3.2

#2 $f'(-3)$ only positive one

$f'(4)$ more negative than $f'(0)$ more negative than $f'(2)$

so in increasing order

$f'(4), f'(0), f'(2), 0, f'(-3)$

#12 $\lim_{h \to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \to 0} \frac{2(x+h)^3 + 1 - 2x^3 + 1}{h}$

$= \lim_{h \to 0} 2\left(\frac{x^3 + 3x^2h + 3xh^2 + h^3 - x^3}{h}\right)$

$= \lim_{h \to 0} 2(3x^2 + 3xh + h^2)$

$= 6x^2$

at $a = -1$, $f(x) = f(-1) = 2(-1) + 1 = -1$

$f'(-1) = 6$

so eqn of tan line

$\Rightarrow (y+1) = 6(x+1)$

or $y = 6x + 5$

18. $\frac{dy}{dx} = \lim_{\Delta x \to 0} \frac{\frac{1}{x + \Delta x + 1} - \frac{1}{x+1}}{\Delta x} = \lim_{\Delta x \to 0} \frac{x + 1 - (x + \Delta x + 1)}{(\Delta x)(x+1)(x + \Delta x + 1)}$

$= \lim_{\Delta x \to 0} \frac{-\Delta x}{(\Delta x)(x+1)(x + \Delta x + 1)}$

$= \lim_{\Delta x \to 0} \frac{-1}{(x + \Delta x + 1)(x+1)}$

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

HW #4

3.2/20

$y = x^{1/3}$

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

$(A-B)(A^2+AB+B^2) = A^3 - B^3$

$$\frac{f(x+h)-f(x)}{h} = \frac{(x+h)^{1/3} - x^{1/3}}{h} \cdot \frac{\left[(x+h)^{2/3} + (x+h)^{1/3}x^{1/3} + x^{2/3}\right]}{\left[(x+h)^{2/3} + (x+h)^{1/3}x^{1/3} + x^{2/3}\right]}$$

$$= \frac{\cancel{x+h} \cancel{-x}}{\cancel{h}\left[(x+h)^{2/3} + (x^2+hx)^{1/3} + x^{2/3}\right]}$$

$$= \frac{1}{\left[(x+h)^{2/3} + (x^2+hx)^{1/3} + x^{2/3}\right]}$$

$$\lim_{h \to 0} \frac{1}{(x+h)^{2/3} + (x^2+hx)^{1/3} + x^{2/3}} = \frac{1}{x^{2/3} + (x^2)^{1/3} + x^{2/3}} = \boxed{\frac{1}{3x^{2/3}}}$$

3.2/23

a. D (derivative starts positive yet constant, quickly changes to 0)

b. F (alternates between two values of the slope)

c. B (deriv. is 0 at $x=0$ and at $x \to \pm\infty$)

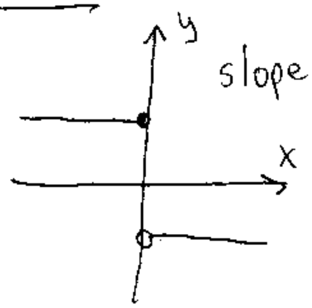
d. C (deriv. is 0 as $x \to \pm\infty$, deriv $\to \pm\infty$ when $x \to 0$)

e. A (deriv. is 0 as $x \to \pm\infty$, deriv. reaches a max at $x=0$)

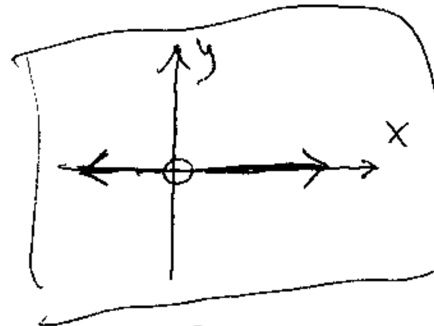
f. E (deriv. is 0 at $x=0$, at the sides of the semicircle the derivative is + or $-\infty$)

3.2/26

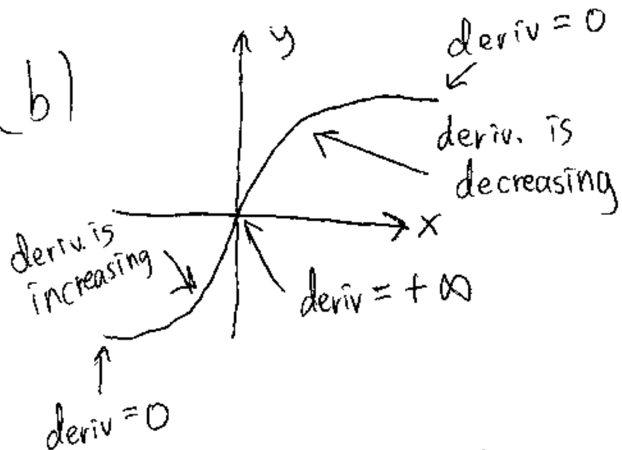
(a)

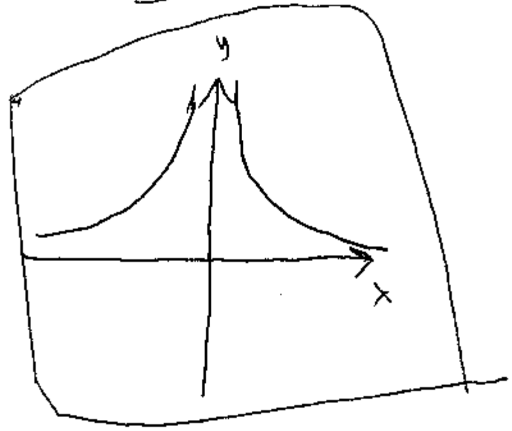


slope is zero everywhere, but there's a discontinuity at $x=0$

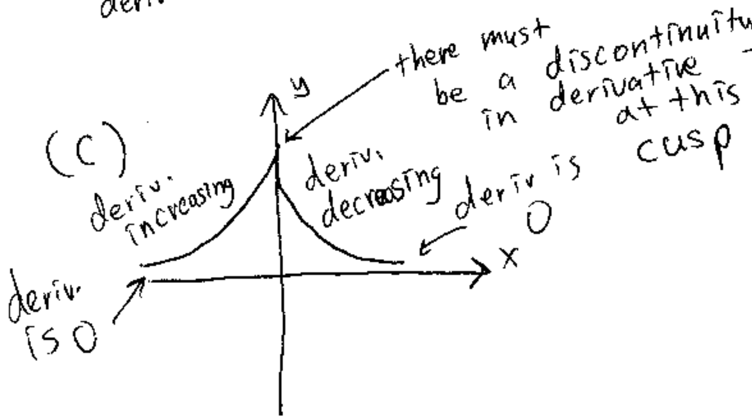


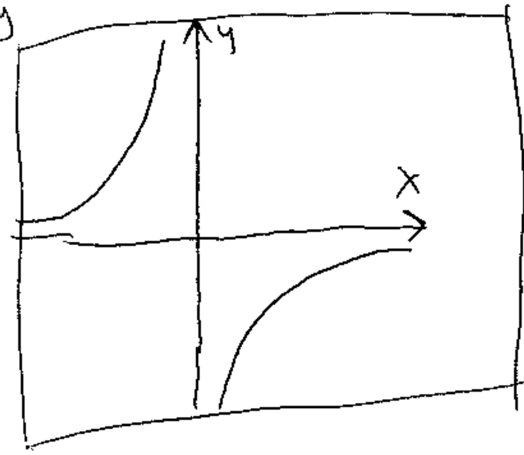
(b)





(c)





3.2/36

(a) units of dg/dp = **gallons/dollar**

(b) the change in gallons sold for every increase in price of \$1

(c) if we raise the price of something, people buy less, so $\boxed{dg/dp < 0}$

(d) $\left.\frac{dg}{dp}\right|_{p=10} = -100$, means when price is \$10, raising price by 1 dollar will decrease the gallons sold by 100.