

$$P(t) = t^3 - 15t^2 + 63t + 10,000$$

$$P'(t) = 3t^2 - 30t + 63$$

a) Population declining $\Rightarrow P'(t) < 0$

$$\Rightarrow 3t^2 - 30t + 63 < 0$$

$$\Rightarrow 3(t^2 - 10t + 21) < 0$$

$$\Rightarrow 3(t-7)(t-3) < 0$$

$$P' \begin{array}{c} + \\[-1ex] - \\[-1ex] + \end{array} \begin{array}{c} 3 \\[-1ex] 7 \end{array}$$

Population is declining when $3 < t < 7$, in other words, between 2003 and 2007.

b) Maximum population occurs at either critical numbers or endpoints

$t=7$, $t=3$ are critical; $t=0$, $t=10$ are endpoints

<u>t</u>	<u>$P(t)$</u>
0	10,000
3	10,081
7	10,049
10	10,130

$$P(3) = 3^3 - 15(3)^2 + 63(3) + 10,000 \\ = 27 - 135 + 189 + 10,000 \\ = 10,081$$

$$P(7) = 7^3 - 15(7)^2 + 63(7) + 10,000 \\ = 343 - 735 + 441 + 10,000 = 10,049$$

$$P(10) = 10^3 - 15(10)^2 + 63(10) + 10,000 \\ = 1000 - 1500 + 630 + 10,000 = 10,130$$

Maximum population occurs when $t=10$, the beginning of 2010.

$$f(x) = \frac{4x}{x^2+9} \quad f'(x) = \frac{(x^2+9)(4) - 4x(2x)}{(x^2+9)^2} = \frac{4x^2 + 36 - 8x^2}{(x^2+9)^2} \\ = \frac{36 - 4x^2}{(x^2+9)^2} = \frac{4(9-x^2)}{(x^2+9)^2}$$

Critical numbers are $x=3$, $x=-3$
(not in $[0, 5]$)

<u>x</u>	<u>$f(x)$</u>
0	0 ← absolute minimum
3	$\frac{2}{3}$ ← absolute maximum, $f(3) = \frac{4(3)}{3^2+9} = \frac{12}{18} = \frac{2}{3}$
5	$\frac{10}{17}$ ← absolute

Note: $\frac{10}{17} < \frac{10}{15} = \frac{2}{3}$

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

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

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

Critical numbers are $x = 3, x = -1$
(not in $[1, 4]$)

x	$f(x)$
1	0 ← absolute maximum $f(3) = \frac{1-3}{3^2+3(3)} = -\frac{2}{18} = -\frac{1}{9}$
3	$-\frac{1}{9}$ ← absolute minimum $f(4) = \frac{1-4}{4^2+3(4)} = -\frac{3}{28}$
4	$-\frac{3}{28}$

$$f(x) \approx 2x^3 - 6x^2 - 48x + 7$$

$$\begin{aligned} f'(x) &= 6x^2 - 12x - 48 \\ &= 6(x^2 - 2x - 8) \\ &= 6(x - 4)(x + 2) \end{aligned}$$

Critical numbers are $x = 4, x = -2$

x	$f(x)$	$f(-6) = 2(-6)^3 - 6(-6)^2 - 48(-6) + 7$
-6	-353 ← absolute minimum	$= -432 - 216 + 288 + 7 = -353$
-2	63	$f(-2) = 2(-2)^3 - 6(-2)^2 - 48(-2) + 7$
4	-153	$= -16 - 24 + 96 + 7 = 63$
8	263 ← absolute maximum $f(4) = 2(4)^3 - 6(4)^2 - 48(4) + 7$	$= 128 - 96 - 192 + 7 = -153$
		$f(8) = 2(8)^3 - 6(8)^2 - 48(8) + 7$
		$= 1024 - 384 - 384 + 7 = 263$

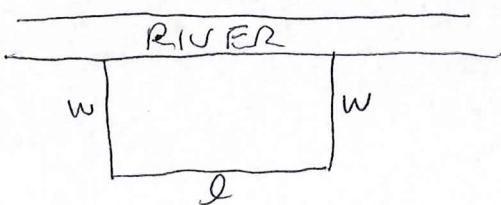
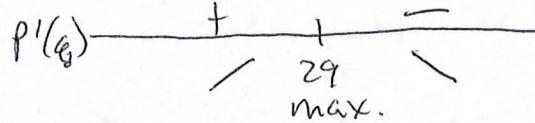
$$C(q) = 6000 + 5q + 0.01q^2$$

$$R(q) = \left(20 - \frac{q}{4}\right)q = -0.25q^2 + 20q$$

$$\begin{aligned} P(q) &= R(q) - C(q) = -0.25q^2 + 20q - 0.01q^2 - 5q - 6000 \\ &= -0.26q^2 + 15q - 6000 \end{aligned}$$

$$P'(q) = -0.52q + 15 \Rightarrow \begin{aligned} P'(q) &= 0 \Rightarrow 0.52q = 15 \\ &\Rightarrow q \approx 29 \end{aligned}$$

If ≈ 29 items are made, profit will be maximized



Goal: Maximize Area = lw

$$\text{Cost} = 6l + 2w + 2w = 240$$

$$\Rightarrow 6l + 4w = 240$$

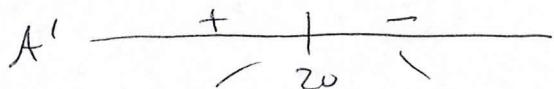
$$4w = 240 - 6l$$

$$\Rightarrow w = 60 - \frac{3}{2}l$$

$$A = l(60 - \frac{3}{2}l) = 60l - \frac{3}{2}l^2$$

$$A'(l) = 60 - 3l = 0$$

$$\Rightarrow 3l = 60 \Rightarrow l = 20$$



$$\text{If } l = 20, w = 60 - \frac{3}{2}(20) = 60 - 30 = 30$$

$$\begin{aligned} (\$10, 375 \text{ people}) &\Rightarrow \frac{475-375}{8-10} = \frac{100}{-2} = -50 \\ (\$8, 475 \text{ people}) \end{aligned}$$

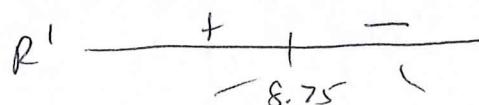
$$\begin{aligned} q - 375 &= -50(p - 10) \\ q - 375 &= -50p + 500 \\ q &= -50p + 875 \end{aligned}$$

GOAL: maximize revenue

$$\begin{aligned} R(p) &= p(-50p + 875) \\ &= -50p^2 + 875p \end{aligned}$$

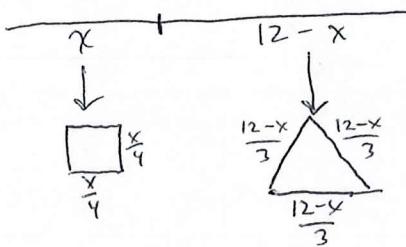
$$R'(p) = -100p + 875$$

$$\begin{aligned} R'(p) &= 0 \Rightarrow 100p = 875 \\ p &= 8.75 \end{aligned}$$



Revenue is maximized when tickets are sold at \$8.75.

12 feet



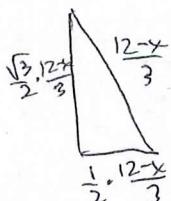
GOAL: minimize combined area of square/triangle

$$A = \left(\frac{x}{4}\right)^2 + \frac{1}{2} \cdot \frac{12-x}{3} \cdot \frac{\sqrt{3}(12-x)}{6}$$

$$A = \frac{1}{16}x^2 + \frac{\sqrt{3}}{36}(12-x)^2$$

$$A'(x) = \frac{1}{8}x + \frac{\sqrt{3}}{18}(12-x)(-1)$$

Notice: height of triangle = $\frac{\sqrt{3}}{6}(12-x)$



$$A' = 0 \Rightarrow \frac{1}{8}x = \frac{\sqrt{3}}{18}(12-x)$$

$$\Rightarrow 9x = \sqrt{3}(12-x)$$

$$\Rightarrow 9x = 12\sqrt{3} - \sqrt{3}x$$

$$\Rightarrow (9+\sqrt{3})x = 12\sqrt{3}$$

$$x = \frac{12\sqrt{3}}{9+\sqrt{3}} \text{ feet}$$

Area is minimized when the wire is cut such that

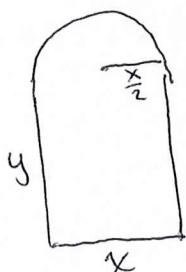
$\frac{12\sqrt{3}}{9+\sqrt{3}}$ feet is bent into the square

and the rest $(12 - \frac{12\sqrt{3}}{9+\sqrt{3}})$ feet

is bent to form the triangle.

$$A' \begin{array}{c} - \\ \diagup \quad \diagdown \\ \frac{12\sqrt{3}}{9+\sqrt{3}} \end{array} +$$

GOAL: maximize light entering window \Rightarrow maximize area of window



$$\text{Perimeter} = x + 2y + \frac{1}{2} \cdot 2\pi \left(\frac{x}{2}\right) = 8$$

$$\Rightarrow x + \frac{\pi}{2}x + 2y = 8$$

$$2y = 8 - x - \frac{\pi}{2}x$$

$$y = 4 - \frac{1}{2}x - \frac{\pi}{4}x$$

$$\text{Area} = \frac{1}{2}\pi \left(\frac{x}{2}\right)^2 + xy$$

$$A(x) = \frac{1}{8}\pi x^2 + x \left(4 - \frac{1}{2}x - \frac{\pi}{4}x\right)$$

$$A(x) = \frac{1}{8}\pi x^2 + 4x - \frac{1}{2}x^2 - \frac{\pi}{4}x^2$$

$$A(x) = -\frac{\pi}{8}x^2 - \frac{1}{2}x^2 + 4x$$

$$A'(x) = -\frac{\pi}{4}x - x + 4$$

Area is maximized when $x = \frac{16}{\pi+4}$ feet

$$\text{and } y = 4 - \frac{1}{2}\left(\frac{16}{\pi+4}\right) - \frac{\pi}{4}\left(\frac{16}{\pi+4}\right) \text{ feet.}$$

$$A'(x) = 0$$

$$\Rightarrow 4 = \frac{\pi}{4}x + x$$

$$\Rightarrow 4 = x\left(\frac{\pi}{4} + 1\right)$$

$$\Rightarrow x = \frac{4}{\frac{\pi}{4} + 1}$$

$$= \frac{16}{\pi+4}$$

$$+ \begin{array}{c} - \\ \diagup \quad \diagdown \\ 16 \end{array} -$$

$$f(x) = 3x^3 - 9x + 7$$

$$f(-1) = 3(-1)^3 - 9(-1) + 7 \\ = -3 + 9 + 7 = 13$$

$$\text{Dom}(f) = \mathbb{R}$$

$$y\text{-int: } f(0) = 7 \quad (0, 7)$$

$$x\text{-int: } 0 = 3x^3 - 9x + 7$$

(eh... too hard)

no asymptotes (it's a polynomial...)

$$f'(x) = 9x^2 - 9 = 9(x^2 - 1) \quad f' \begin{array}{c} + \\ - \\ -1 \end{array}$$

f is increasing on $(-\infty, -1) \cup (1, \infty)$ local max $(-1, 13)$

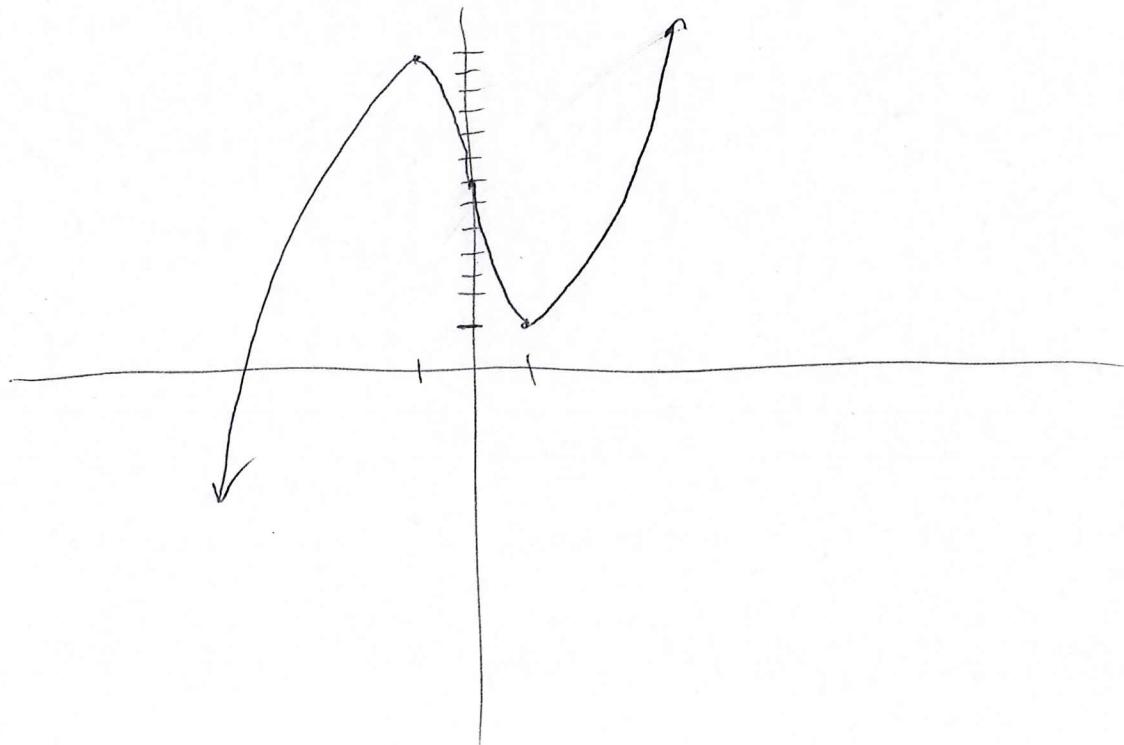
f is decreasing on $(-1, 1)$ local min $(1, 1)$

$$f''(x) = 18x \quad f'' \begin{array}{c} - \\ + \\ 0 \end{array}$$

f is concave down on $(-\infty, 0)$

inflection pt: $(0, 7)$

f is concave up on $(0, \infty)$



$$g(x) = \frac{x^2}{3x-2}$$

$$g'(x) = \frac{3x^2 - 4x}{(3x-2)^2}$$

$$g''(x) = \frac{8}{(3x-2)^3}$$

Domain: $x \neq \frac{2}{3}$ $(-\infty, \frac{2}{3}) \cup (\frac{2}{3}, \infty)$

$$y\text{-int: } g(0) = \frac{0^2}{-2} = 0 \quad (0, 0)$$

$$x\text{-int: } 0 = \frac{x^2}{3x-2} \Rightarrow x^2 = 0 \Rightarrow x = 0 \quad (0, 0)$$

Notice: $\lim_{x \rightarrow \frac{2}{3}^-} g(x) = -\infty$, $\lim_{x \rightarrow \frac{2}{3}^+} g(x) = \infty \Rightarrow x = \frac{2}{3}$ Vertical asymptote.

$$\begin{aligned} \text{Notice: } 3x-2 &\mid x^2 + 0x + 0 \\ &- (x^2 - \frac{2}{3}x) \\ \hline &\frac{\frac{2}{3}x + 0}{-(\frac{2}{3}x - \frac{4}{9})} \\ &\hline \end{aligned}$$

$y = \frac{1}{3}x + \frac{2}{9}$ is a Slant Asymptote
(Don't worry about this.
Won't be tested, but an interesting observation)

$$g' = 0 \Rightarrow 3x^2 - 4x = 0$$

$$x(3x-4) = 0$$

$$g'(\frac{4}{3}) = \frac{(\frac{4}{3})^2}{3(\frac{4}{3})-2} = \frac{\frac{16}{9}}{\frac{2}{3}} = \frac{16}{18} = \frac{8}{9}$$

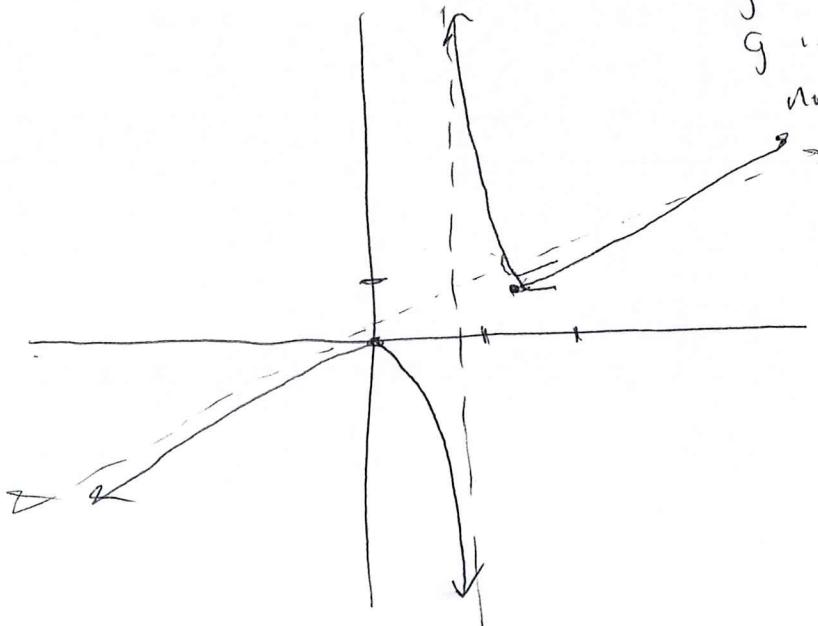
$$g' \quad \begin{array}{c} + \\ \hline 0 & \frac{2}{3} & \frac{4}{3} \end{array} \quad \begin{array}{l} \text{local max: } (0, 0) \\ \text{local min: } (\frac{4}{3}, \frac{8}{9}) \end{array}$$

g is increasing on $(-\infty, 0) \cup (\frac{4}{3}, \infty)$
 g is decreasing on $(0, \frac{2}{3}) \cup (\frac{2}{3}, \frac{4}{3})$

$$g'' = 0 \rightarrow 8 = 0 \Rightarrow \text{never}$$

$$g'' \quad \begin{array}{c} - \\ \hline \frac{2}{3} \end{array} \quad \begin{array}{l} + \end{array}$$

g is concave down on $(-\infty, \frac{2}{3})$
 g is concave up on $(\frac{2}{3}, \infty)$
no inflection points



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

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

$$f''(x) = \frac{2(x^2 - 6)}{x^5}$$

$$\text{Dom}(f) = x \neq 0 \quad (-\infty, 0) \cup (0, \infty)$$

$y_{\text{int}} = \text{none}$

$$x_{\text{int}}: 0 = \frac{x^2 - 1}{x^3} \Rightarrow x^2 - 1 = 0 \Rightarrow x = \pm 1 \quad (1, 0) \quad (-1, 0)$$

$$\text{Notice: } \lim_{\substack{x \rightarrow 0 \\ \pm \infty}} \frac{x^2 - 1}{x^3} = 0 \Rightarrow y = 0 \text{ Horizontal Asymptote}$$

$$\lim_{x \rightarrow -\infty} f(x) = \infty, \quad \lim_{x \rightarrow 0^+} f(x) = -\infty \Rightarrow x = 0 \text{ Vertical asymptote.}$$

$$f'(x) = 0 \Rightarrow 3-x^2 = 0 \Rightarrow x = \pm \sqrt{3}$$

$$f(\sqrt{3}) = \frac{(\sqrt{3})^2 - 1}{(\sqrt{3})^3} = \frac{3-1}{\sqrt{27}} = \frac{2}{\sqrt{27}}$$

$$f''(x) = 0 \Rightarrow 2(x^2 - 6) = 0 \Rightarrow x = \pm \sqrt{6}$$

$$f(\sqrt{6}) = \frac{(\sqrt{6})^2 - 1}{(\sqrt{6})^3} = \frac{5}{\sqrt{216}} = \frac{5}{6\sqrt{6}}$$

$$\begin{array}{c} - + + - \\ -\sqrt{3} \quad 0 \quad \sqrt{3} \end{array}$$

f is increasing on $(-\sqrt{2}, 0) \cup (0, \sqrt{3})$

f is decreasing on $(-\infty, -\sqrt{2}) \cup (\sqrt{3}, \infty)$

local min $(-\sqrt{3}, -\frac{2}{\sqrt{27}})$

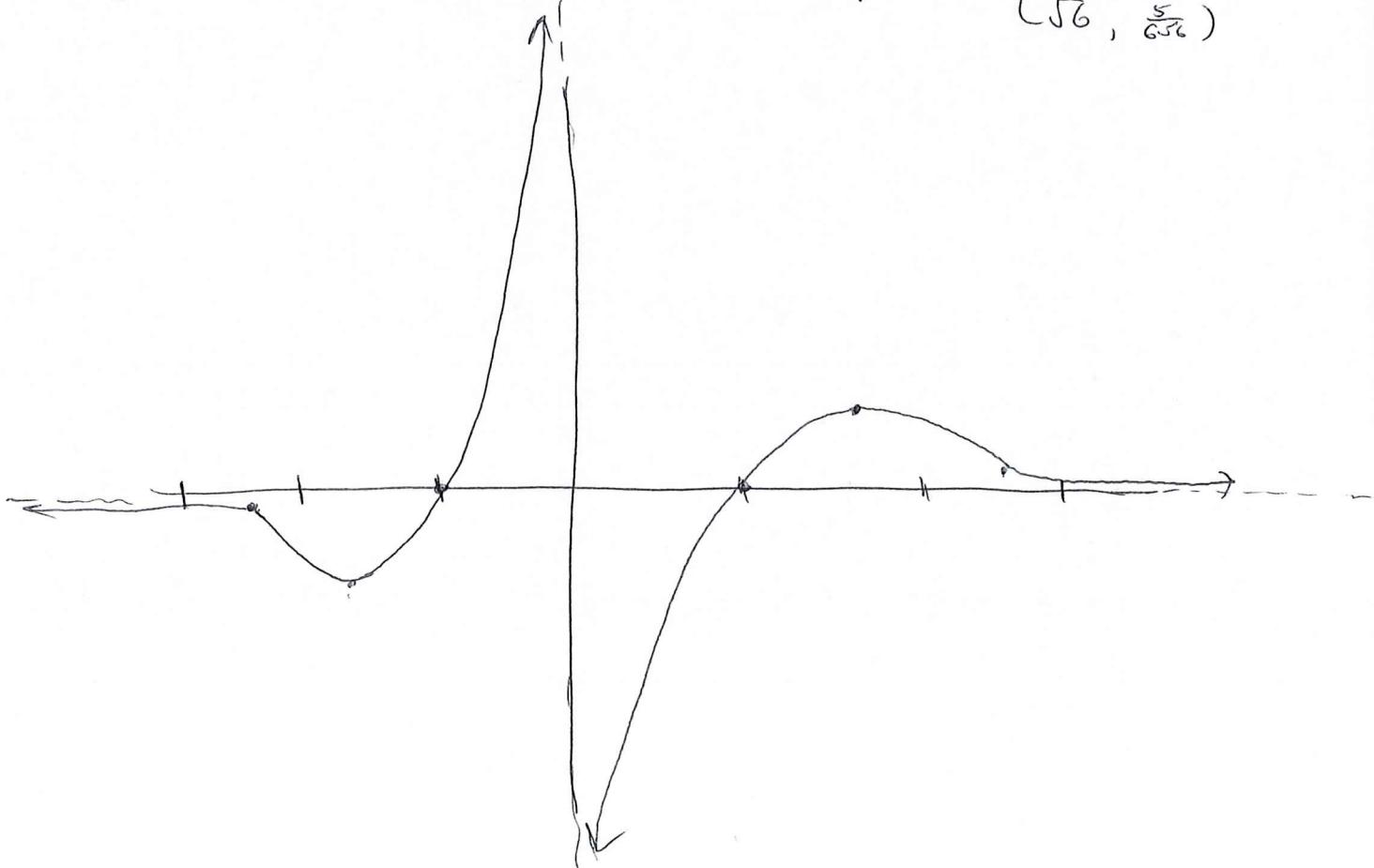
local max $(\sqrt{3}, \frac{2}{\sqrt{27}})$

$$\begin{array}{c} - + - + \\ -\sqrt{6} \quad 0 \quad \sqrt{6} \end{array}$$

f is concave up on $(-\sqrt{6}, 0) \cup (\sqrt{6}, \infty)$

f is concave down on $(-\infty, -\sqrt{6}) \cup (0, \sqrt{6})$

inflection points: $(-\sqrt{6}, -\frac{5}{6\sqrt{6}})$
 $(\sqrt{6}, \frac{5}{6\sqrt{6}})$



$$h(x) = x^{2/3} \left(\frac{5}{2} - x\right)$$

$$h'(x) = \frac{5(1-x)}{3x^{1/3}}$$

$$h''(x) = \frac{-5(1+2x)}{9x^{4/3}}$$

$$\text{Dom}(h) = (-\infty, \infty)$$

$$\text{y-intercept: } h(0) = 0 \quad (0, 0)$$

$$\text{x-intercept: } 0 = x^{2/3} \left(\frac{5}{2} - x\right) \Rightarrow \begin{cases} x=0 \\ x=\frac{5}{2} \end{cases} \quad (0, 0) \quad \left(\frac{5}{2}, 0\right)$$

No asymptotes

$$h'(x) = 0 \Rightarrow 5(1-x) = 0 \Rightarrow x=1$$

$$h' \text{ DNE when } x=0$$

$$h(1) = 1^{2/3} \left(\frac{5}{2} - 1\right) = 1 \left(\frac{3}{2}\right) = \frac{3}{2}$$

$$\begin{array}{c} - + + - \\ \hline 0 \quad 1 \end{array}$$

h is decreasing on $(-\infty, 0) \cup (1, \infty)$

h is increasing on $(0, 1)$

local min $(0, 0)$

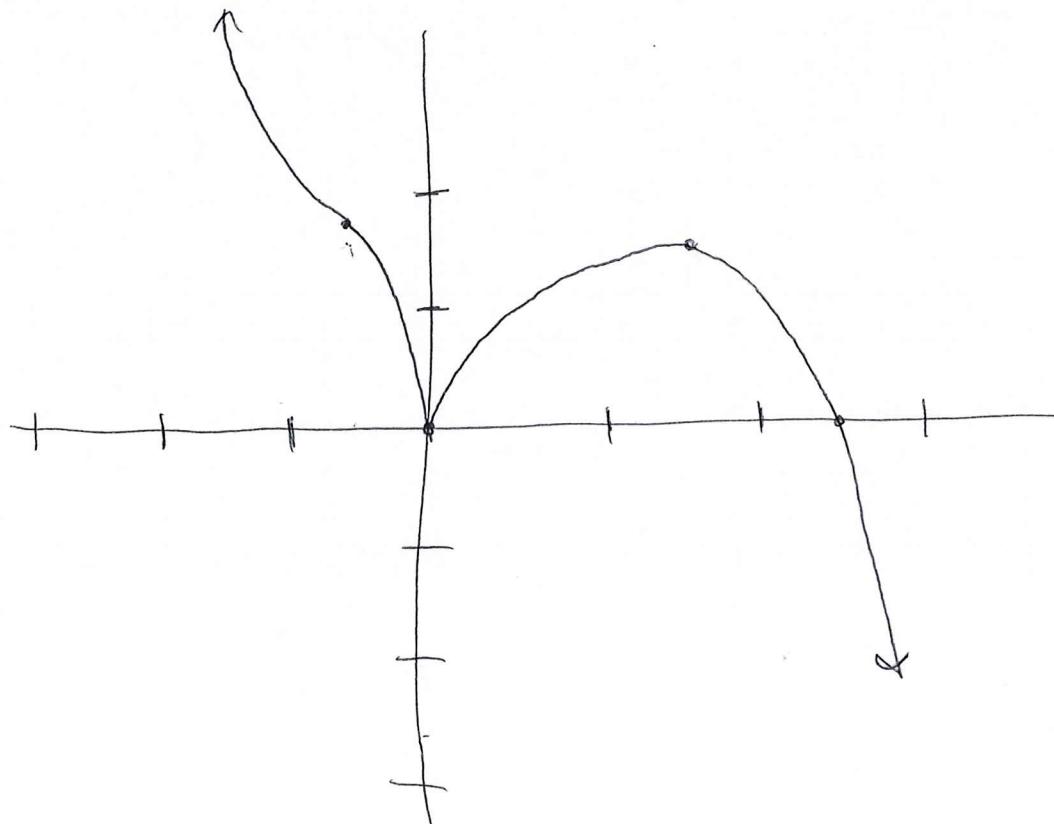
local max $(1, \frac{3}{2})$

$$\begin{array}{c} + - + - \\ \hline -\frac{1}{2} \quad 0 \end{array}$$

h is concave up on $(-\infty, -\frac{1}{2})$

h is concave down on $(-\frac{1}{2}, 0) \cup (0, \infty)$

inflection point $(-\frac{1}{2}, \frac{3\sqrt[3]{2}}{2})$



$$f(x) = \frac{2x^2 - 6x}{3x^2 - 8x - 3}$$

Notice that $\lim_{x \rightarrow \pm\infty} \frac{2x^2 - 6x}{3x^2 - 8x - 3} = \lim_{x \rightarrow \pm\infty} \frac{\frac{2x^2}{x^2} - \frac{6x}{x^2}}{\frac{3x^2}{x^2} - \frac{8x}{x^2} - \frac{3}{x^2}} = \lim_{x \rightarrow \pm\infty} \frac{2 - \frac{6}{x}}{3 - \frac{8}{x} - \frac{3}{x^2}} = \frac{2}{3}$

$\Rightarrow y = \frac{2}{3}$ is a horizontal asymptote.

Notice that $3x^2 - 8x - 3 = 0 \rightarrow (3x+1)(x-3) = 0$
 $\Rightarrow x = -\frac{1}{3}, x = 3$ not in Domain.

$$\lim_{x \rightarrow 3} \frac{2x^2 - 6x}{3x^2 - 8x - 3} = \lim_{x \rightarrow 3} \frac{2x(x-3)}{(3x+1)(x-3)} = \lim_{x \rightarrow 3} \frac{2x}{3x+1} = \frac{2(3)}{3(3)+1} = \frac{6}{10} = \frac{3}{5}$$

There is no vertical asymptote at $x = 3$, $(3, \frac{3}{5})$ is a point of removable discontinuity,

$$\lim_{x \rightarrow -\frac{1}{3}^-} \frac{2x}{3x+1} = +\infty, \quad \lim_{x \rightarrow -\frac{1}{3}^+} \frac{2x}{3x+1} = -\infty \Rightarrow x = -\frac{1}{3}$$

is a vertical asymptote.

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

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

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

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

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

$$= 8(x-4)^2(x-1)$$

$$f'(x) = 0 \Rightarrow x = 4, x = 1$$

$$\begin{aligned} f(1) &= 2(1)(1-4)^3 \\ &= 2(-3)^3 \\ &= -54 \end{aligned}$$

$$f' \begin{array}{c} \overline{-} \\ \diagup \quad \diagdown \\ 1 \quad 4 \end{array} \begin{array}{c} + \\ \diagup \quad \diagdown \\ + \quad + \end{array} \begin{array}{c} + \\ \diagup \quad \diagdown \\ + \quad + \end{array}$$

Notice f has a local minimum at $x = 1 : (1, -54)$

There are no other local extrema.

$$q = \sqrt{50-p^2}$$

$$\frac{dq}{dp} = \frac{1}{2}(50-p^2)^{-1/2} \cdot (-2p) = \frac{-p}{\sqrt{50-p^2}}$$

$$E(p) = -\frac{dq}{dp} \cdot \frac{p}{q} = \frac{p}{\sqrt{50-p^2}} \cdot \frac{p}{\sqrt{50-p^2}} = \frac{p^2}{50-p^2}$$

$$E(3) = \frac{3^2}{50-3^2} = \frac{9}{41} < 1$$

At \$3.00, demand is inelastic. Increasing price results in increased revenue.

$$\begin{aligned} 3p + \sqrt{q_1} &= 800 \\ \Rightarrow \sqrt{q_1} &= 800 - 3p \\ \Rightarrow q_1 &= (800 - 3p)^2 \end{aligned}$$

$$\begin{aligned} \frac{dq_1}{dp} &= 2(800 - 3p)(-3) \\ &= -6(800 - 3p) \\ &= -4800 + 18p \end{aligned}$$

$$\begin{aligned} a) E(p) &= -(-4800 + 18p) \cdot \frac{p}{(800 - 3p)^2} = \frac{6p(800 - 3p)}{(800 - 3p)^2} = \frac{6p}{800 - 3p} \\ b) E(70) &= -(-4800 + 18(70)) \cdot \frac{70}{(800 - 2(70))^2} = \frac{247,800}{348,100} < 1 \end{aligned}$$

Demand is inelastic at fair price.

c) To increase revenue, price should be increased.

$$d) E(p) = 1 \Rightarrow 6p = 800 - 3p \Rightarrow 9p = 800 \\ p \approx \$88.89.$$

Price of about \$89 would maximize revenue.

$$q = 1500 - 0.05p^2 - 0.2p \Rightarrow \frac{dq}{dp} = -0.10p - 0.2$$

$$a) E(p) = \frac{(0.10p + 0.2)p}{1500 - 0.05p^2 - 0.2p} = \frac{0.10p^2 + 0.2p}{-0.05p^2 - 0.2p + 1500}$$

$$b) E(100) = \frac{0.1(100)^2 + 0.2(100)}{-0.05(100)^2 - 0.2(100) + 1500} = \frac{1000 + 20}{-500 - 20 + 1500} = \frac{1020}{980} = \frac{102}{98} = \frac{51}{49} > 1$$

Increasing price decreases revenue because demand is elastic at this price.

$$c) E(p) = 1 \Rightarrow 0.10p^2 + 0.2p = -0.05p^2 - 0.2p + 1500$$

$$\text{Revenue maximized } 0.15p^2 + 0.4p - 1500 = 0$$

If price is
 $\approx \$98.68$

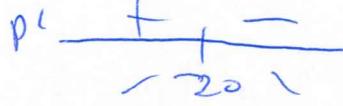
Use quadratic formula to get $p \approx \$98.68$

$p \approx -\$101.34$ (doesn't make sense)

Multiple Choice

$$P(x) = x(40-x) = 40x - x^2$$

$$P'(x) = 40 - 2x$$

P' 

$P' = 0$ when $x = 20$

Product has a maximum when $x = 20$.

$$S(x) = x + \frac{9}{x} = x + 9x^{-1}$$

$$\begin{aligned} S'(x) &= 1 - \frac{9}{x^2} \\ &= \frac{x^2 - 9}{x^2} \end{aligned}$$

$$S' = 0 \text{ when } x = \pm 3$$

$$S' \quad \begin{array}{c} - \\ \diagup 3 \end{array} \quad \begin{array}{c} + \\ \diagdown \end{array}$$

Problem said x must be positive
so $x = 3$ only critical number

Sum has a minimum when $x = 3$.

- b) Any odd-degree polynomial has an absolute extreme on the reals is not true.

For example: $f(x) = x^3$ has no extrema.

- b) If a function is continuous on $[a, b]$, then -- it will have both absolute max and absolute min on $[a, b]$. This is "EXTREME VALUE THEOREM."

- b) Absolute min of $f(x) = \ln(x+2)$ on $[-1, \infty)$

is when $x = -1$. $f'(x) = \frac{1}{x+2} > 0$ on $[-1, \infty)$

So min must be at the beginning of the interval.

a) $f(x) = x^3 - 6x^2 + 9x - 8$ on $[0, 5]$

$$f'(x) = 3x^2 - 12x + 9$$

$$f' = 0 \Rightarrow 3x^2 - 12x + 9 = 0$$

$$\Rightarrow 3(x^2 - 4x + 3) = 0$$

$$\Rightarrow 3(x-1)(x-3) = 0$$

$$x=1 \quad x=3$$

x	$f(x)$
0	-8
1	-4
3	-8
5	12

Absolute max occurs when $x=5$.

b) If $x=y$ and $xy+xz+yz=100$,

$$\text{then } x \cdot x + xz + xz = 100$$

$$\Rightarrow 2xz = 100 - x^2$$

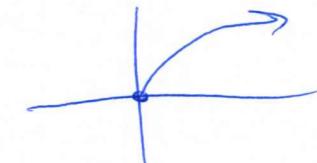
$$z = \frac{100 - x^2}{2x}$$

$$\text{So } xyz$$

$$= x \cdot x \cdot \frac{100 - x^2}{2x} = \frac{x(100 - x^2)}{2}$$

a) and b) are both true.

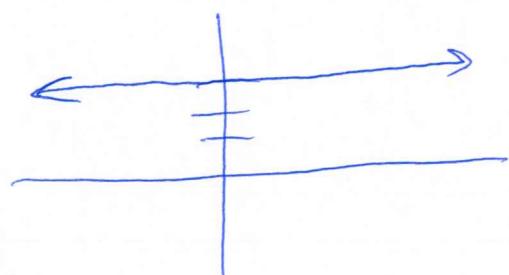
For a) consider something like $f(x) = 5x$.



Clearly has absolute min at an endpoint.

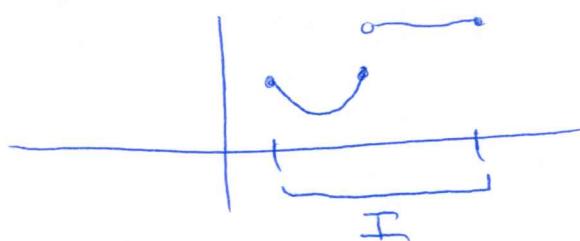
For b) consider $f(x) = 3$

Every point is both a local minimum and an absolute maximum.



b) A function with an absolute minimum on I

does not need to be continuous on I



Has absolute min on I but not continuous on I.

c) A function f has an absolute max or an interval if the interval is closed and f is continuous on the interval. (Again, Extreme Value Theorem--)

a) $f(x) = e$ has the value e as absolute max as min for every point

d) If $f'(c) = 0$, then c is a CANDIDATE for local extrema. f' might not change sign at $x=c$. If it goes + to -, max. If it goes - to +, min.