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Calc BC Notes 5.3.4

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Velocity and Other Rates of Change

The rate of change means the instantaneous
Rate of change. (The derivative.)

Ex:

$$A = \pi r^2$$

Find the rate
of change of A

with respect to r

$$\frac{dA}{dr} = 2\pi r$$

$$\frac{dA}{dr}$$

How fast is the Area changing when
the radius = 5

$$\left. \frac{dA}{dr} \right|_{r=5} = 2\pi(5) = 10\pi$$

Velocity

If s is the position function in
terms of t (s(t))

$$\frac{ds}{dt} = \text{velocity}$$

Speed

Velocity w/o direction

$$|v(t)| = \text{speed}$$

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Acceleration

The change in velocity with respect to time is acceleration

$$s(t) = \text{position}$$

$$\frac{ds}{dt} = \text{velocity}$$

$$\frac{d^2s}{dt^2} = \text{acceleration}$$

Free fall

$$s(t) = \frac{1}{2}gt^2$$

$$g = 32 \frac{ft}{s^2}$$

or

$$g = 9.8 \frac{m}{s^2}$$

A rock is thrown in the air with an initial velocity of 64 feet per second.

Its position is given by $s(t) = 64t - 16t^2$.

- a) Find its velocity at $t=2$ seconds.
- b) Find its average velocity from $t=0$ to $t=2$ seconds.
- c) How high does it go?

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BC Notes 3.4

A particle moves along a line so that its position is given by $s(t) = t^2 - 6t + 3$, where s is in meters and t in seconds.

- a) Find the displacement of the object during the first 2 seconds
- b) Find the average velocity during the 1st 4 seconds
- c) Find the instantaneous velocity at $t=4$
- d) Find the acceleration at $t=4$
- e) when does the object change directions

Marginal = instantaneous rate of change in economics.

Ex: If the cost of producing ~~the~~ x widgets is $c(x) = 3x^2 - 2x + 3$ dollars find the marginal cost of producing 8 widgets

$$c'(x) = 6x - 2$$

$$c'(8) = 48 - 2 = 46 \frac{\text{widgets}}{\text{dollar}}$$

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