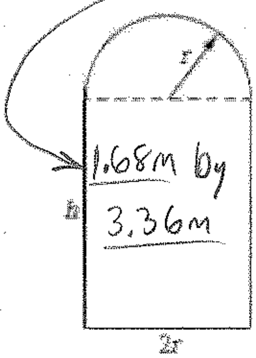
Help wanted! Requesting all Applications

1. A window is being built and the bottom is a rectangle and the top is a semicircle. If there is 12 m of framing materials what must the dimensions of the window be to let in the most light (Circle formulas you might need: $A = \pi r^2$ *and* $C = 2\pi r$)?

Max Area



$P = \pi r + 2h + 2r$

$12 = \pi r + 2h + 2r$

$-\pi r \quad -\pi r \qquad -2r$

$-2r$

$\dfrac{\quad}{2} \qquad \dfrac{\quad}{2}$

$\boxed{6 - \frac{1}{2}\pi r - r = h}$

$A = \frac{1}{2}\pi r^2 + 2hr$

$A = \frac{1}{2}\pi r^2 + 2r\left(6 - \frac{1}{2}\pi r - r\right)$

$A = \frac{1}{2}\pi r^2 + 12r - \pi r^2 - 2r^2$

$A = -\frac{1}{2}\pi r^2 + 12r - 2r^2$

a value $= -\frac{1}{2}\pi - 2$

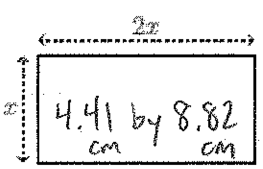
$\frac{-b}{2a} = \frac{-12}{2\left(-\frac{1}{2}\pi - 2\right)} \approx \boxed{1.68m}$

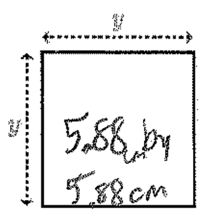
$h = 6 - \frac{1}{2}\pi(1.68) - 1.68$

$h \approx 1.68m$

2. You have 50 cm of wire, and you have to use part of this wire to make a rectangle that's twice as long as it is wide, and the rest of the wire (if there is any left) to make a square. What should the dimensions of the shapes be if you want the total area to be as small as possible? What if you want the total area to be as large as possible?

Min A.





$50 = 6x + 4y$

$y = \frac{50 - 6x}{4}$

$y = 12.5 - 1.5x$

$A = 2x^2 + y^2$

$A = 2x^2 + (12.5 - 1.5x)^2$

$A = 2x^2 + 2.25x^2 - 37.5x + 156.25$

$\boxed{A = 4.25x^2 - 37.5x + 156.25}$

$\frac{-b}{2a} = \frac{37.5}{2(4.25)} = 4.41cm = x$

$y = 12.5 - 1.5(4.41) = 5.88cm$

3. You run a canoe-rental business on a small river in Ohio. You currently charge $12 per canoe and average 36 rentals a day. An industry journal says that, for every fifty-cent increase in rental price the average business can expect to lose two rentals a day. Use this information to attempt to maximize your income. What should you charge?

X	Rentals	Price	Revenue
0	36	12	
1	34	12.50	
x	(36-2x)	(12+0.50x)	

Revenue $= (36 - 2x)(12 + 0.5x) = -x^2 - 6x + 432$

x-int = 18   x-int = -24

x-vertex = # of \$0.50 increases = -3

$\frac{-b}{2a} = \frac{6}{2(-1)} = -3$

OR

So we must decrease our price by $-3 \cdot \$0.50 = \$1.50$.

* Charge \$10.50 per canoe to maximize revenue.

4. Calculators are sold to students for 20 dollars each. Three hundred students are willing to buy them at that price. For every 5 dollar increase in price, there are 30 fewer students willing to buy the calculator. What selling price will produce the maximum revenue and what will the maximum revenue be?

X = # of $5 price increases

Cost per calc. # of students.

Revenue $= (20+5x)(300-30x) = -150x^2+900x+6000$ $R(3) = \$7350$

x-int = −4   x-int = 10

x of vertex = # of $5 increases = 3 OR $\frac{-b}{2a} = \frac{-900}{2(-150)} = 3$

$3 \cdot \$5 = \$15$ increase. Charge $35 per calculator to max revenue. Max revenue of $7350.

Problems not about the maximum/minimum (vertex). Write an equation and solve accordingly.

5. The sum of the squares of two consecutive integers is 365. What are the integers?

x, x+1...

$x^2+(x+1)^2 = 365$

$x^2+x^2+2x+1 = 365$

$2x^2+2x-364 = 0$

$2(x^2+x-182) = 0$

$2(x+14)(x-13) = 0$

$\boxed{x=-14 \text{ and } x+1=-13}$ $\boxed{x=13 \text{ and } x+1=14}$

Because $(-14)^2+(-13)^2 = (13)^2+(14)^2 = 365$

6. A rectangular building lot is 8 m longer than it is wide and has an area of 2900m2. Find the dimensions of the lot.

x+8

$\boxed{A = 2900m^2}$ x

$2900 = x(x+8)$

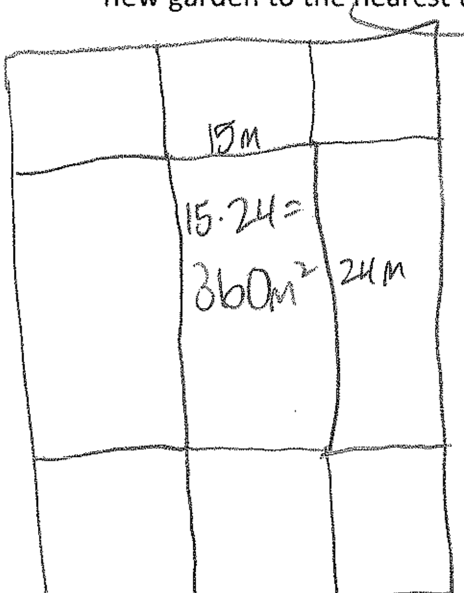
$x^2+8x-2900 = 0$

$(x+58)(x-50) = 0$

$\cancel{x=-58}$ $x = 50$

Dimensions are 50m by 58

7. A rectangular garden measures 15 m by 24 m. A larger garden is to be made by increasing each side length by the same amount. The resulting area is to be 1.5 times the original area. Find the dimensions of the new garden to the nearest tenth of a meter.



$(15+x)(24+x) = 540$

$x^2+39x+360 = 540$

$x^2+39x-180 = 0$

Not factorable.

$x = \frac{-39 \pm \sqrt{39^2-4(1)(-180)}}{2(1)}$

$\boxed{x = 4.17}$ and $\cancel{x = -43.17}$

Dimensions must be 19.17m by 28.17m

$\boxed{19.2m \text{ by } 28.2m}$

$360 \cdot 1.5 = 540m^2$

x = amount length/width increased