3.2

17. $f(x) = \frac{6x}{\pi} - 4\sin^2 x$, $[0, \frac{\pi}{6}]$

f cts. on $[0, \frac{\pi}{6}]$? yes

diff. on $(0, \frac{\pi}{6})$? yes

yes! Rolle's Thm applies, i.e. $\exists c \in (a,b)$ s.t. $f'(c) = 0$

$f(a) = f(b)$?

$f(0) = 0$

$f(b) = 1 - 4(\frac{1}{4}) = 0$

$f'(x) = \frac{6}{\pi} - 8\sin x \cdot \cos x$

$\frac{6}{\pi} - 8\sin x \cos x = 0$

solve: $6/\pi - 8\sin x\cos$

$\frac{-8\sin x \cos x}{-4} = \frac{-6}{\frac{\pi}{-4}}$

$2\sin x \cos x = \frac{3}{2\pi}$

$\sin 2x = \frac{3}{2\pi}$

$2x = \sin^{-1}(\frac{3}{2\pi})$

$x = \frac{\sin^{-1}(\frac{3}{2\pi})}{2}$

solve $(6/\pi - 8\sin(x)\cos(x) = 0, x)$

Mean Value Theorem:

f cts. on $[a,b]$

diff. on (a,b)

MVT give $c \in (a,b)$ s.t.

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

$$|x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

$f(x) = \frac{x+5}{x-2}$, $[1,3]$

$f(x) = |x-2|$, $[1,3]$

34.

$f(x) = \frac{x+1}{x}, \quad [\frac{1}{2}, 2]$

$-\frac{3}{2} \cdot \frac{2}{3} = -1$

$\frac{f(b)-f(a)}{b-a} = \frac{\frac{2+1}{2} - \frac{\frac{1}{2}+1}{\frac{1}{2}}}{2-\frac{1}{2}} = \frac{\frac{3}{2} - \frac{3}{2}\cdot\frac{2}{1}}{\frac{3}{2}}$

$\left((2+1)/2 - (1/2+1)/(1/2)\right)/\left(2-(1/2)\right)$

$\frac{f(b)-f(a)}{b-a} = -1$

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

$d((x+1)/x, x) = -1/x\text{^}2$

$\frac{-1}{x^2} = -1$

$-x^2 = -1$

$x^2 = 1 \quad x = \pm 1$

MVT Probs:

1. is f cts/diff?
2. find $\frac{f(b)-f(a)}{b-a}$
3. find $f'(x)$
4. set #2 & 3 equal, solve for x
5. answer is values from #4 that are actually in interval

38. $f(x) = 2\sin x + \sin 2x, \quad [0, \pi]$

$\frac{f(\pi)-f(0)}{\pi-0} = \frac{2\sin\pi + \sin 2\pi - (2\sin 0 + \sin 2(0))}{\pi}$

$= 0$

$f'(x) = 2\cos x + 2\cos 2x$

$2\cos x + 2\cos 2x = 0$

$2\cos x + 2(2\cos^2 x - 1) = 0$

$2\cos^2 x + \cos x - 1 = 0$

$(2\cos x - 1)(\cos x + 1) = 0$

$\cos x = 1/2 \qquad \cos x = -1$

$x = \pi/3 \qquad x = \pi$

32. $f(x) = x(x^2 - x - 2)$ $[-1, 1]$

$f(x) = x^3 - x^2 - 2x$

$f'(x) = 3x^2 - 2x - 2$

$$\frac{f(1) - f(-1)}{1 - (-1)} = \frac{-2 - (-1 - 1 + 2)}{2} = -1$$

$3x^2 - 2x - 2 = -1$

$3x^2 - 2x - 1 = 0$

$(3x + 1)(x - 1) = 0$

$x = -\frac{1}{3}$, ~~$x = 1$~~ not in open interval

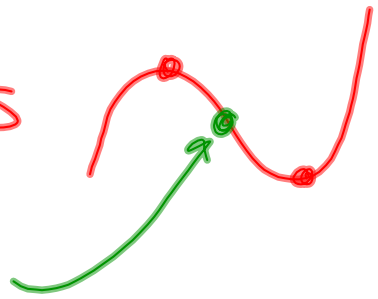
f	f′
	+
	—

f'	f
+	increasing
−	decreasing

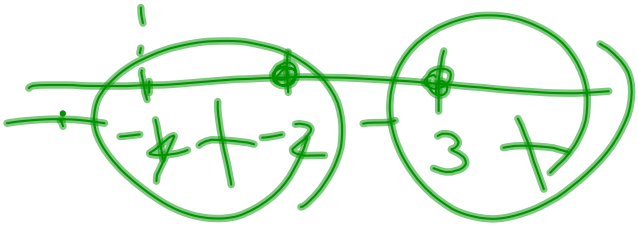
f''	f'	f
+	increasing	concave up
−	decreasing	concave down

find f' & critical #'s

f'' & inflection points



$$\frac{(x+2)(x-3)}{x+4} \geq 0$$



$(-4, -2] \cup [3, \infty)$

3.2, 3.1, -3.7 odd one out