$\boxed{\text{FDWK p 232 \#24}}$

$r(x) = \text{revenue} = \dfrac{x^2}{x^2+1}$

$c(x) = \text{cost} = \dfrac{(x-1)^3}{3} - \dfrac{1}{3}$

x = 1000's of units

$r'(x) = \dfrac{2x(x^2+1) - x^2(2x)}{(x^2+1)^2} = \dfrac{2x^3 + 2x - 2x^3}{(x^2+1)^2}$

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

$\boxed{r'(x) = \dfrac{2x}{(x^2+1)^2}}$

$\boxed{c'(x) = (x-1)^2}$

Profit is maximum when $r'(x) = c'(x)$

$(x-1)^2 = \dfrac{2x}{(x^2+1)^2} \rightarrow x^2-2x+1 = \dfrac{2x}{x^4+2x^2+1}$

$\boxed{\text{this looks like a GDC problem}}$

$\boxed{\text{FDWK p232 \#23 cont}}$

$\frac{dr}{dx}$ = marginal revenue $= \frac{4}{\sqrt{x}}$

$\frac{dc}{dx}$ = marginal revenue $= 4x$

$$4x = \frac{4}{\sqrt{x}}$$

$$4x\sqrt{x} = 4$$

$$x\sqrt{x} = 1$$

$$x \cdot x^{1/2} = 1$$

$$x^{3/2} = 1$$

23a

$$\boxed{x = 1^{2/3} = 1}$$

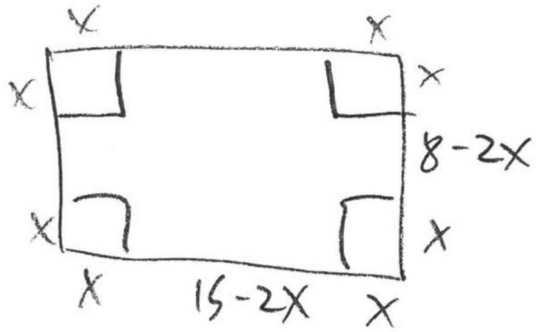
23b

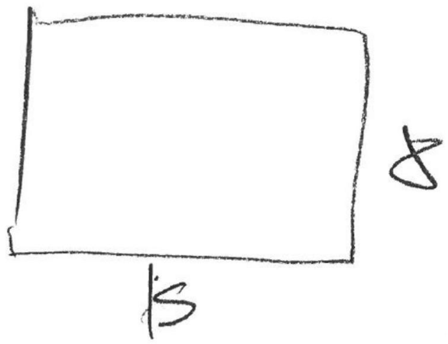
So profit is maximized at $x=1$

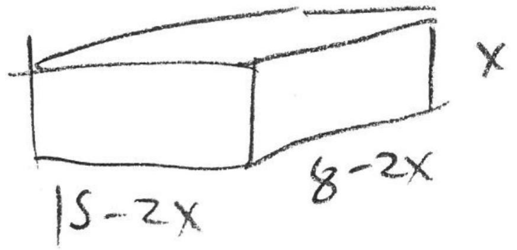
but recall x is measured in 1000's

So profit is maximized at 1000 units

$\boxed{\text{FDWK p 231 \# 7}}$ no top box





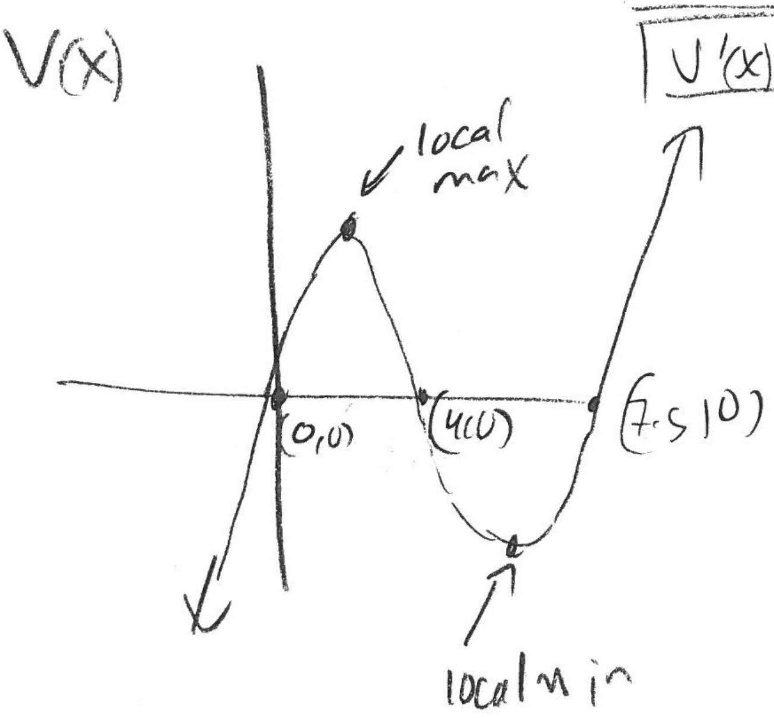


$$V = x(15-2x)(8-2x)$$

$$= x(120 - 16x - 30x + 4x^2)$$

$$\boxed{V(x) = 4x^3 - 46x^2 + 120x}$$

$$\boxed{V'(x) = 12x^2 - 92x + 120}$$



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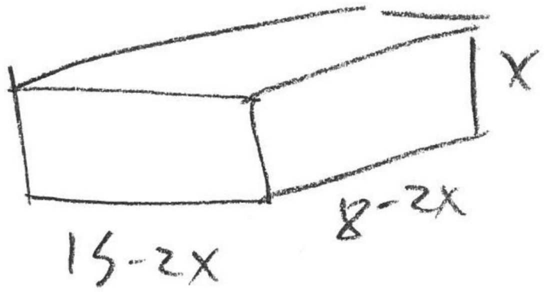
FDWK p 231 #7 cont



$V(x) = 4x^3 - 46x^2 + 120x$

$V'(x) = 12x^2 - 92x + 120$

$V'(x) = 0 \rightarrow$ local extremes

$D = 92^2 - 4(12)(120) = 2704$ PS!!

$$x = \frac{92 \pm \sqrt{2704}}{24} = \frac{92 \pm 52}{24}$$

$x = \frac{144}{24}$ $\quad$ $x = \frac{40}{24}$

↓ local min occurs at $\boxed{x = \frac{144}{24} = 6}$

↓ local max occurs at $\boxed{x = \frac{40}{24} = \frac{5}{3}}$

$\boxed{\text{FDWK p231 \#7 cont}}$

$V(x)$ has local max at $x = \frac{5}{3}$

$V(x) = 4x^3 - 46x^2 + 120x$

$$\boxed{V\left(\tfrac{5}{3}\right) = \frac{2450}{27} \approx 90.\overline{740}}$$

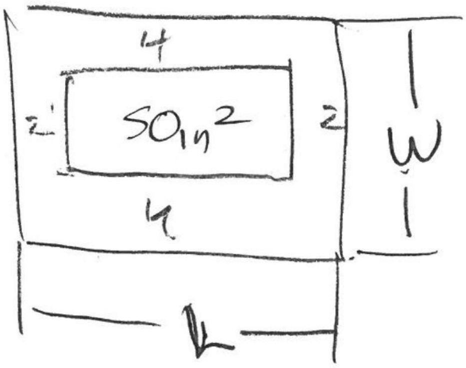
$x = \frac{5}{3}$

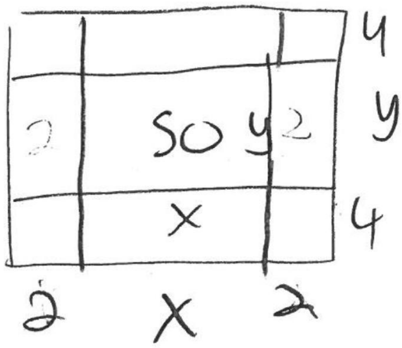
$15 - 2\left(\frac{5}{3}\right) = 15 - \frac{10}{3} = \frac{35}{3}$

$8 - 2\left(\frac{5}{3}\right) = 8 - \frac{10}{3} = \frac{14}{3}$

$$\boxed{\text{Dimensions} \quad \frac{5}{3} \times \frac{35}{3} \times \frac{14}{3}}$$

$\boxed{\text{FDWK p 231 \#13}}$





$\boxed{L = x+4}$ $\boxed{W = y+8}$ $xy = 50$

$\boxed{W = \frac{50}{x} + 8}$ $\boxed{y = \frac{50}{x}}$

$$A(x) = (x+4)\left(\frac{50}{x} + 8\right) = 50 + \frac{200}{x} + 8x + 32$$

$$\boxed{A(x) = 82 + \frac{200}{x} + 8x}$$

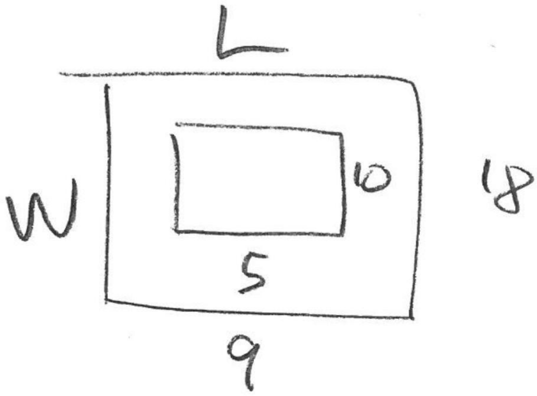
$$A'(x) = -200x^{-2} + 8$$

$$\boxed{A'(x) = \frac{-200}{x^2} + 8}$$

$A'(x) = 0$
will tell us
local extremes

FDWK p231 #13 con't

$$0 = -\frac{200}{x^2} + 8$$



$$\frac{200}{x^2} = 8$$

$$200 = 8x^2$$

$$25 = x^2$$

$$\boxed{x = \pm 5}$$

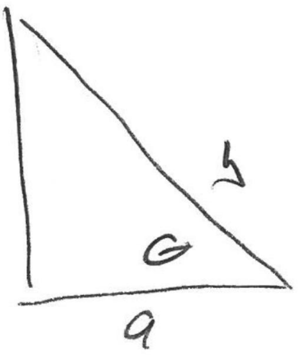
x=5 feasible

$$y = \frac{50}{5} = 10$$

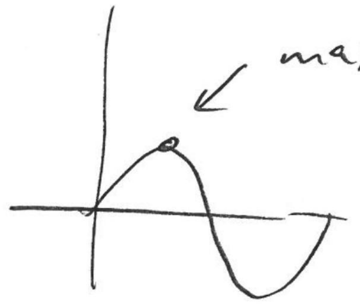
$$L = 5 + 4 = 9$$

$$W = 10 + 8 = 18$$

$\boxed{\text{FDWK p231 \#15}}$



$A = \frac{1}{2} ab \sin\theta$



max occurs at $\theta = \frac{\pi}{2}$

So this means as triangles go right triangles are the most efficient use of two sides in terms of area maximization

$$\boxed{\theta = \frac{\pi}{2} \to 90^\circ} \to \boxed{rt\triangle}$$

$\boxed{\text{F DWK p232 \#25}}$

$c(x) = x^3 - 10x^2 - 30x$

average cost $a(x) = \frac{c(x)}{x} = x^2 - 10x - 30$

marginal cost $c'(x) = 3x^2 - 20x - 30$

$\boxed{\text{average cost is minimum when marginal cost = average cost}}$

Big Idea

$$3x^2 - 20x - 30 = x^2 - 10x - 30$$
$$-x^2 + 10x + 30 \quad -x^2 + 10x + 30$$

$$2x^2 - 10x = 0$$

$$2x(x-5) = 0$$

$$\boxed{x = 0 \quad x = 5}$$

$x = 0$ means no production

$\boxed{\text{x = 5 means 5000 units will minimize average cost per unit}}$