DR. MANDI'S LECTURE OUTLINE
SECTION 6.1: VELOCITY AND NET CHANGE

Think about it!. Suppose we know a function $s(t)$ for the position of an object at time t, How do we find a function for velocity? Speed? Acceleration?

Example 1. A stampede of zombies is accelerating at a rate of 5 ft/sec^2. At time $t = 0$, they start 70 feet away from you and move at 1 foot/sec. Find an equation for

(a) the velocity $v(t)$ at time t

(b) the distance $s(t)$ from you at time t.

Date:

Position from Velocity from Acceleration

For an object moving in a straight line,

- Given an equation for the acceleration $a(t)$ at time t and the initial velocity $v(0)$, to find an equation for velocity $v(t)$:

  (1) Determine ______________

  (2) Solve for ______________ using the value of ______________

- Given an equation for the velocity $v(t)$ at time t and the initial position $s(0)$, to find an equation for position $s(t)$:

  (1) Determine ______________

  (2) Solve for ______________ using the value of ______________

Example 2. On day 0, there were 50 zombies. The CDC estimates that the zombie population is growing at a rate of $e^{0.2t}$ zombies per day. Write an equation for the size $P(t)$ of the zombie population after t days.

Displacement vs Distance Travelled

Example 3. Think about the following situation:

An object is moving up and down. For 5 seconds, it moves up with velocity 30cm/s. It then moves down with velocity 10 cm/s for 5 seconds.

- Write an equation and sketch a graph of the velocity.

- What does the expression $5 \cdot 30 - 5 \cdot 10$ represent? (Physically? Mathematically?)

- What does the expression $5 \cdot 30 + 5 \cdot 10$ represent? (Physically? Mathematically?)

Displacement and Distance

Given the velocity $v(t)$ of an object moving in a straight line:

- the *displacement* can be determined by

- the *distance traveled* can be determined by

But the same idea applies to net change in other situations:

Example 4. Suppose again that the zombie population is growing at a rate of

$$P'(t) = e^{0.2t}$$

zombies per day. Determine the net change in the population between days 5 and 10 of the zombie apocalypse.

Net Change More Generally

Given that a population of something changes at a rate of $P'(t)$, the net change from time a to time b is

____________________.

Think about it!. Given a function $f(x)$, what are the units of $\int f(x)dx$?

Example 5. Suppose still that the zombie population is growing at a rate of

$$P'(t) = e^{0.2t}$$

zombies per day and that on day 5, there are 150 zombies. How many zombies are there on day 10?