Today's Plan:

Learning Target (standard): I will find use the definition of derivative to calculate a rate of change. I will explain the definition of derivative in terms of tangent lines and velocity.

Students will: Complete practice problems over previous concepts at the boards, put up homework problems on the board and make neccessary corrections to their own work, take notes over new material and complete practice problems over new concepts.

Teacher will: Provide practice problems over previous concepts, check homework problems for accuarcy and provide students feedback, describe and provide examples of new concepts and assign students assessment problems over new concepts.

Assessment: Board work, homework check and homework assignment

Differentiation: Students will work at the board, go over and correct homework at their seats, actively engage in lecture over new concepts, practice new concepts with the aid of other students and the teacher and complete homework assignment.

p.89 #5,7,8

$$5a)\,11.8\frac{cm}{\sec},11.4\frac{cm}{\sec},11.04\frac{cm}{\sec},11.004\frac{cm}{\sec}$$

$$b)\,v(a)=(8a+3)\frac{cm}{\sec};v(1)=11\frac{cm}{\sec}$$

$$c)\,moves:$$

$$right\left(-\frac{3}{8},\infty\right);left\left(-\infty,-\frac{3}{8}\right)$$

p.89 #5,7,8

$$7)\, v(a) = \left(-32a + 112\right)\frac{ft}{\sec}$$

$$v(2) = 48\frac{ft}{\sec}$$

$$v(3) = 16\frac{ft}{\sec}$$

$$v(4) = -16\frac{ft}{\sec}$$

$$\max - height : t = \frac{7}{2}\sec$$

$$hits - ground : t = 7\sec$$

$$velocity - strikes - ground : -112\frac{ft}{\sec}$$

p.89 #5,7,8

$$8) v(a) = -32a \frac{ft}{\sec}$$

$$v(1) = -32 \frac{ft}{\sec}$$

$$hits - ground : t = \frac{5\sqrt{5}}{2} \sec$$

$$v(2) = -64 \frac{ft}{\sec}$$

$$velocity - strikes - ground : -80\sqrt{5} \frac{ft}{\sec}$$

$$v(3) = -96 \frac{ft}{\sec}$$

If the position function of a particle is given by $s(t) = 8t^2 - 2t$ feet, what is the (1) velocity at a time of a seconds? (2) When will the particle hit the ground? (3) At what velocity will it hit the ground? (4) When will it reach its maximum height? (5) When will the particle move in the positive direction? (6) The negative direction?

(1) $v(a) = \lim_{h \to 0} \frac{s(a+h) - s(a)}{h}$

$= \lim_{h \to 0} \frac{[8(a+h)^2 - 2(a+h)] - [8a^2 - 2a]}{h}$

$= \lim_{h \to 0} \frac{8a^2 + 16ah + 8h^2 - 2a - 2h - 8a^2 + 2a}{h}$

$= \lim_{h \to 0} \frac{h(16a + 8h - 2)}{h}$

$= \lim_{h \to 0} (16a + 8h - 2)$

$= 16a + 0 - 2$

$v(a) = (16a - 2)$ ft/sec

(2) $s(t) = 0$

$8t^2 - 2t = 0$

$2t(4t - 1) = 0$

$t = 0, \frac{1}{4}$

hit the ground @ $t = \frac{1}{4}$ sec

(3) $v(\frac{1}{4}) = 16(\frac{1}{4}) - 2$

$= 4 - 2$

$v(\frac{1}{4}) = 2$ ft/sec

(4) maximum height

$v(a) = 0$

$16a - 2 = 0$

$16a = 2$

$a = \frac{1}{8}$ sec

(5) positive direction:

$v(a) > 0$

$16a - 2 > 0$

$16a > 2$

$a > \frac{1}{8}$ sec

(6) negative direction:

$v(a) < 0$

$16a - 2 < 0$

$16a < 2$

$a < \frac{1}{8}$ sec

$f(x) = -3x^3 - 4x^2 + 5x - 1$ Explain the meaning of both.

$v(a) =$

$v(-3) =$

$$v(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$$= \lim_{h \to 0} \frac{[-3(a+h)^3 - 4(a+h)^2 + 5(a+h) - 1] - [-3a^3 - 4a^2 + 5a - 1]}{h}$$

$$= \lim_{h \to 0} \frac{-3(a^3 + 3a^2h + 3ah^2 + h^3) - 4(a^2 + 2ah + h^2) + 5a + 5h - 1 + 3a^3 + 4a^2 - 5a + 1}{h}$$

$$= \lim_{h \to 0} \frac{-3a^3 - 9a^2h - 9ah^2 - 3h^3 - 4a^2 - 8ah - 4h^2 + 5a + 5h - 1 + 3a^3 + 4a^2 - 5a + 1}{h}$$

$$= \lim_{h \to 0} \frac{h(-9a^2 - 9ah - 3h - 8a - 4h + 5)}{h}$$

$$= \lim_{h \to 0} (-9a^2 - 9ah - 3h - 8a - 4h + 5)$$

$$= -9a^2 - 0 - 0 - 8a - 0 + 5$$

$$v(a) = -9a^2 - 8a + 5$$

$$v(-3) = -9(-3)^2 - 8(-3) + 5$$
$$= -81 + 24 + 5$$
$$v(-3) = -52$$

∴ The velocity of a particle moving along $f(x) = -3x^3 - 4x^2 + 5x - 1$ @ a time of "a" is $-9a^2 - 8a + 5$. The velocity of the particle moving along $f(x) = -3x^3 - 4x^2 + 5x - 1$ @ a time of -3 is -52.

Definition:

A function is differentiable on a closed interval [a,b] if it is continuous on (a,b) and if the following exist:

$$\lim_{h \to 0^-} \frac{f(a+h)-f(a)}{h} \quad \text{and} \quad \lim_{h \to 0^+} \frac{f(a+h)-f(a)}{h}$$

$$\lim_{h \to 0} \frac{f(a+h)-f(a)}{h}$$

differentiable - adjective

derivative - noun

differentiate - verb

"Rate of Change"

Notation: Derivatives

$f'(x)$ "*f* prime of *x*"

$D_x y$ "the derivative of *y* with respect to *x*"

independent variable

$\dfrac{dy}{dx}$ "the derivative of *y* with respect to *x*"

independent variable

y' "*y* prime"

$\dfrac{\Delta y}{\Delta x}$ "the change in *y* with respect to the change in *x* "

Find the derivative and state 2 interpretations:

$$f(x) = 3x^2 - 5x + 4$$

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \to 0} \frac{[3(x+h)^2 - 5(x+h) + 4] - [3x^2 - 5x + 4]}{h}$$

$$= \lim_{h \to 0} \frac{3x^2 + 6xh + 3h^2 - 5x - 5h + 4 - 3x^2 + 5x - 4}{h}$$

$$= \lim_{h \to 0} \frac{h(6x + 3h - 5)}{h}$$

$$= \lim_{h \to 0} (6x + 3h - 5)$$

$$f'(x) = 6x - 5$$

Assignment:

p.96 #2-20 even