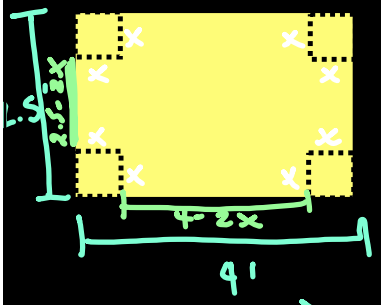
January 11, 2024

VOLUME

6.



$(0, 1.25)$

$\lim_{x \to 0} 4x^3 - 13x^2 + 10x = 0$

$\lim_{x \to 1.25} 4x^3 - 13x^2 + 10 = 0$

1/2	1/4	= 2.25

$V = lwh$

$V = (4 - 2x)(2.5 - 2x)x$ $\quad 3 \cdot \frac{3}{2} \cdot \frac{1}{2}$

$V = (10 - 8x - 5x + 4x^2)x$

$V = (10 - 13x + 4x^2)x$

$* V = 4x^3 - 13x^2 + 10x$

$V' = 12x^2 - 26x + 10 = 0$

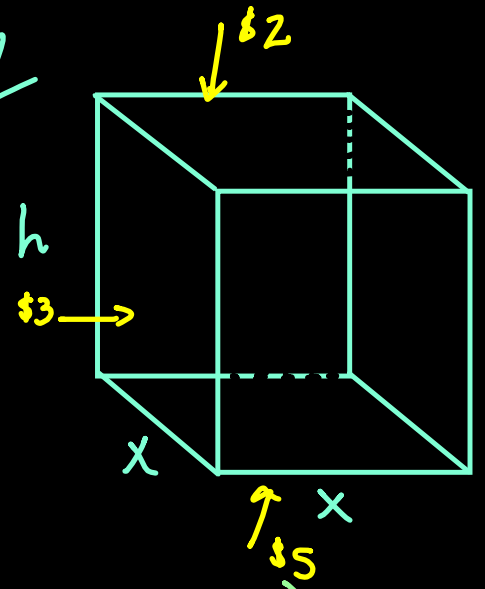
$2(6x^2 - 13x + 5) = 0$

$2(2x - 1)(3x - 5) = 0$

$x = 1/2, 5/3$

1/2 ' square

1



$V = x \cdot x \cdot h$

$V = x^2 h$

$756 = 5x^2 + 2x^2 + \$3 \cdot 4xh$

$7x^2 + 12xh = 756$

$\frac{12xh}{12x} = \frac{756 - 7x^2}{12x}$

$h = \frac{63}{x} - \frac{7}{12}x$

$7x^2 = 756$

$x^2 = 108$

$x = \sqrt{108} = 6\sqrt{3}$

$x: (0, \sqrt{108})$

$\lim_{x \to 0} 63x - \frac{7}{12}x^3 = 0$

$\lim_{x \to \sqrt{108}} 63x - \frac{7}{12}x^3 = 0$

$V = x^2\left(\frac{63}{x} - \frac{7}{12}x\right)$

$* V = 63x - \frac{7}{12}x^3$

$V' = 63 - \frac{7}{4}x^2 = 0$

$\frac{4}{7} \cdot 63 = \frac{4}{4}x^2 \cdot \frac{4}{7}$

$\sqrt{36} = \sqrt{x^2}$

$\pm 6 = x$

6	252

$h = \frac{63}{6} - \frac{7}{12} \cdot 6 = \frac{21}{2} - \frac{7}{2} = \frac{14}{2} = 7'$

$6' \times 6' \times 7'$

$V = 16\pi \text{ in}^3$

Bottom costs twice as much as sides

$r: (0, \infty)$

Minimize Cost

$A = \pi r^2$
$C = 2\pi r$

$$C = 2\pi r^2 + 2\pi r h$$

$$\Rightarrow \pi r^2 h = 16\pi$$

$$h = \frac{16\pi}{\pi r^2}$$

$$C = 2\pi r^2 + 2\pi r\left(\frac{16}{r^2}\right)$$

$$* \quad C = 2\pi r^2 + \frac{32\pi}{r}$$

9 $24 \frac{\text{trees}}{\text{acre}}$ — 600 apples/tree

↑ tree ↓ 12 apples

Maximize apple production.

Apples = 24 trees · 600 apples

$[-24, 50]$ $A = (24 + x)(600 - 12x)$

$600 - 12x = 0$

$600 = 12x$

$50 = x$

$A = 14400 - 288x + 600x - 12x^2$

$A = 14400 + 312x - 12x^2$

$A' = 312 - 24x = 0$

$312 = 24x$

$13 = x$

-24	0
13	16428
50	0

plant 13 more trees or 37 trees total

$A = (24+13)(600-12(13))$

$A = (37)(444)$ trees

$A = 16{,}428$ apples