Today's Plan:

Learning Target (standard): I will find the "c" guaranteed by the mean value theorem. I will explain the meaning of this "c."

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.144 #9-11,13,14

9) c = 2 (c = -2 is not between -2 & 4)

10) c = 2

11) c = 2 (c = -2 is not between 1 & 4)

13) the function is not differentiable at x = 0

14) the function is not continuous at x = 1

Find the derivative:

$$f(x)=\sqrt{\frac{2x+5}{7x-9}}$$

$$f(x)=\left(\frac{2x+5}{7x-9}\right)^{\frac{1}{2}}$$

$$f'(x)=\frac{1}{2}\left(\frac{2x+5}{7x-9}\right)^{-\frac{1}{2}}\left[\frac{2(7x-9)-7(2x+5)}{(7x-9)^2}\right]$$

$$=\frac{1}{2}\left(\frac{7x-9}{2x+5}\right)^{\frac{1}{2}}\left[\frac{14x-18-14x-35}{(7x-9)^2}\right]$$

$$=\frac{1}{2}\left(\frac{7x-9}{2x+5}\right)^{\frac{1}{2}}\left[\frac{-53}{(7x-9)^2}\right]$$

$$\frac{m^{\frac{1}{2}}}{m^2}=\frac{1}{m^{\frac{3}{2}}}$$

$$m^{\frac{1}{2}-2}=m^{-\frac{3}{2}}$$

$$f'(x)=\frac{-53}{2\sqrt{(2x+5)(7x-9)^3}}$$

Find the critical numbers.

$$f(x)=\left(1+\frac{1}{x}\right)(x-1)$$

$$f(x)=(1+x^{-1})(x-1)$$

$$=x-1+x^0-x^{-1}$$

$$=x-1+1-x^{-1}$$

$$f(x)=x-x^{-1}$$

$$f'(x)=1+x^{-2}$$

$$f'(x)=1+\frac{1}{x^2}$$

$$f'(x)=\frac{x^2+1}{x^2}$$

$$0=\frac{x^2+1}{x^2}$$

$$0=x^2+1$$

$$\pm\sqrt{-1}=\sqrt{x^2}$$

Critical #: $x=0$

$x=i,-i$

Find the critical numbers.

$$f(x)=(x+5)^2\sqrt[3]{x-4}$$

$$f(x)=(x+5)^2(x-4)^{\frac{1}{3}}$$

$$f'(x)=2(x+5)(1)(x-4)^{\frac{1}{3}}+\frac{1}{3}(x-4)^{-\frac{2}{3}}(1)(x+5)^2$$

$$=\frac{1}{3}(x+5)(x-4)^{-\frac{2}{3}}\left[6(x-4)+(x+5)\right]$$

$$=\frac{1}{3}(x+5)(x-4)^{-\frac{2}{3}}\left[6x-24+x+5\right]$$

$$f'(x)=\frac{(x+5)(7x-19)}{3\sqrt[3]{(x-4)^2}}$$

critical #s:

$$x=-5,\ \frac{19}{7},\ 4$$

Determine whether the function satisfies the hypothesis of the MVT and if so, find *c* that satisfies the conclusion.

$f(x)=x^3-2x^2+x+3$ cont $[-1,1]$ ✓

$[-1,1]$ diff $(-1,1)$ ✓

$f'(x)=3x^2-4x+1$

$1-2+1+3$

$-1-2-1+3$

$$f(b)-f(a)=(b-a)f'(c)$$

$$f(1)-f(-1)=(1+1)(3c^2-4c+1)$$

$$3+1=2(3c^2-4c+1)$$

$$4=2(3c^2-4c+1)$$

$$2=3c^2-4c+1$$

$$0=3c^2-4c-1$$

$$c=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

$$c=\frac{4\pm\sqrt{16-4(3)(-1)}}{2(3)}$$

$$=\frac{4\pm\sqrt{16+12}}{6}$$

$$=\frac{4\pm\sqrt{28}}{6}$$

$$=\frac{4\pm2\sqrt{7}}{6}$$

$$c=\cancel{\frac{2+\sqrt{7}}{3}},\ \frac{2-\sqrt{7}}{3}$$

$$c=\frac{2-\sqrt{7}}{3}$$

Determine whether the function satisfies the hypothesis of the MVT and if so, find *c* that satisfies the conclusion. Explain the meaning of *c*.

$$f(x) = 3x^2 + 5x - 2$$
$$[-1,1]$$

$\text{cont } [-1,1] \checkmark$

$f'(x) = 6x+5$ $\quad$ $\text{diff } (-1,1) \checkmark$

$f(1) - f(-1) = (1+1)(6c+5)$

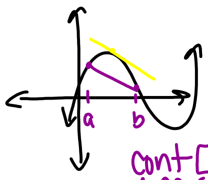
$6 + 4 = 2(6c+5)$

$10 = 2(6c+5)$

$5 = 6c+5$ $\quad$ $c = 0$

$0 = 6c$

$\therefore$ A tangent line through $x=0$ to $f(x)=3x^2+5x-2$ will be parallel to the secant line through $x=-1$ and $x=1$ to $f(x)=3x^2+5x-2$. In other words, the instantaneous rate of change @ $x=0$ will be the same as the average rate of change between $x=-1$ and $x=1$.



$\text{cont } [a,b] \checkmark$
$\text{diff } (a,b) \checkmark$

Determine whether the function satisfies the hypothesis of the MVT and if so, find *c* that satisfies the conclusion.

$$f(x) = \frac{6}{x} - 3$$
$$[1,2]$$

$\text{Continuous } [1,2] \checkmark$

$f(x) = 6x^{-1} - 3$

$f'(x) = -6x^{-2}$ $\quad$ $\text{differentiable } (1,2) \checkmark$

$f'(x) = -\frac{6}{x^2}$

$f(b) - f(a) = (b-a) f'(c)$

$0 - 3 = (2-1)\left(-\frac{6}{c^2}\right)$

$-3 = 1\left(-\frac{6}{c^2}\right)$

$-3 = -\frac{6}{c^2}$

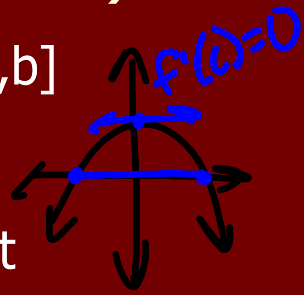
$-3c^2 = -6$

$\sqrt{c^2} = \pm\sqrt{2}$

$c = \sqrt{2}, \cancel{-\sqrt{2}}$ ← not in $(1,2)$

$c = \sqrt{2}$

Rolle's Theorem (a special case)



If f(x) is continuous on the interval [a,b] and is differentiable on (a,b), and if f(a) = f(b) = 0, then there is at least one number c between a and b such that f ′ (c) = 0.

Interpretation

Graphical –a continuous, differentiable curve has a horizontal tangent between any two points where it crosses the x-axis.

Assignment:

- Wkst 80 #2,3,5,7,9,10