2. [10 points] The velocity, in cm per second, of an inchworm moving in a straight line can be modeled by a **sinusoidal** function, $v(t)$, where t is the number of seconds since the inchworm started moving. Suppose the inchworm reaches its maximum velocity of 0.1 cm/sec one second after it starts moving and its minimum velocity of 0 cm/sec two seconds after it starts moving.

a. [5 points] Find a formula for $v(t)$ which is consistent with the information above.

Solution: The period is 2 (because the distance from the x-coordinate of a max to the x-coordinate of a min is 1), the amplitude is .05, and the midline is .05. The graph starts at a min, so it is a negative cosine function with no horizontal shift.

$$v(t) = -.05\cos(\pi t) + .05$$

b. [2 points] Based on your answer from (a), find a formula for $a(t)$, the acceleration of the inchworm t seconds after it started moving.

Solution: Acceleration is the derivative of velocity, so

$$a(t) = .05\pi \sin(\pi t)$$

c. [3 points] Based on your answers above, find a time when the inchworm's acceleration attains its largest positive value.

Solution: The maximum values of $\sin(x)$ are attained when $x = \ldots -3\pi/2, \pi/2, 5\pi/2, \ldots$, so (since we are looking at $\sin(\pi t)$) we can take $t = \frac{1}{2}$ (or many other answers). Alternatively, we could compute the derivative of $a(t)$ and set that equal to zero; if you did it this way, be sure that you wrote down a max and not a min.