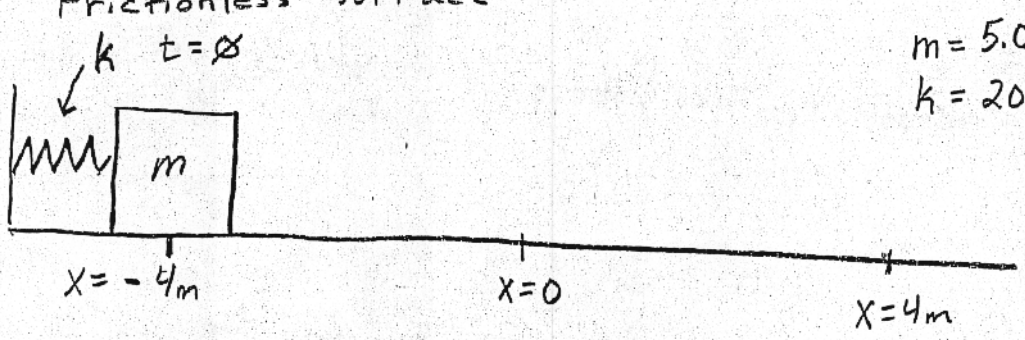
AP1 SHM Practice Name: KEY

1. Frictionless surface



$m = 5.06\,kg$
$k = 200\,N/m$

a. What is the period of this spring's motion?

$$T = 2\pi\sqrt{\frac{m}{k}} = 2\pi\sqrt{\frac{5.06}{200}} = \boxed{1\,s}$$

b. What is the frequency in hertz and in rad/s?

$$f = \frac{1}{T} = \boxed{1\,Hz} \qquad \omega = \frac{2\pi}{T} = \boxed{2\pi\ rad/s}$$

c. What is the restoring force when $x = -1m$?

$$F = -kx = -(200)(-1m) = \boxed{200N}$$

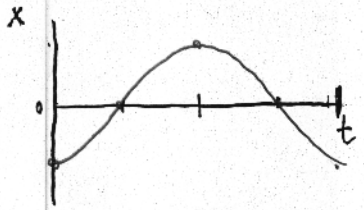
d. What is the acceleration of the mass when $x = 2m$?

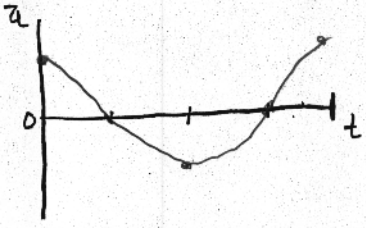
$$a = \frac{\Sigma F}{m} = \frac{-(200)(2)}{5.06} = -79.1\,m/s^2$$

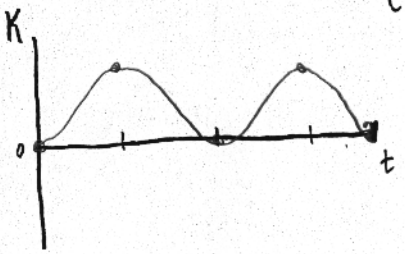
e. Write a function for the position of the mass in respect to time.

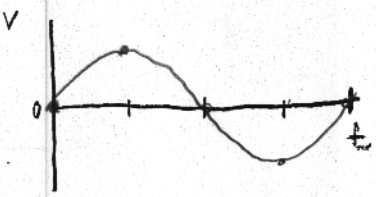
$$X = 4m\cos(2\pi t)$$

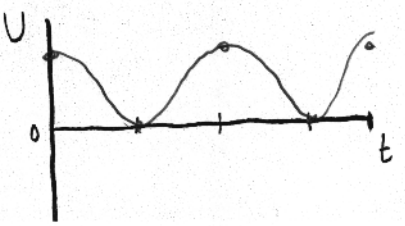
f. Draw a graph of the following quantities for 1 cycle of motion starting at $t = \emptyset s$.











g. What is the v_{max} of the mass?

$$V_{max} = \omega A = \boxed{25\ m/s}$$

$$\tfrac{1}{2}kA^2 = \tfrac{1}{2}mv^2 \qquad v = \sqrt{\frac{kA^2}{m}} = \sqrt{\frac{k}{m}}A = 25\ m/s$$

h. What is the speed of the mass at $t = 0.3\ s$?

$$X = -4\cos(2\pi(0.3)) = -3.99\ m$$

$$V = \sqrt{\frac{kA^2 - kx^2}{m}} = \boxed{1.78\ m/s}$$

$$E = K + U$$

$$\tfrac{1}{2}kA^2 = \tfrac{1}{2}mv^2 + \tfrac{1}{2}kx^2$$

i. What is the total Energy of the system?

$$K = \tfrac{1}{2}mv_{max}^2 = 1600\ J$$

- or -

$$U = \tfrac{1}{2}kA^2 = 1600\ J$$

j. If there was friction what would the graph look like?