												,										
												,										
												,										
L	A	S	T		N	A	M	E	S			,	F	I	R	S	T		N	A	M	E	S

MATH 2301 GW32: Position, Velocity, and Acceleration

Review of Position, Velocity, Acceleration

Recall that for an object moving in a straight line, we have the following definitions:

$s(t)$ is the position (in some units of distance) at time t (in some units of time).

$v(t)$ is the velocity (in units of distance per time) at time t (in units of time).

$a(t)$ is the acceleration (in units of distance per time squared) at time t (in units of time).

And recall the derivative relationships: $s'(t) = v(t)$ and $v'(t) = a(t)$.

Because of these derivative relationships, the Fundamental Theorem of Calculus tells us

$$\text{change in position (also called displacement)} = \Delta s = s(b) - s(a) \underset{FTC}{=} \int_a^b v(t)dt$$

$$\text{distance travelled} = \int_a^b |v(t)|dt$$

$$\text{change in velocity} = \Delta v = v(b) - v(a) \underset{FTC}{=} \int_a^b a(t)dt$$

Remark: Displacement can be negative. But distance travelled is always positive or zero.

[1] An object's position is given by the function

$$s(t) = (x - 1)e^{(-x)} \text{ meters at time } t \text{ seconds, for } 0 \leq t \leq 10$$

(a) When will the object be at position 0?

(b) When will the object be at rest?

(c) When will the object be moving backwards?

(d) What will the object's acceleration be at time $t = 4$?

[2](This is Apex Calculus problem 5.4#41)

An object's velocity is given by the function

$$v(t) = -32t + 22 \text{ feet per second at time } t \text{ seconds, for } 0 \leq t \leq 7$$

(a) When will the object be at rest?

(b) When will the object be moving forwards?

(c) When will the object be moving backwards?

(d) Find the accleration of the object at time $t = 4$ seconds.

(e) Find the displacement of the object over the time interval $[0,7]$.

(f) Find the distance travelled by the object over the time interval $[0,7]$.

Hint: In (e) and (f), you will need to compute definite integrals. Notice that these integrals can be done most easily using geometry. (Graph the integrand, and find the areas of certain regions using area formulas from geometry.) It would be a good exercise for you to first find the integrals that way, and then find the integrals again, using the Fundamental Theorem of Calculus, and see if you get the same answer.