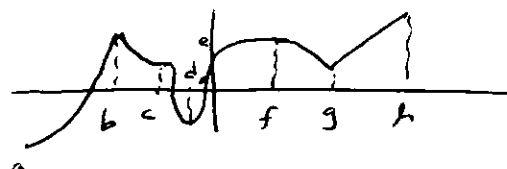


Sect 4.1 #3 $f'(x) < 0$ for $(b, d) \cup (f, g)$

#5 $f'(x) = 0$ for $x = c, d$, and f



#25 $f(x) = x^3 - 6x^2 + 1$

$f'(x) = 3x^2 - 12x = 3x(x-4) = 0$ at $x = 0, 4$

local max at $x=0$, local min at $x=4$

sign chart for f' : $++++0-----0+++++$

intervals: $(-\infty, 0) \cup (4, \infty)$ is increasing; $(0, 4)$ is decreasing.

local max at $(0, 1)$; local min at $(4, -31)$

#89 $C(x) = 0.05x^2 + 20x + 320$ $0 < x < 150$

(A) $\bar{C}(x) = \frac{C(x)}{x} = 0.05x + 20 + \frac{320}{x}$

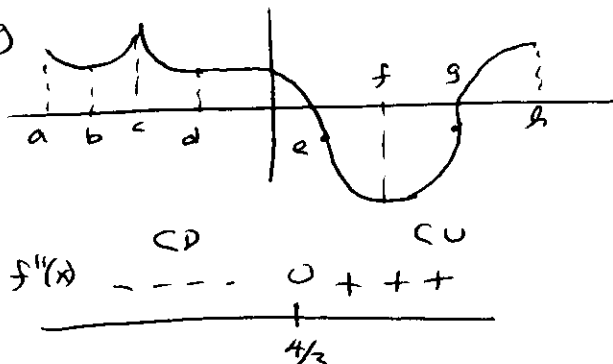
(B) $\bar{C}'(x) = 0.05 - \frac{320}{x^2} = 0 \Rightarrow 0.05x^2 = 320$
 $x^2 = 6400$
 $x = 80$

decr. $(0, 80)$; incr. $(80, \infty)$

$\bar{C}(80) = 4 + 20 + 4 = 28$

Sect 4.2

- #1 (A) $C \cup (a, c) \cup (c, d) \cup (e, g) \Leftarrow (D) f''(x) > 0$ (B) $f'(x)$ is incr
 (B) $C \cup (d, e) \cup (g, h) \Leftarrow (C) f''(x) < 0$ (A) $f'(x)$ is decr
 (H) Infl. pts.: $x = d, e, g$



#5 $f'(x) < 0$ decr. $\Rightarrow (D)$
 $f''(x) > 0$ CU

#17 $f(x) = x^3 - 4x^2 + 5x - 2$
 $f'(x) = 3x^2 - 8x + 5$
 $f''(x) = 6x - 8 = 0$ at $x = \frac{8}{6} = \frac{4}{3}$
 I.P. $x = \frac{4}{3}$

sign chart for $f''(x)$: $-----0++++$

local max at $x = \frac{4}{3}$

sign chart for $f'(x)$: $+++0----$

local max at $x = 60$

#63 $P = 1296 - 0.12x^2$ $0 < x < 80$

$R = xp = 1,296x - 0.12x^3$
 $R'(x) = 1296 - 0.36x^2 = 0$ at $x^2 = \frac{1296}{0.36} = 3600 \Rightarrow x = 60$ $R(60) = 51,840$
 $R''(x) = -0.72x < 0 \forall x$ always CD

#64 $C(x) = 830 + 396x$

$P(x) = R(x) - C(x) = 1296x - 0.12x^3 - 830 - 396x = 900x - 0.12x^3 - 830$
 (A) $P'(x) = 900 - 0.36x^2 = 0$ $x^2 = \frac{900}{0.36} = 2500 \Rightarrow x = 50$ is a local max
 $P(50) = 29,170$
 (B) $P''(x) = -0.72x < 0$ Always CD

Sect 4.3 #3 $f(x) = \frac{3x-4}{x}$ horizontal $\frac{3x}{x} = 3 \quad y=3$
 vertical $x=0$

Math 108 (2)
 Prof. R. B. Goldstein
 Chap 4 HW
 Barnett - 10th

#7 $f(x) = \frac{x}{x^2-1}$ horizontal $\frac{x}{x^2} = \frac{1}{x} \rightarrow 0 \quad y=0$
 vertical $x^2-1=0 \Rightarrow x=+1$ or $x=-1$

#31 $f(x) = \frac{2x}{1-x^2}$ horizontal $\frac{2x}{-x^2} = -\frac{2}{x} \rightarrow 0 \quad y=0$
 vertical $1-x^2=0 \Rightarrow x=+1$ or $x=-1$ } asymptotes

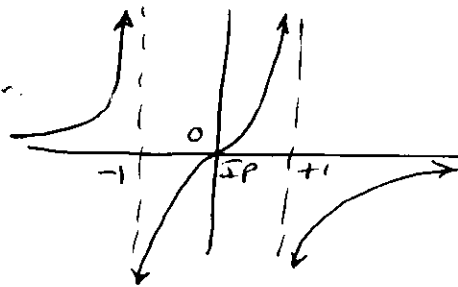
D: \mathbb{R} except $-1, +1$ or $(-\infty, -1) \cup (-1, 1) \cup (1, \infty)$

intercepts $x=0 \quad y=0$ only $(0,0)$

$f'(x) = \frac{(1-x^2)(2) - 2x(-2x)}{(1-x^2)^2} = \frac{2(x^2+1)}{(x^2-1)^2} > 0 \quad \forall x$ always incr.

$f''(x) = \frac{4x(x^2+3)}{(1-x^2)^3}$ f'' $++$ PNE $--$ 0 $++$ PNE $--$
 $-1 \quad 0 \quad 1$

CU $(-\infty, -1) \cup (0, 1)$ I.P. at $x=0$
 CD $(-1, 0) \cup (1, \infty)$

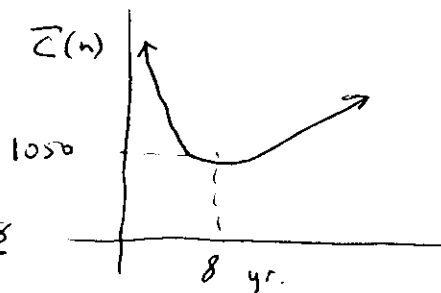


#73 $C(n) = 3200 + 250n + 50n^2$

(A) $\bar{C}(n) = \frac{C(n)}{n} = \frac{3200}{n} + 250 + 50n$

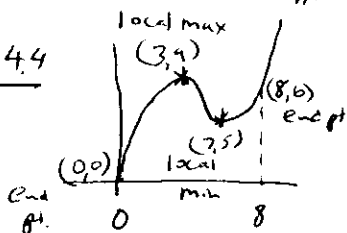
(B) \Rightarrow graph

(C) $\bar{C}'(n) = -\frac{3200}{n^2} + 50 = 0 \Rightarrow n^2 = \frac{3200}{50} = 64 \Rightarrow n=8$



Sect 4.4

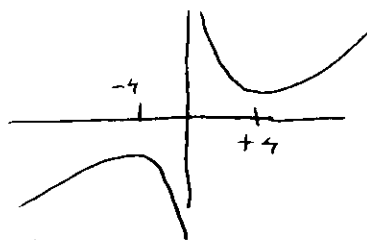
#3



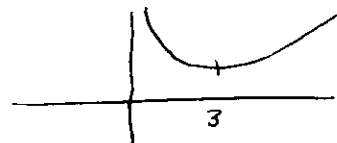
abs max $(3,9)$

abs min $(0,0)$

#19 $f(x) = x + \frac{16}{x}$ $f'(x) = 1 - \frac{16}{x^2}$ $x^2 = 16$ $x=4, x=-4$ are local min & max only



#36 $f(x) = 4 + x + \frac{9}{x}$ abs min on $(0, \infty)$
 $f'(x) = 1 - \frac{9}{x^2} \Rightarrow x^2 = 9 \quad x=+3$ or $x=-3$



#41 $f(x) = x^3 - 6x^2 + 9x - 6$
 $f'(x) = 3x^2 - 12x + 9 = 3(x^2 - 4x + 3) = 3(x-3)(x-1) = 0 \Rightarrow$ crit pts. $x=1, x=3$

[A] $[-1, 5]$

$f(-1) = -22 \leftarrow$ abs min
 $f(1) = -2$
 $f(3) = -6$
 $f(5) = +14 \leftarrow$ abs max

[B] $[-1, 3]$

$f(-1) = -22 \leftarrow$ abs min
 $f(1) = -2 \leftarrow$ max
 $f(3) = -6$

[C] $[2, 5]$

$f(2) = -4$
 $f(3) = -6 \leftarrow$ abs min
 $f(5) = +14 \leftarrow$ abs max

Sect 4.5

Math 108 (3)
 Prof. R. B. Goldstein
 Chap 4 HW
 Barnett - 10th

#3 $x - y = 30 \Rightarrow y = x - 30$
 xy is minimum $f(x) = x(x - 30) = x^2 - 30x$
 $f'(x) = 2x - 30 = 0 \Rightarrow x = 15$

\therefore numbers are 15, -15 product = -225

#17 $\frac{x}{670} \quad \frac{p}{\$8.00}$
 $\frac{680}{87.90} \quad m = \frac{7.90 - 8}{680 - 670} = \frac{-0.1}{10} = -0.0025$

$p - 8 = -0.0025(x - 670) \Rightarrow p = -0.0025x + 9.6$

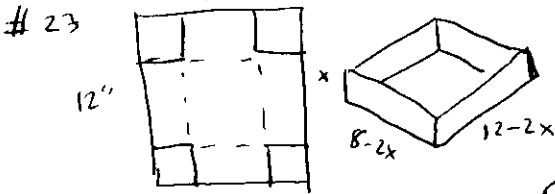
(A) $R(x) = xp = -0.0025x^2 + 9.6x \quad R' = -0.005x + 9.6 = 0 \Rightarrow x = \frac{9.6}{0.005} = 1920 \quad p = 4.80$

(B) $\frac{x}{635} \quad \frac{p}{\$7.80}$ now express $x = x(p)$ (can do either way)
 $\frac{655}{8.00} \quad m = \frac{655 - 640}{7.8 - 8.0} = \frac{15}{-0.2} = -75 \quad x = 640 = -75(p - 8)$
 $x = -75p + 1240$

$R = xp = (-75p + 1240)p = -75p^2 + 1240p$

$R' = -150p + 1240 = 0 \quad p = \frac{1240}{150} = 8.26 > 8 \quad \therefore$ max at 8

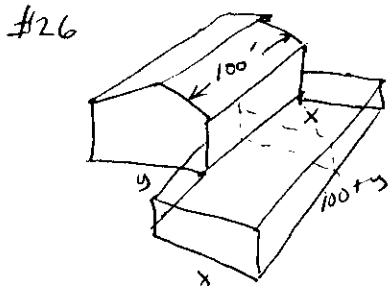
otherwise, they would need to raise prices!



$V = x(8 - 2x)(12 - 2x) = 96x - 40x^2 + 4x^3$

$V' = 96 - 80x + 12x^2 = 4(3x^2 - 20x + 24) = 0$

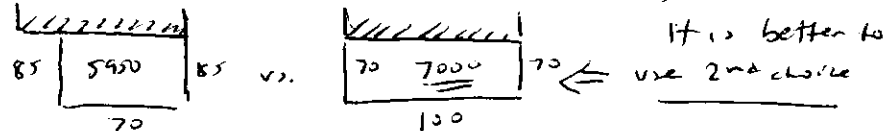
$x = \frac{10}{3} \pm \frac{2\sqrt{5}}{3} \quad x = 5.097$ impossible $x = 1.569$ OK



(A) $P = 240 = 2x + 100 + 2y \quad 2x + 2y = 140 \quad y = 70 - x$

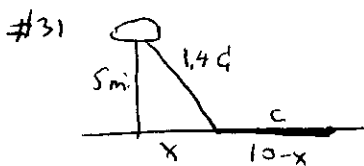
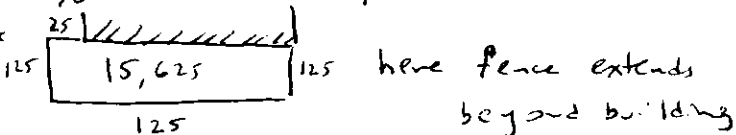
or if $y < 0 \quad 240 = 2x + z \quad z = 240 - 2x$

$A = x(100 + y) = x(170 - x) = 170x - x^2 \quad A' = 170 - 2x = 0 \quad x = 85 \quad \therefore y < 0$
 then $A = 85 \cdot 70 = 5950$ (if building wall $A = 100 \cdot 70 = 7000$)



(B) $P = 400 = 2x + 100 + 2y \Rightarrow y = 150 - x$

$A = x(250 - x) = 250x - x^2 \quad A' = 250 - 2x = 0 \quad x = 125$



(A) under lake $\sqrt{5^2 + x^2} = \sqrt{25 + x^2}$

$T =$ total cost $= 1.4c \sqrt{25 + x^2} + (10 - x)c$ (ignore c)

$T' = \frac{1.4x - \sqrt{x^2 + 25}}{\sqrt{x^2 + 25}} = 0 \quad 1.4x = \sqrt{x^2 + 25} \quad 0.96x^2 = 25$
 $1.96x^2 = x^2 + 25 \quad x^2 = 26.04 \Rightarrow x = 5.1$ mi

(B) $T = 1.1\sqrt{25 + x^2} + 10 - x$

$T' = \frac{1.1x - \sqrt{x^2 + 25}}{\sqrt{x^2 + 25}} = 0 \quad 1.1x = \sqrt{x^2 + 25} \quad 0.21x^2 = 25$
 $x = 119.04 \Rightarrow x = 10.9 > 10 \quad \therefore x = 10$ mi