$SA_{cyl} = 2\pi rh + 2\pi r^2$

12 fl. oz. = 22 in^3

$V_{cyl} = \pi r^2 h$

$\frac{22}{\pi r^2} = \frac{\pi r^2 h}{\pi r^2}$

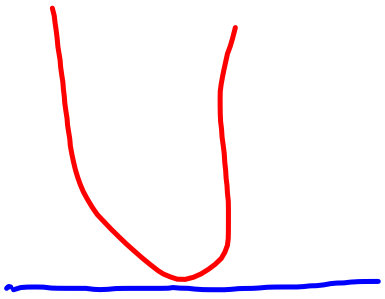
$h = \frac{22}{\pi r^2}$

$2\pi r\left(\frac{22}{\pi r^2}\right) + 2\pi r^2 = SA$

$\frac{44}{r} + 2\pi r^2 = A$

$C(r) = \frac{-44(1)}{r^2} + 4\pi r = A'$

$C'(r) = \frac{44}{r^2} + 4\pi r = A'$



$\frac{44}{r^2} + \frac{-44}{r^2} + 4\pi r = 0 + \frac{44}{r^2}$

$r^2 \cdot \frac{44}{r^2} = 4\pi r \cdot r^2$

$\frac{44}{4\pi} = \frac{4\pi r^3}{4\pi}$

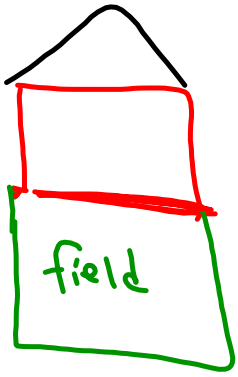
$\sqrt[3]{r^3} = \sqrt[3]{\frac{44}{4\pi}}$

$r = 1.518$ in

1. We need to enclose a field with a fence.

We have 500 feet of fencing material and a building is on one side of the field which will not need any fencing.

Determine the dimensions of the field that will enclose the largest area.



Perimeter = 500 ft $P = 2l + w$

Area = ? $A = lw$

$500 = 2l + w$

$-2l \quad -2l$

$500 - 2l = w$

$A = l(500 - 2l)$

$A = 500l - 2l^2$

$A' = 500 - 4l$

$0 = 500 - 4l$

$+4l \quad +4l$

$4l = 500$

$l = 125$ ft

$500 = 2l + w$

$500 = 2(125) + w$

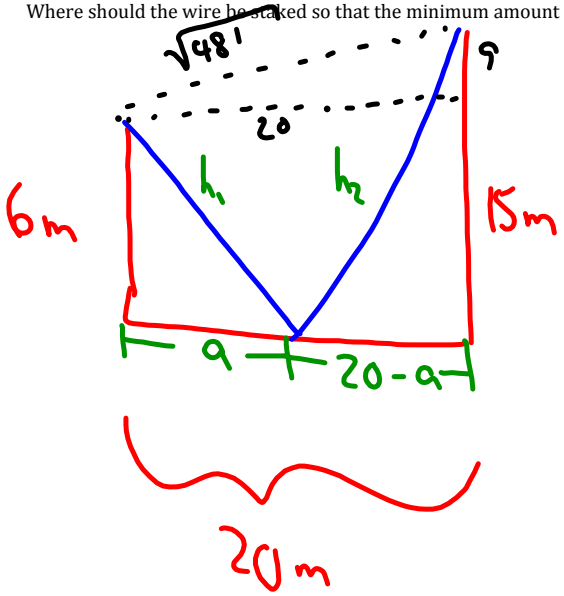
$500 = 250 + w$

$w = 250$ ft

1. Two poles, one 6 meters tall and one 15 meters tall, are 20 meters apart.

A length of wire is attached to the top of each pole and it is also staked to the ground somewhere between the two poles.

Where should the wire be staked so that the minimum amount of wire is used?



$h_1 = \sqrt{6^2 + a^2}$

$h_1 = \sqrt{36 + a^2}$

$h_2 = \sqrt{225 + (20-a)^2}$

length of wire → $L = h_1 + h_2$

$L = \sqrt{36 + a^2} + \sqrt{225 + (20-a)^2}$

derive L & solve

1. An apartment complex has 250 apartments to rent. If they rent *x* apartments then their monthly profit, in dollars, is given by $P(x) = -8x^2 + 3200x - 80000$. How many apartments should they rent order to maximize their profit?

$P'(x) = -16x + 3200$

$0 = -16x + 3200$

$+16x \quad +16x$

$16x = 3200$

$x = 200$

1. A car with position function $x(t) = 100t - 5t^2$ is traveling 100 ft/s when the driver suddenly applies the brakes. How far and for how long does the car skid before it comes to a stop?

position $x(t) = 100t - 5t^2$

velocity $x'(t) = 100 - 10t$

acceleration $x''(t) = -10$

jerk $x'''(t) = 0$

$0 = 100 - 10t$

$100 = 10t$

$t = 10$ sec

$x(10) = 100(10) - 5(10)^2$

$1000 - 500 = 500$ ft

1. The production costs per week for producing x widgets is given by $C(x) = 500 + 350x - 0.09x^2, 0 \leq x \leq 1000$.

a. What is the cost to produce the 301st widget?

b. What is the rate of change of the cost at $x = 300$?

derive

a. $C(301) = 500 + 350(301) - 0.09(301)^2$

$- (C(300) = 500 + 350(300) - 0.09(300)^2$

b. $C'(300) = 350 - 0.18(300)$