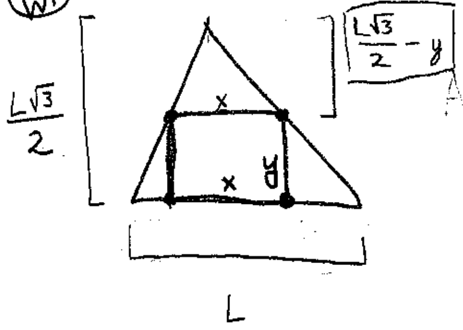
(W1)



$A = xy$ **Worksheet 9**

maximize this. We need to solve for y or x

So by similar triangles,

$$\frac{\cancel{L}}{x} = \frac{\cancel{L}\sqrt{3}}{2} \Big/ \left(\frac{L\sqrt{3}}{2} - y\right)$$

So $2\left(\frac{L\sqrt{3}}{2} - y\right) = \sqrt{3}x$

$L\sqrt{3} - 2y = \sqrt{3}x$

$$\boxed{y = \frac{-\sqrt{3}x + L\sqrt{3}}{2}} \implies A = x\left(\frac{-\sqrt{3}x + L\sqrt{3}}{2}\right)$$

$$= \frac{-\sqrt{3}}{2}x^2 + \frac{L\sqrt{3}}{2}x$$

$$A' = -\sqrt{3}x + \frac{L\sqrt{3}}{2} = 0$$

$$x = \frac{L}{2}, \quad y = \frac{-\sqrt{3}\left(\frac{L}{2}\right) + L\sqrt{3}}{2} = \frac{\sqrt{3}L}{4}$$

$$\boxed{A = \frac{\sqrt{3}L^2}{8}}$$

(This is half the area of the triangle)

(W2) We want to find the root of $x^5 = 36$, or $x^5 - 36 = 0$. Newton's method says

$$X_2 = X_1 - \frac{f(x_1)}{f'(x_0)} = X_1 - \frac{x_1^5 - 36}{5x_1^4}$$

$$= 2 - \frac{2^5 - 36}{5(2)^4} = 2 - \frac{(-4)}{5(16)} = 2 + \frac{1}{20} = 2.05.$$

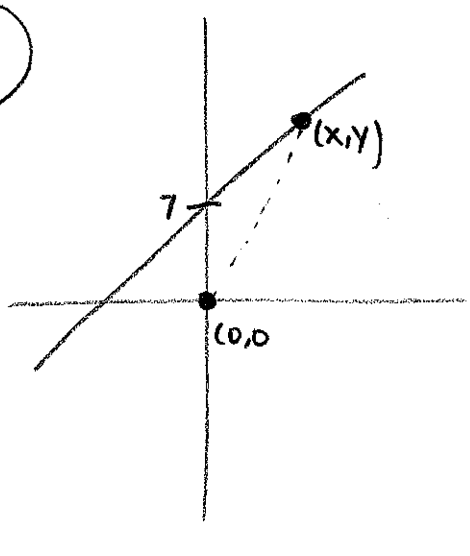
(01) Call the number x. Then we want to maximize

$M = x + \frac{1}{x}$. Then $M' = 1 - \frac{1}{x^2} = 0$

$\Rightarrow x = \pm 1$ but we want a positive #, so pick $x = 1$. Check that it's a minimum:

$$\underset{1}{\overset{- - - - \quad | \quad + + + +}{\longrightarrow}} \quad M'$$

(02)



$D = \sqrt{x^2 + y^2}$ and $y = 4x + 7$,

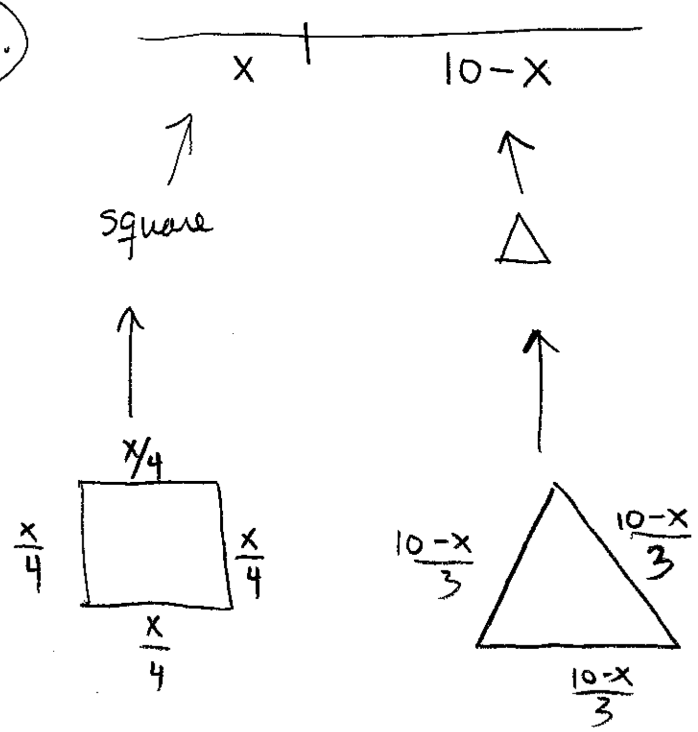
So $D = \sqrt{x^2 + (4x+7)^2} = \sqrt{x^2 + 16x^2 + 56x + 49}$

$$D' = \frac{34x + 56}{2\sqrt{17x^2 + 56x + 49}} = 0 \text{ when}$$

$$\boxed{x = -\frac{56}{34} = \frac{-28}{17}}$$

$$\boxed{y = \frac{112}{34} + 7}$$

(03.)



Formula: Area of equil. triangle of side length s is

$$\boxed{A = \frac{s^2\sqrt{3}}{4}}$$

$$A_{\square} = \frac{x^2}{16} \qquad A_{\Delta} = \left(\frac{10-x}{3}\right)^2 \cdot \frac{\sqrt{3}}{4}$$

So we want to minimize

$$A = \frac{x^2}{16} + \left(\frac{10-x}{3}\right)^2 \cdot \frac{\sqrt{3}}{4}$$

$$A' = \frac{x}{8} + 2\left(\frac{10-x}{3}\right)\left(\frac{-1}{3}\right) \cdot \frac{\sqrt{3}}{4}$$

$$= \frac{x}{8} - \frac{\sqrt{3}}{18}(10-x) = 0 \qquad \cdot(24)$$

$$9x - 4\sqrt{3}(10-x) = 0$$

$$x(9 + 4\sqrt{3}) = 40\sqrt{3}$$

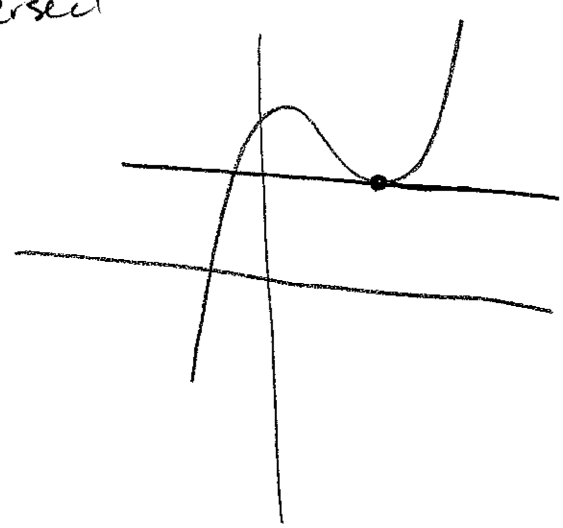
$$\boxed{x = \frac{40\sqrt{3}}{9+4\sqrt{3}}}$$

(N1) We want to solve $f(x)=x^4-78=0$. Notice $3^4=81$ is close.

$x_1 = 3$

$$x_2 = 3 - \frac{f(3)}{f'(3)} = 3 - \frac{81-78}{4(3)^3} = 3 - \frac{3}{4\cdot 3^3} = 3 - \frac{1}{36}$$

(N2.) You can't use it because $f'(1)=0$ so the tangent line is horizontal. You could say that the formula is undefined, but really what is going on is that the tangent line doesn't intersect the x-axis.



(N3) Find a soln to $f(x)=\ln x - 0.1$ $\quad f'(x)=\frac{1}{x}$

a good guess is $x_1=1$,

$$x_2 = 1 - \frac{f(1)}{f'(1)} = 1 - \frac{-0.1}{\frac{1}{1}} = 1+.1 = 1.1$$