2.5: 6. $Q = x^2 y \quad x + y = 2$

$\Rightarrow y = 2 - x$

so $Q = x^2(2-x) = 2x^2 - x^3$

$Q' = 4x - 3x^2$

set $Q' = 0$

$4x - 3x^2 = 0$

$x(4-3x) = 0$

$x = 0$ or $4 = 3x \Rightarrow x = \frac{4}{3}$

confirm it's a max

rel min at 0, rel max at $4/3$ on the X axis

	(<0)	0		$4/3$	
x	$-$		$+$		$+$
$4-3x$	$+$		$+$		$-$
Q'	$-$		$+$		$-$

we need positive #'s, so $x \neq 0$

thus $x = \boxed{\frac{4}{3}}$

$y = 2 - x = 2 - \frac{4}{3} = \boxed{\frac{2}{3}}$

12. Volume open rectangular box w/ square base.

$V = x^2 h = 32 \text{ ft}^3 \Rightarrow h = \frac{32}{x^2}$

$SA = x^2 + 4xh \leftarrow$ minimal

$SA = x^2 + 4x\left(\frac{32}{x^2}\right) = x^2 + 128x^{-1}$ (note $x \neq 0$)

$SA' = 2x - \frac{128}{x^2}$ set $SA' = 0$

$0 = 2x - \frac{128}{x^2}$

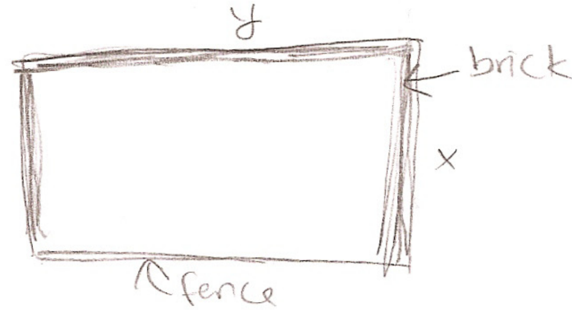
$\frac{128}{x^2} = 2x \Rightarrow 64 = x^3 \Rightarrow x = 4 \Rightarrow h = \frac{32}{(4)^2} = 2$

confirm:

rel min at 4 on the X axis

		0		4	
SA'	$- \; -$	does not exist	$-$		$+ \; + \; +$

5. $A = 75\ ft^2 = xy$



$C = 5y + 3(10)x$

$= 5y + 30x$

$y = \frac{75}{x}$

$C = 5\left(\frac{75}{x}\right) + 30x = \frac{375}{x} + 30x = 375x^{-1} + 30x$ $\boxed{\text{note } x \neq 0}$

$C' = -\frac{375}{x^2} + 30$

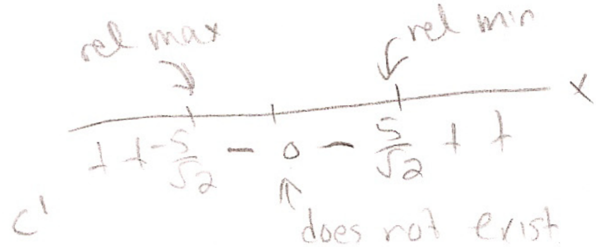
set $C' = 0$

$\frac{375}{x^2} = 30 \Rightarrow x^2 = 12.5 = \frac{25}{2} \Rightarrow x = \pm \frac{5}{\sqrt{2}}$

we can ignore $x \le 0$, so $y = \frac{5}{\sqrt{2}}$

$y = \frac{75}{x} = 15\sqrt{2}$ answer: $\frac{5}{\sqrt{2}} \times 15\sqrt{2}$ feet

confirm it's a min:



2

2.6 1. A Avg amount of cherries = 90 cherries

B Max amount: 180 cherries

C # or orders: 6 orders

D Pounds sold in 1 year: 1080 lbs

2 A $I = C + O = 7(90) + 6(50) = \$930$

B $I = C + O = 7(90)(2) + 6(50) = \$1560$

4 A $I = 160r + 32\left(\frac{x}{2}\right) = 160r + 16x$

B $rx = 640$

C $r = \frac{640}{x}$

$I = 160\left(\frac{640}{x}\right) + 16x = 102400x^{-1} + 16x$

$I' = -\frac{102400}{x^2} + 16 \quad x \neq 0$

set $I' = 0$

$16 = \frac{102400}{x^2} \Rightarrow \quad x^2 = 6400 \Rightarrow x = \pm 80$ choose $\boxed{x = 80}$

$r = \frac{640}{80} = \boxed{\$8}$

$I_{min} = 160(8) + 32\left(\frac{80}{2}\right) = \$2560$

confirm min

rel max | undefined | rel min

x: -80, 0, 80

I': + + 0 - - - 0 + + +

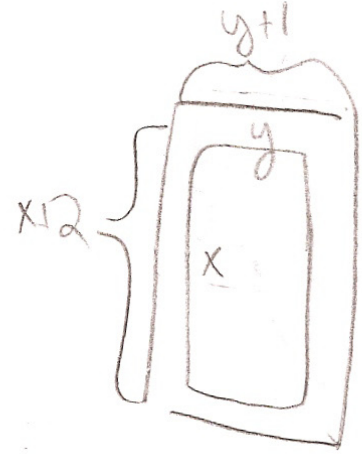
28.

$xy = 50 \text{ in}^2$ $\qquad x = \dfrac{50}{y}$

$P = (x+2)(y+1)$

$= xy + 2y + x + 2$

$= 52 + 2y + \dfrac{50}{y}$



$P' = 2 - \dfrac{50}{y^2} \qquad y \neq 0$

set $P' = 0$

$\dfrac{50}{y^2} = 2 \Rightarrow y = \pm 5$ in.,

ignore $y \leq 0$, so $y = 5$ in. $\rightarrow x = \frac{50}{5} = 10$ in

confirm min:

28 $f(x)$ is defined for all $0 \le x \le 5$

$f'(x) < 0$ for all x

$f(x)$ will have it's greatest value at $x = 0$, since $f'(x) < 0$ implies that the value is decreasing for all x.

Section 2.7

1 $C(x) = x^3 - 6x^2 + 13x + 15$

marginal cost: $C'(x) = 3x^2 - 12x + 13$

$C''(x) = 6x - 12$

set $C''(x) = 0$

$6x = 12 \Rightarrow x = 2$

x		rel min 2	
$C''(x)$	$-$ $-$		$+$ $+$ $+$

$C'(2) = 3(2)^2 - 12(2) + 13 = \$1$

5 $C(x) = x^3 - 6x^2 + 13x + 15$

$R(x) = 28x$

$P(x) = R(x) - C(x) = -x^3 + 6x^2 + 15x - 15$

$P'(x) = -3x^2 + 12x + 15$

set $P'(x) = 0$

$0 = -3x^2 + 12x + 15$

$0 = -3(x^2 - 4x - 5) = -3(x-5)(x+1)$

$x = 5$ or $\cancel{x = -1}$ we need $x \ge 0 \Rightarrow x = \$5$

x		rel max -1		rel min 5	
$(x-5)$	$-$		$-$		$+$
$(x+1)$	$-$		$+$		$+$
$P'(x)$	$+$		$-$		$+$
					$+$

(12) (x, p): x = people p = price

$(4000, \$50)$ $(3800, \$52)$

$$p - 50 = \frac{52-50}{3800-4000}(x - 4000)$$

$$p - 50 = -\frac{2}{200}(x - 4000)$$

$$p - 50 = \frac{-x}{100} + 4$$

$$p = \frac{-x}{100} + 54$$

$$R(x) = x \cdot p = x\left(\frac{-x}{100} + 54\right) = \frac{-x^2}{100} + 54x$$

$$R'(x) = -\frac{x}{50} + 54$$

set $R'(x) = 0$

$$\frac{x}{50} = 54 \Rightarrow x = 2700$$

$$p(2700) = -\frac{2700}{100} + 54 = \boxed{\$27}$$