

Review Chapt 3

① $f(x) = x^2 + 3x - 4$

$f'(x) = 2x + 3$

$0 = 2x + 3$

$2x = -3$

$x = -\frac{3}{2}$

② $f(x) = 3x^3 - 27x$

$f'(x) = 9x^2 - 27$

$0 = 9(x^2 - 3)$

$x^2 = 3$

$x = \pm\sqrt{3}$

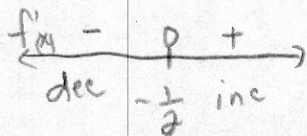
③ $f(x) = x^2 + x - 2$

$f'(x) = 2x + 1$

$0 = 2x + 1$

$2x = -1$

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



inc: $(-\frac{1}{2}, \infty)$

dec: $(-\infty, -\frac{1}{2})$

④ $f(x) = \frac{x}{x+2}$

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

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

$0 = \frac{2}{(x+2)^2}$

inc: $(-\infty, -2)$ $(-2, \infty)$

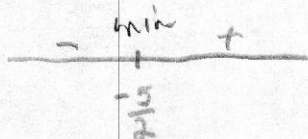
⑤ $f(x) = x^2 + 5x + 6$

$f'(x) = 2x + 5$

$0 = 2x + 5$

$2x = -5$

$x = -\frac{5}{2}$



rel min at $x = -\frac{5}{2}$

inc: $(-\frac{5}{2}, \infty)$

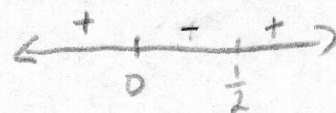
⑥ $f(x) = 4x^3 - 3x^2$

$f'(x) = 12x^2 - 6x$

$0 = 6x(2x - 1)$

$6x = 0$ $2x - 1 = 0$

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



Rel max at $x = 0$

Rel min at $x = \frac{1}{2}$

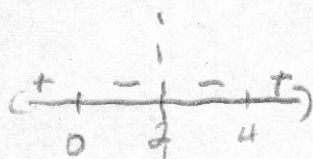
⑦ $f(x) = \frac{x^2}{x-2}$

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

$= \frac{2x^2 - 4x - x^2}{(x-2)^2}$

$= \frac{x^2 - 4x}{(x-2)^2}$

$x - 2 = 0$
 $x = 2$



$x^2 - 4x = 0$
 $x(x-4) = 0$
 $x = 0$ $x = 4$

Rel max at $x = 0$

Rel min at $x = 4$

$$f'(x) = 4x^2 + 3x - 6x$$

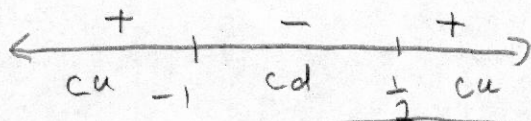
$$f''(x) = 12x^2 + 6x - 6$$

$$0 = 6(2x^2 + x - 1)$$

$$0 = 6(2x - 1)(x + 1)$$

$$2x - 1 = 0 \quad x + 1 = 0$$

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



$$cu: (-\infty, -1) \quad (\frac{1}{2}, \infty)$$

$$cd: (-1, \frac{1}{2})$$

$$(12) \quad f(x) = x^4 - 2x^3 + 1$$

$$f'(x) = 4x^3 - 6x^2$$

$$f''(x) = 12x^2 - 12x$$

$$0 = 12x(x - 1)$$

$$12x = 0 \quad x - 1 = 0$$

$$x = 0 \quad x = 1$$



$$cu: (-\infty, 0) \quad (1, \infty)$$

$$cd: (0, 1)$$

$$(13) \quad f(x) = x^3 - 9x^2 + 24x - 18$$

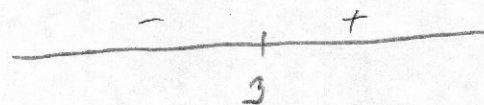
$$f'(x) = 3x^2 - 18x + 24$$

$$f''(x) = 6x - 18$$

$$0 = 6x - 18$$

$$6x = 18$$

$$x = 3$$



$$cu: (3, \infty)$$

$$cd: (-\infty, 3)$$

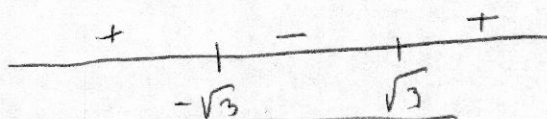
$$(14) \quad f(x) = x^4 - 18x^2 + 5$$

$$f'(x) = 4x^3 - 36x$$

$$f''(x) = 12x^2 - 36$$

$$0 = 12(x^2 - 3)$$

$$x = \pm\sqrt{3}$$



$$cu: (-\infty, -\sqrt{3}) \quad (\sqrt{3}, \infty)$$

$$cd: (-\sqrt{3}, \sqrt{3})$$

15) $f(x) = x^3 - 6x$

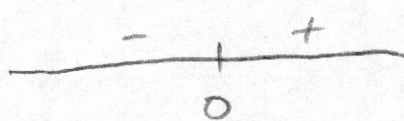
$f'(x) = 3x^2 - 6$

$f''(x) = 6x$

$6x = 0$

$x = 0$

poi: (0,0)



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

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

$= (x-1)^2 (x+4) [(x-1)2 + 3(x+4)]$

$= (x-1)^2 (x+4) (2x-2 + 3x+12)$

$= (x-1)^2 (x+4) (5x+10)$

$= 5(x-1)^2 (x+4) (x+2)$

$= 5(x-1)^2 (x^2 + 6x + 8)$

$= 5(x-1)^2 (2x+6) + (x^2 + 6x + 8) (2(x-1))$

$= 10(x-1) [(x-1)(x+3) + x^2 + 6x + 8]$

$= 10(x-1) [x^2 + 2x - 3 + x^2 + 6x + 8]$

$= 10(x-1) (2x^2 + 8x + 5)$

$0 = (x-1)$

$x = -3.22$

$x = -12.899$

$x = \frac{-8 \pm \sqrt{64 - 4(2)(5)}}{2 \cdot 2}$

$= \frac{-8 \pm \sqrt{64 - 40}}{4}$

$= \frac{-8 \pm \sqrt{24}}{4}$
 $= \frac{-8 \pm 2\sqrt{6}}{4}$

$x = 1$
 $x = \frac{-8 \pm 2\sqrt{6}}{4}$

17) $f'(x) = 0$ critical point

18) $f''(x) > 0$ concave up

19) $f' > 0$ increasing

20) $f' < 0$ decreasing

21) $f' = 0$ critical #

22) $f'' < 0$ concave down

23) f 24) d 25) b 26) a 27) e 28) c

29) $x = -2, y = 2$

30) $x = \pm 2, y = 0$

31) none, $y = 1$

32) $x = 3$, none

33) $x = 2, x = -1, y = 2$

$(x-2)(x+1)$

$\frac{(2x-1)(x+2)}{(x-2)(x+1)}$