Derivatives & Tangents ES

1. $\sqrt{3.7}$

$f(x) = \sqrt{x}$ $\quad f(4) = \sqrt{4} = 2$

$f'(x) = \dfrac{1}{2\sqrt{x}}$ $\quad f'(4) = \dfrac{1}{2\sqrt{4}} = \dfrac{1}{4}$

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

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

$y = \frac{1}{4}x + 1$

$y = \frac{1}{4}(3.7) + 1$

$y = \dfrac{7.7}{4} = 1.925$

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2. $y = \sqrt{4 + \sin x}$ $\quad x = 0$

$y' = \frac{1}{2}(4 + \sin x)^{-\frac{1}{2}} \cdot \cos x$

$y' = \dfrac{1 \cdot \cos x}{2\sqrt{4 + \sin x}}$

When $x = 0$, $y = \sqrt{4 + \sin 0}$

$y = \sqrt{4}$

$y = 2$

$y' = \dfrac{\cos 0}{\sqrt{4 + \sin 0}} = \dfrac{1}{\sqrt{4}} = \dfrac{1}{2}$

$y - 2 = \frac{1}{2}(x - 0)$

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

$y = \frac{1}{2}x + 2$

$y = \frac{1}{2}(0.12) + 2$

$y = 0.06 + 2$

$y = 2.06$

3. $f(3)=2$

$f'(3)=5$

$y-2=5(x-3)$

$y-2=5x-15$

$y=5x-13$

Approx. "a zero" AKA "a root!"

$0=5x-13$

$\frac{13}{5}=x$ or $x=2.6$

Extrema & Optimization Retake

1. $x^3 - 3x^2 + 12 \quad [-2, 4]$

$f'(x) = 3x^2 - 6x$

$0 = 3x(x-2)$

$x = 0 \quad x = 2$

$f(-2) = -8$

$f(0) = 12$

$f(2) = 8$

$f(4) = 4$

Max occurs @ $x = 0$

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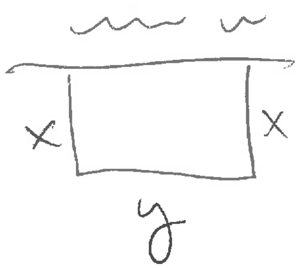
2. 2400ft of fencing



$P = 2x + y$

$2400 = 2x + y$

$2400 - 2x = y$

$A = xy$

$A = x(2400 - 2x)$

$A = 2400x - 2x^2$

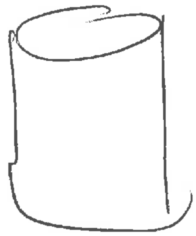
$A' = 2400 - 4x$

$0 = 2400 - 4x$

$\frac{-2400}{-4} = \frac{-4x}{-4}$

$\boxed{\begin{array}{c} 600\text{ft} = x \\ 1200\text{ft} = y \end{array}}$

3.



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

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

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

$$\left(S = 2\pi r^2 + \frac{32\pi}{r}\right)$$

$$S' = 4\pi r - \frac{32\pi}{r^2}$$

$$\left(0 = 4\pi r - \frac{32\pi}{r^2}\right) r^2$$

$$0 = 4\pi r^3 - 32\pi$$

$$\frac{32\pi}{4\pi} = \frac{\cancel{4\pi} r^3}{\cancel{4\pi}}$$

$$8 = r^3$$

$$2 = r$$

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

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

$$4 = h$$

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