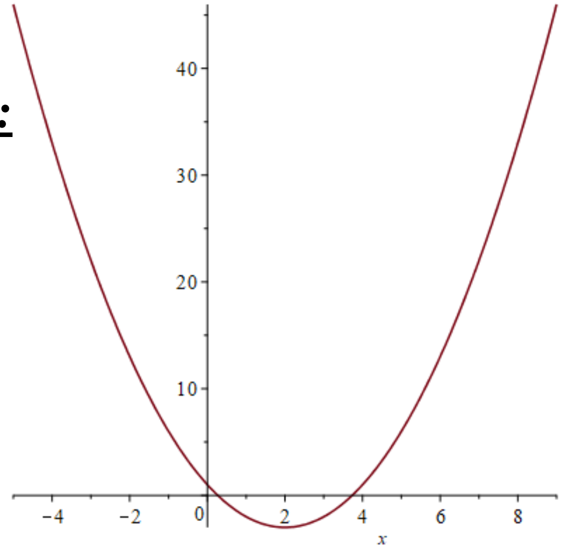
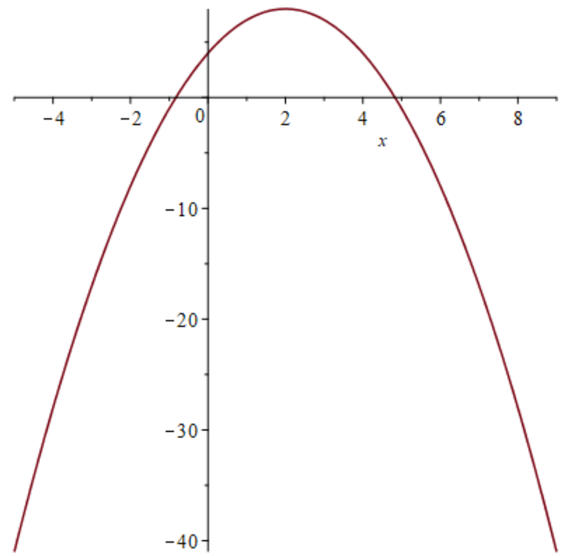
Review of Quadratic Functions:



General Form:

$$f(x) = ax^2 + bx + c \; ; a \neq 0$$



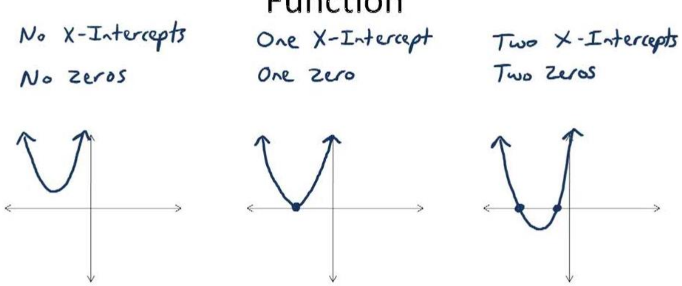
Standard Form:

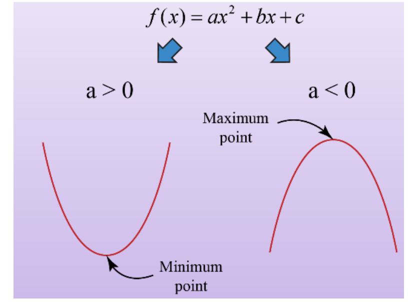
$$f(x) = a(x-h)^2 + k \; ; a \neq 0$$

Intercept Form:

$f(x) = a(x - x_1)(x - x_2)\; ; a \neq 0, x_1$ and x_2 are real numbers

Finding the Zeros of a Quadratic Function





General Form:

$f(x) = ax^2 + bx + c \; ; a \neq 0$

If $a > 0$, the parabola opens up; if $a < 0$, the parabola opens down. The *y*-intercept is c.

Standard Form:

$f(x) = a(x-h)^2 + k \; ; a \neq 0$

The vertex is at (h,k) and it's a minimum vertex if $a > 0$ and a maximum vertex if $a < 0$.

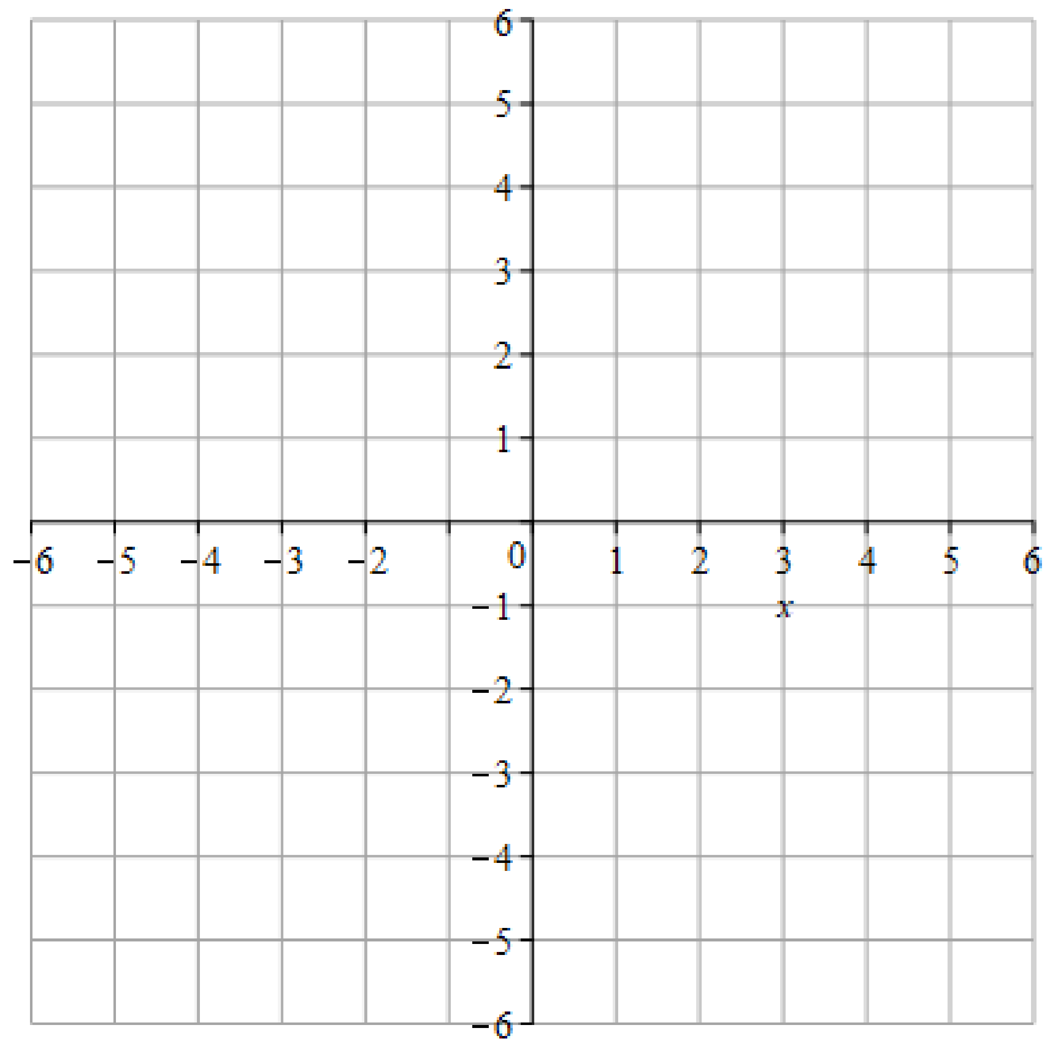
Intercept Form:

$f(x) = a(x-x_1)(x-x_2) \; ; a \neq 0, x_1$ and x_2 are real numbers

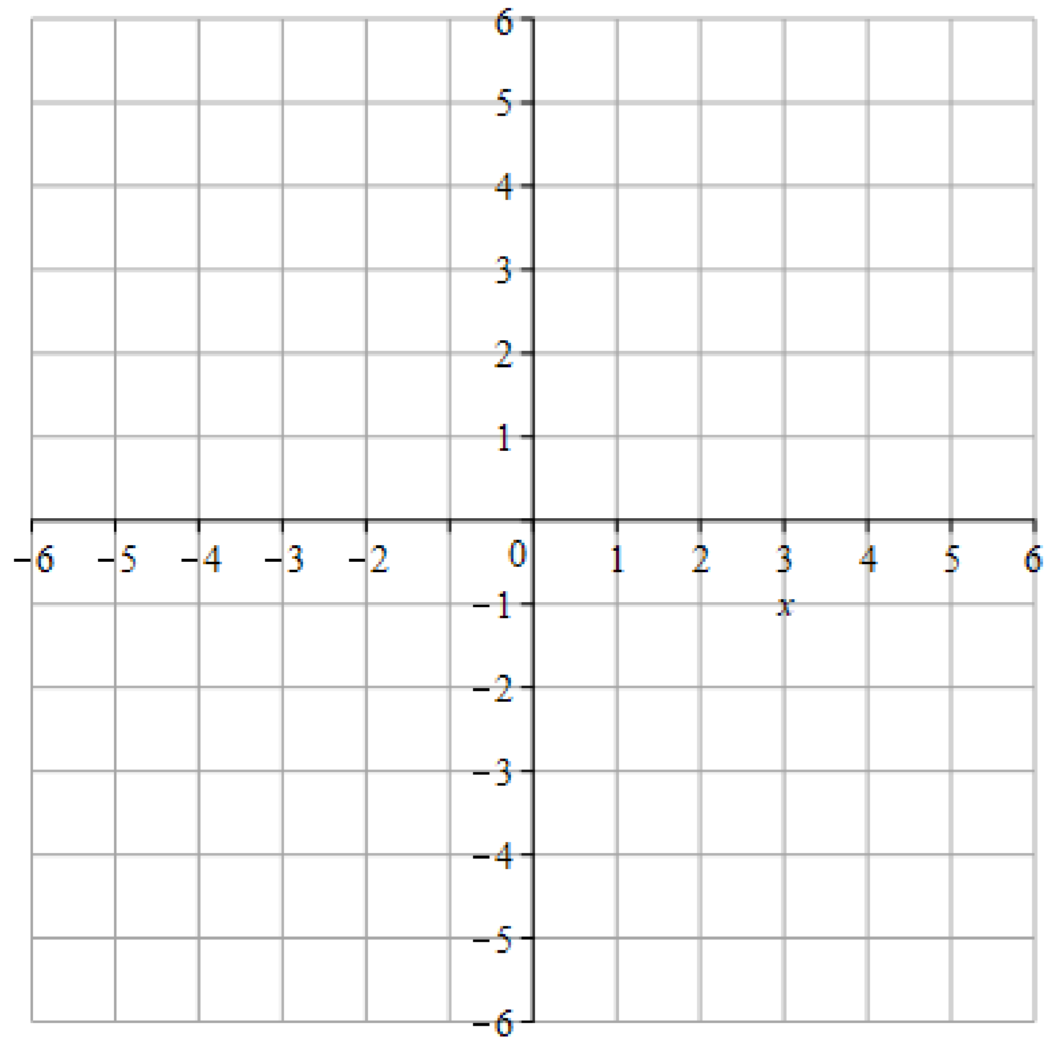
x_1 and x_2 **are the *x*-intercepts, and the *x*-coordinate of the vertex is** $\dfrac{x_1 + x_2}{2}$**. The vertex is a minimum if $a > 0$ and a maximum if $a < 0$.**

Graph the following quadratic functions. Indicate the vertex and all the intercepts.

1. $f(x) = -x^2 + 4x$ ***{Convert to intercept form by factoring out $-x$.}***

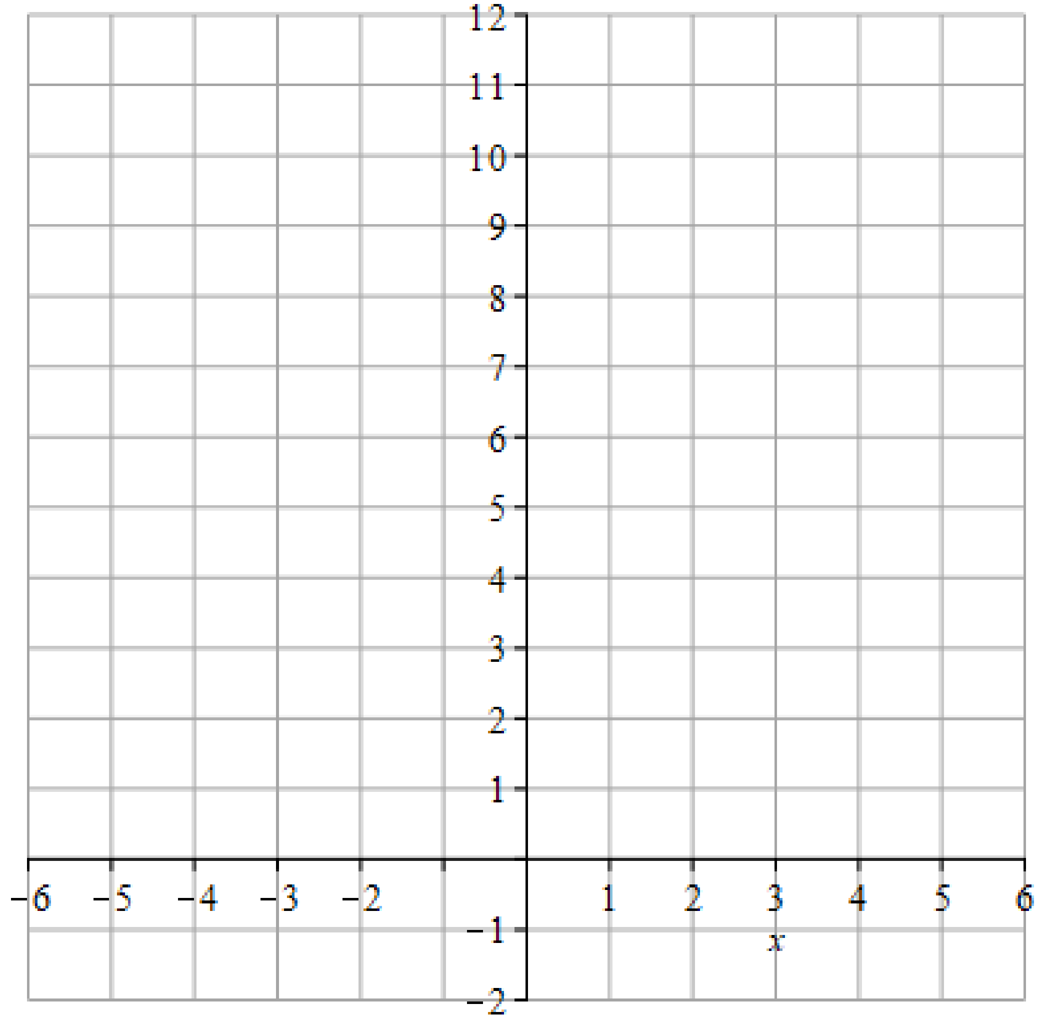


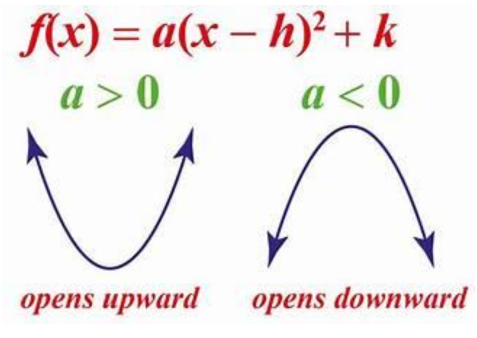
2. $f(x) = x^2 - 2x - 3$ ***{Convert to intercept form by factoring the trinomial.}***



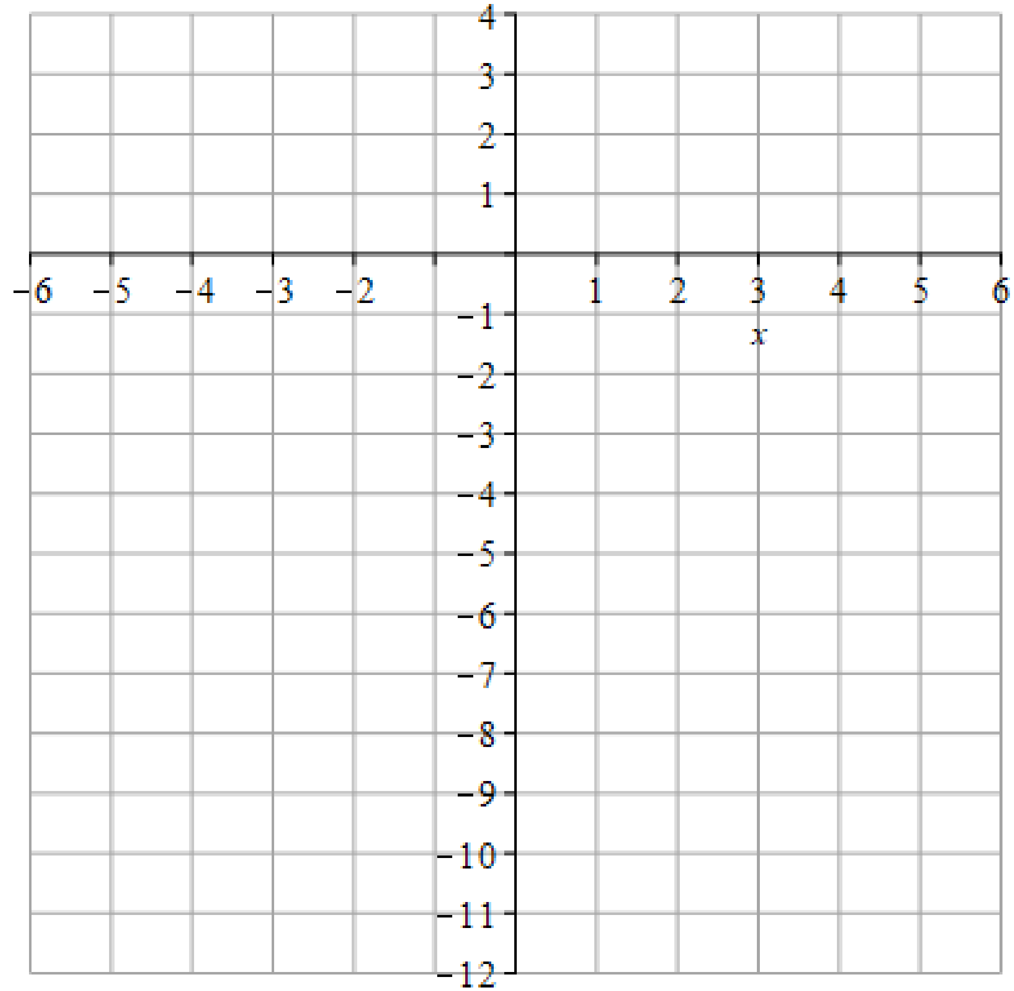
"In Roman numerals that's 100!"

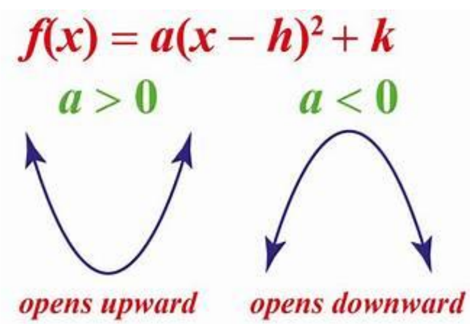
3. $f\left(x\right)=\left(x-2\right)^{2}+4$ ***{It's in standard form.}***



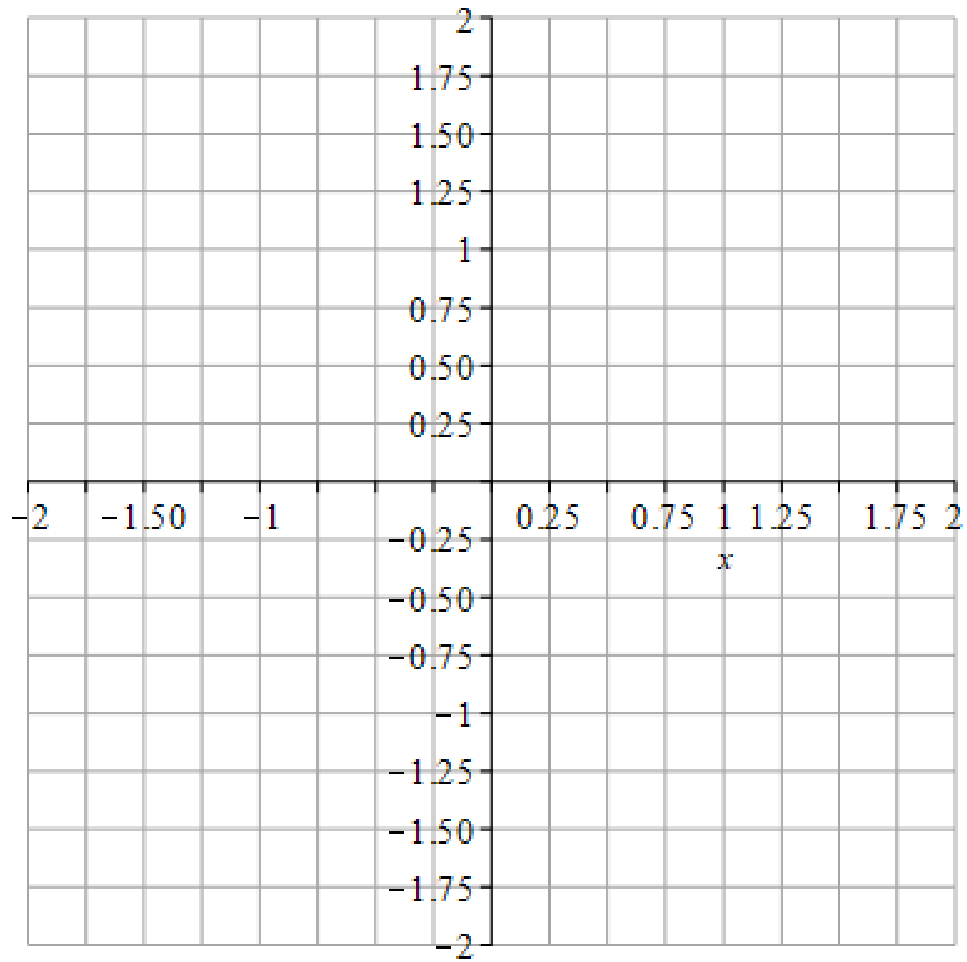


4. $f(x) = -2(x+2)^2 + 2$ ***{It's in standard form.}***

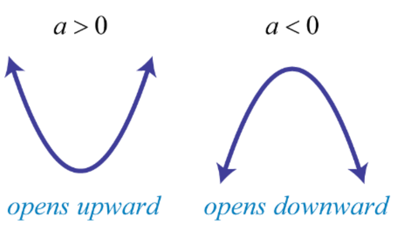




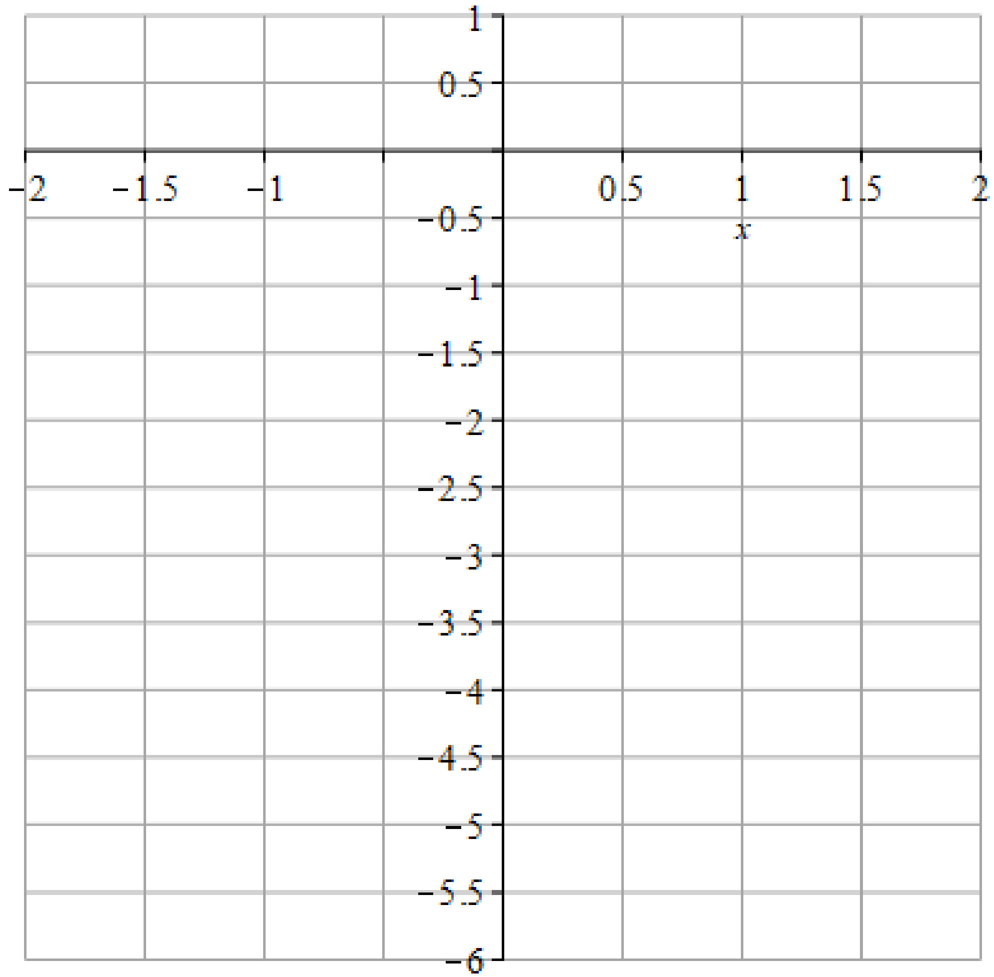
5. $f(x) = 4x^2 - 2x + 1$ ***{Convert to standard form by completing the square.}***



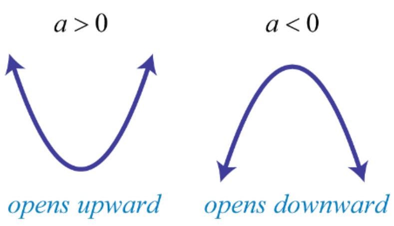
Parabola $f(x) = ax^2 + bx + c$



6. $f(x) = -2x^2 + 2x - 3$ ***{Convert to standard form by completing the square.}***



Parabola $f(x) = ax^2 + bx + c$



Finding Formulas for Quadratic Functions:

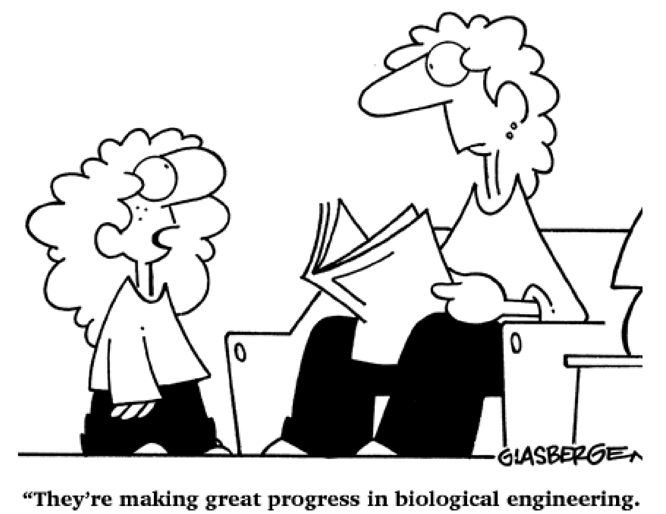
1. The vertex of the parabola is $(1,2)$, and it passes through the point $(3,0)$.

$$\left\{ f(x) = a(x-h)^2 + k \right\}$$

"Take out your eBooks and open up 'Understanding Algebra'. Turn to page 198. Open your smart phone's math app and select "solving quadratic equations'."

2. The *x*-intercepts are 5 and -3, and the graph passes through the point $(0,-4)$.

$$\{f(x)=a(x-x_1)(x-x_2)\}$$



"They're making great progress in biological engineering. How do you know money doesn't grow on trees?"

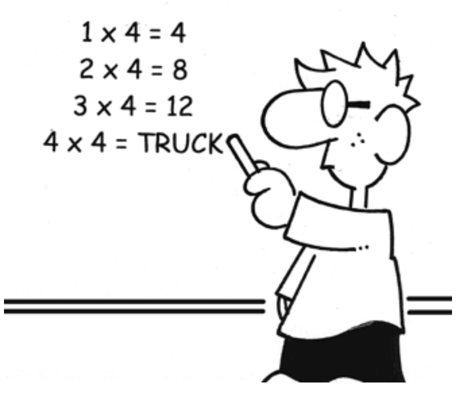
3. The graph passes through the points $(0,1)$, $(1,2)$, and $(-1,4)$.

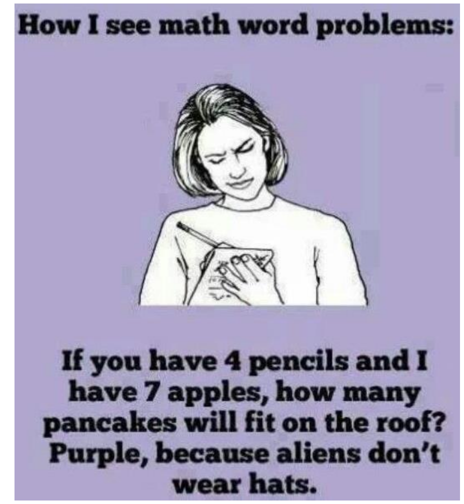
$$\{f(x) = ax^2 + bx + c\}$$

"Rather than learning how to solve that, shouldn't I be learning how to operate software that can solve that?"

4. The graph passes through the points $(1,2)$ and $(5,2)$, and the minimum value of the function is -4.

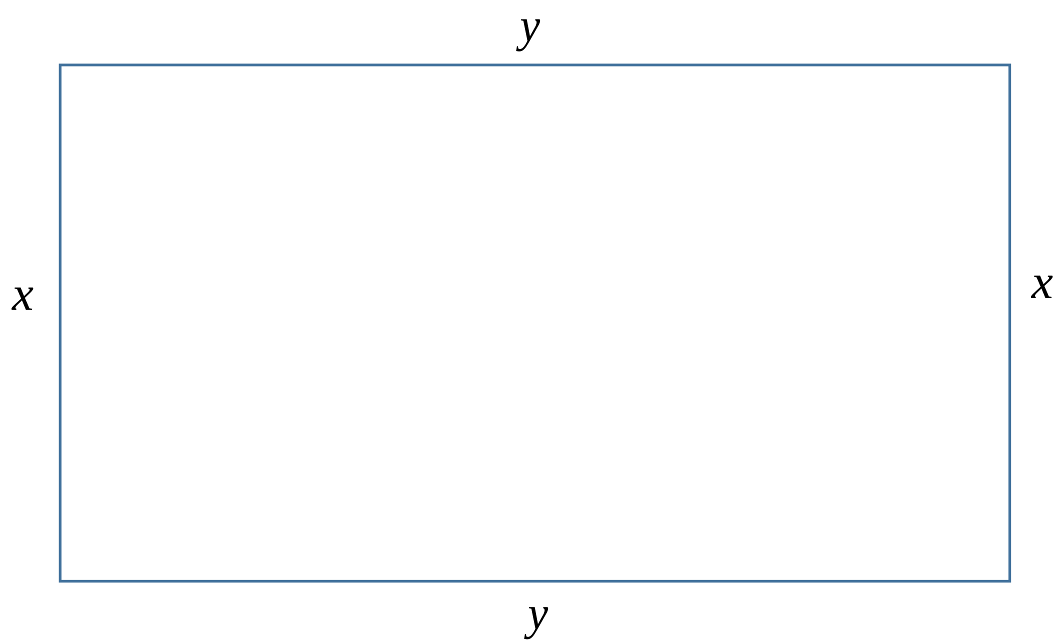
$$\{f(x) = a(x-h)^2 + k\}$$





<u>Word Problems:</u>

1. Joe has 3,000 feet of fence available to enclose a rectangular field.



$$2x + 2y = 3000$$

$$x + y = 1500$$

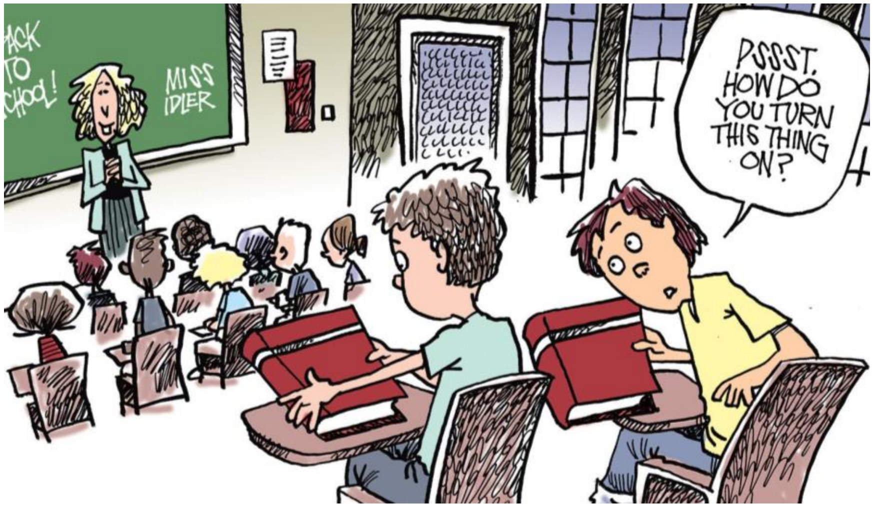
a) Express the enclosed area, *A*, as a function of *x*.

"COULD YOU PLEASE EXPLAIN ALGEBRA WITHIN 30 SECONDS? I CAN'T FOLLOW EXPLANATIONS THAT TAKE LONGER THAN A COMMERCIAL SPOT ON TV."

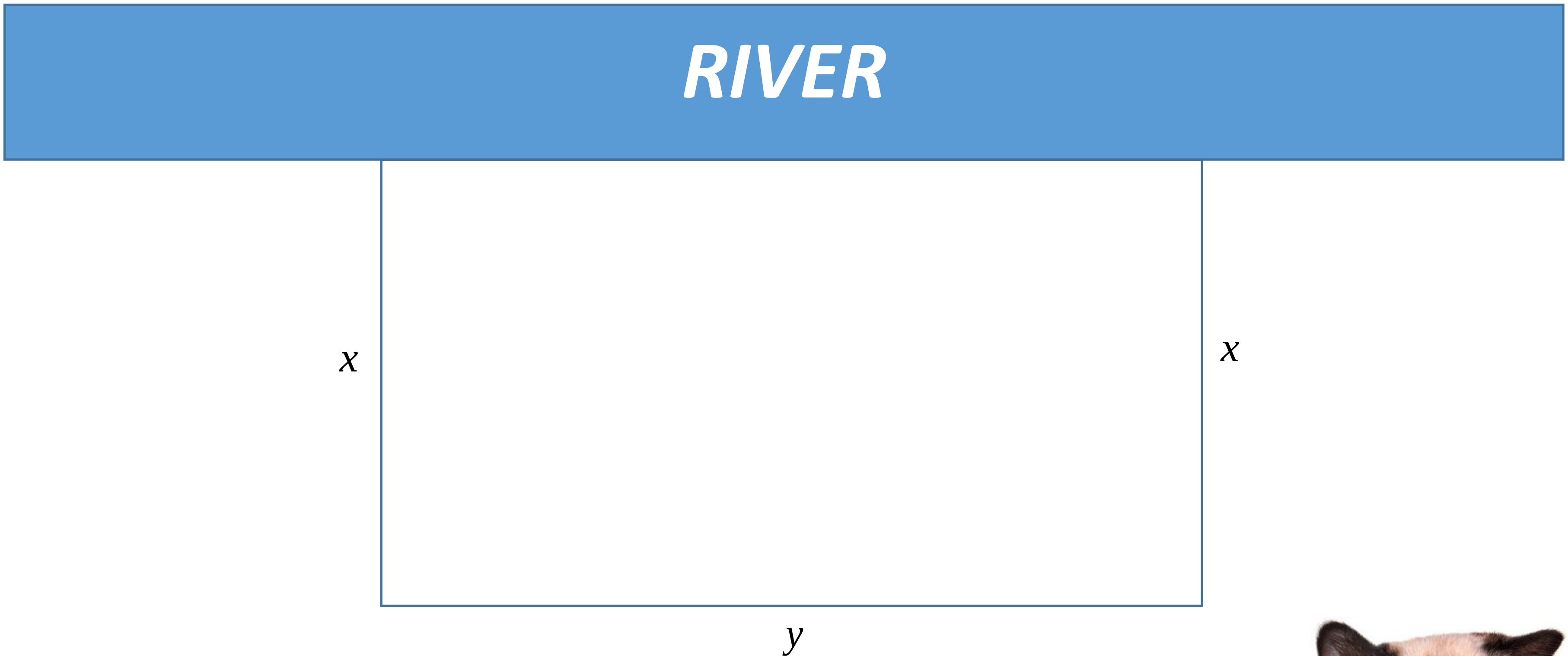
b) Determine the domain of the function, $A(x)$**.**

c) For what value of *x* is the enclosed area the largest?

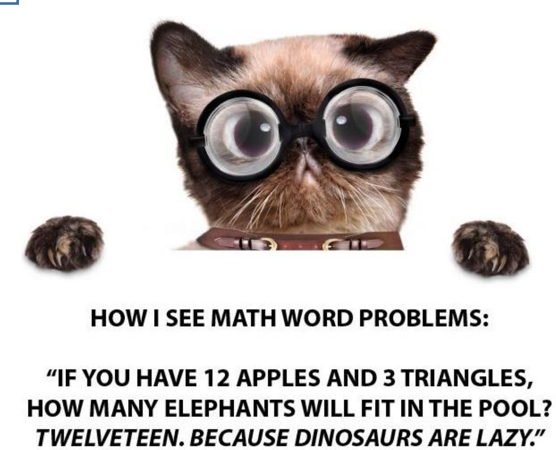
d) What is the value of the largest enclosed area?



2. **A farmer with 2,000 yards of fence wants to enclose a rectangular field that borders on a straight river-so he'll only need fence on three sides of the field.**



$$2x + y = 2000$$



a) Express the enclosed area, *A*, as a function of *x*.

b) Determine the domain of the function, $A(x)$.

c) For what value of *x* is the enclosed area the largest?

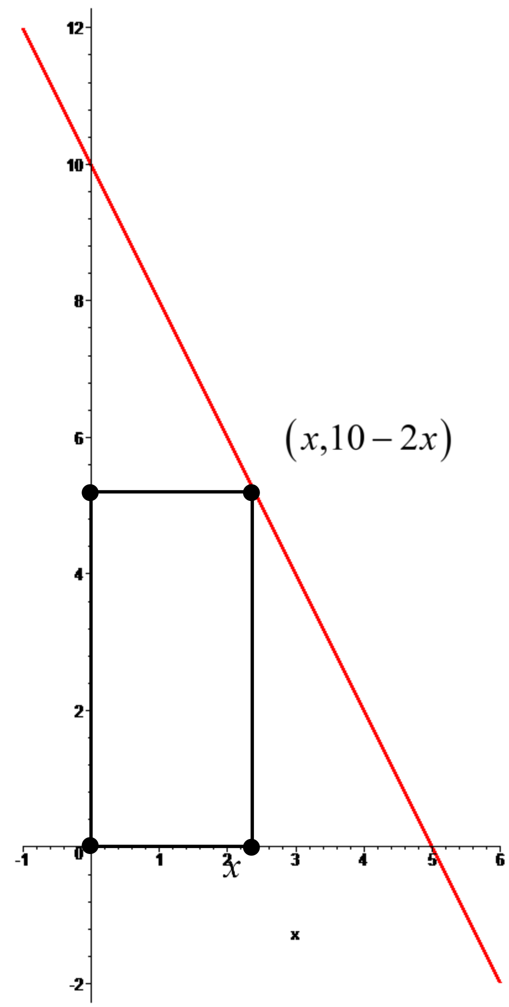
d) What is the value of the largest enclosed area?

teacher

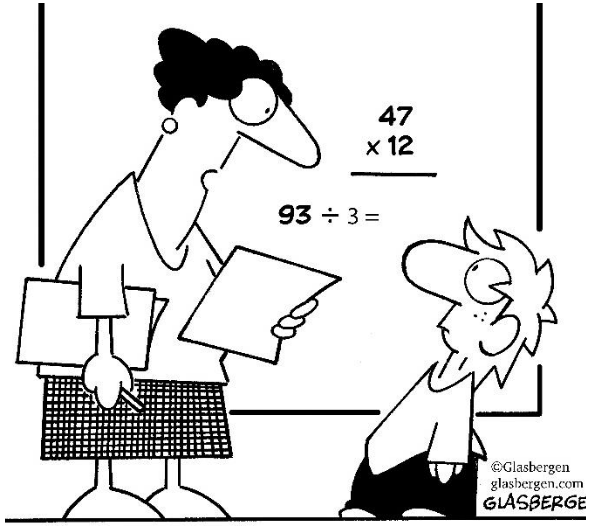
(noun)

a person who helps you solve problems you'd never have without them.

3. A rectangle in the first quadrant has one vertex on the line $y = 10 - 2x$**, another at the origin, one on the positive *x*-axis, and one on the positive *y*-axis. *(See the figure.)***



a) Express the area *A* of the rectangle as a function of *x*.

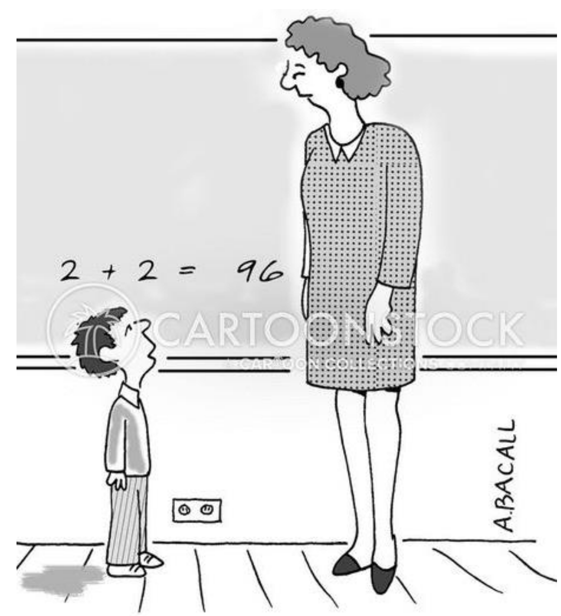


"Yes, love is the answer...but not on a math test."

b) What's the domain of $A(x)$?

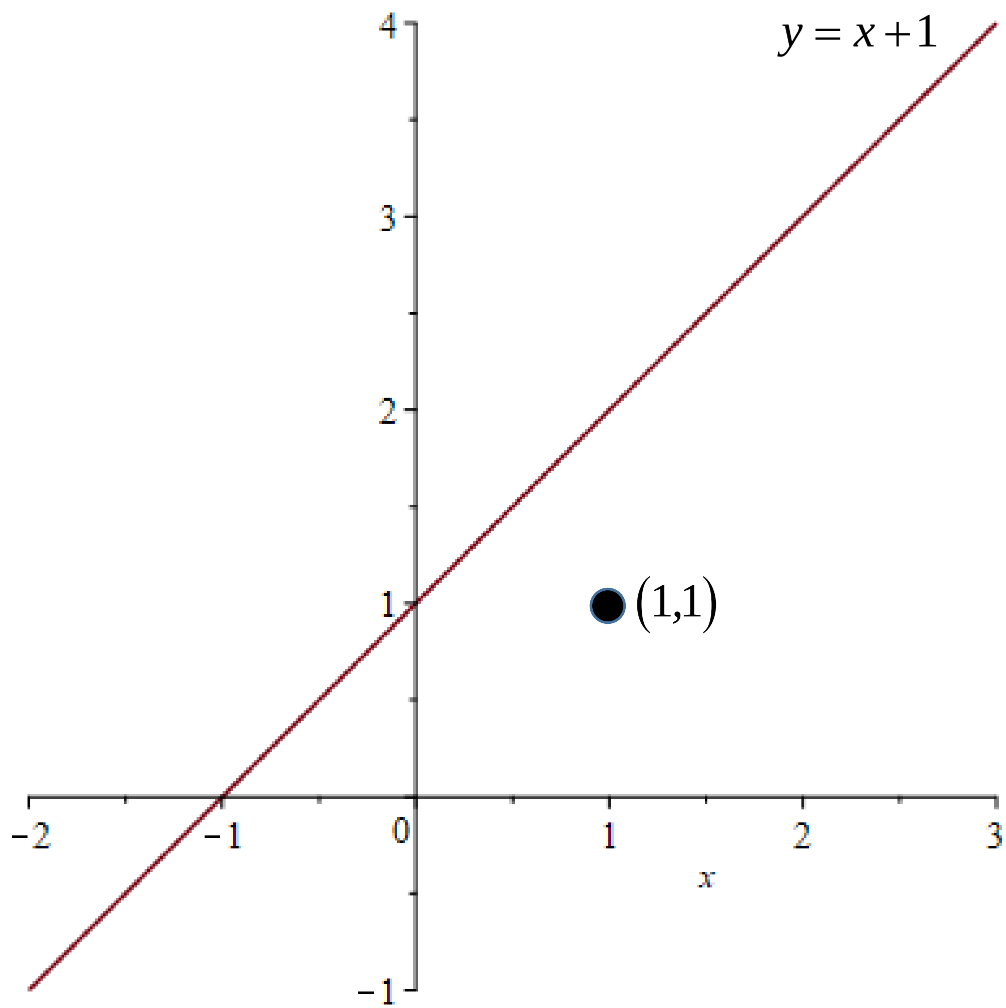
c) What value of *x* produces the maximum area?

d) What is the maximum area?

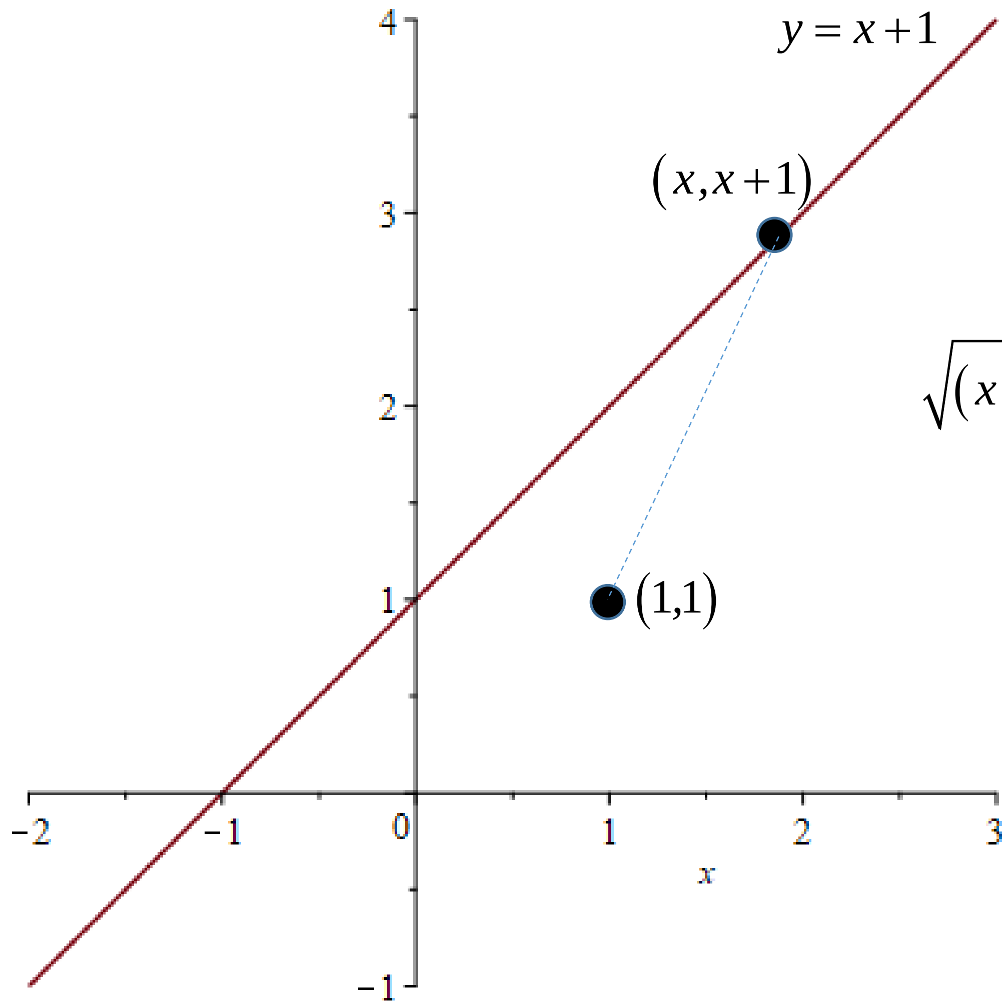


"You said the answer is not as important as the process."

4. Find the point on the line $y = x + 1$ that is closest to the point $(1,1)$.



a) Express the distance from a point on the line $(x, x+1)$ to the point $(1,1)$ as a function of *x*.



$$\sqrt{(x-1)^2 + \left[(x+1)-1\right]^2}$$

$$\sqrt{(x-1)^2 + x^2}$$

$$\sqrt{2x^2 - 2x + 1}$$

b) Express the square of the distance as a nice quadratic function.

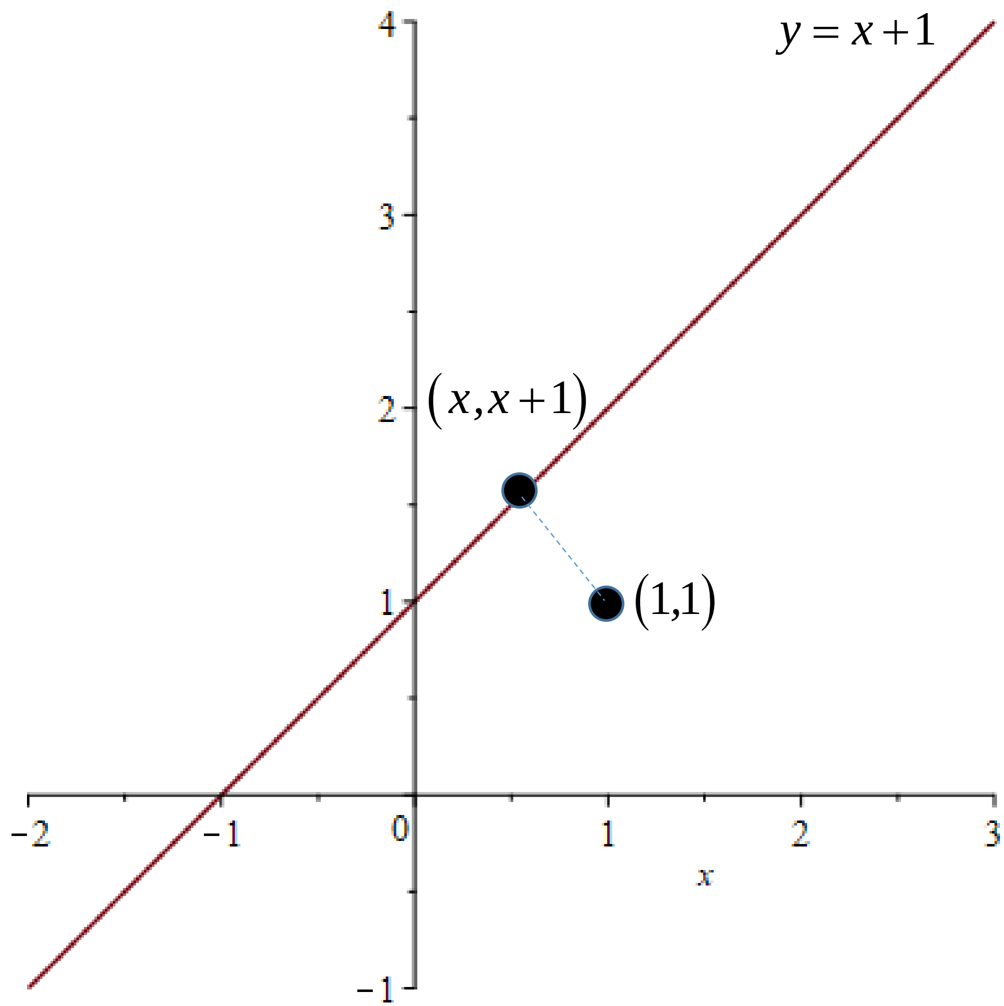
c) What's the domain of the function?

"Who is putting all the Math books in the Horror section?"

d) Use the quadratic function to find the closest point on the line.

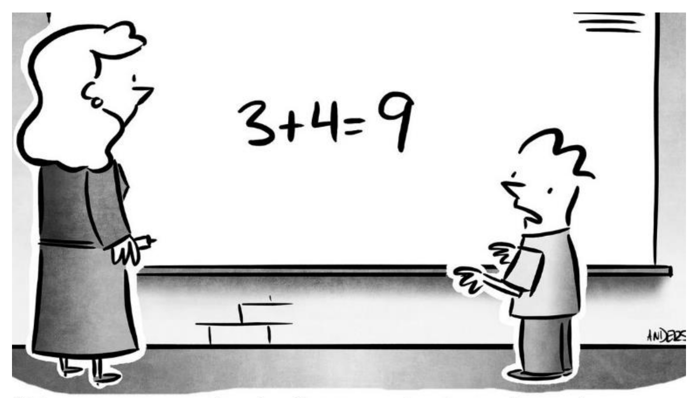
"What do you expect? My edition of the math book doesn't have the answers in it like yours does."

e) An alternative method using geometry.



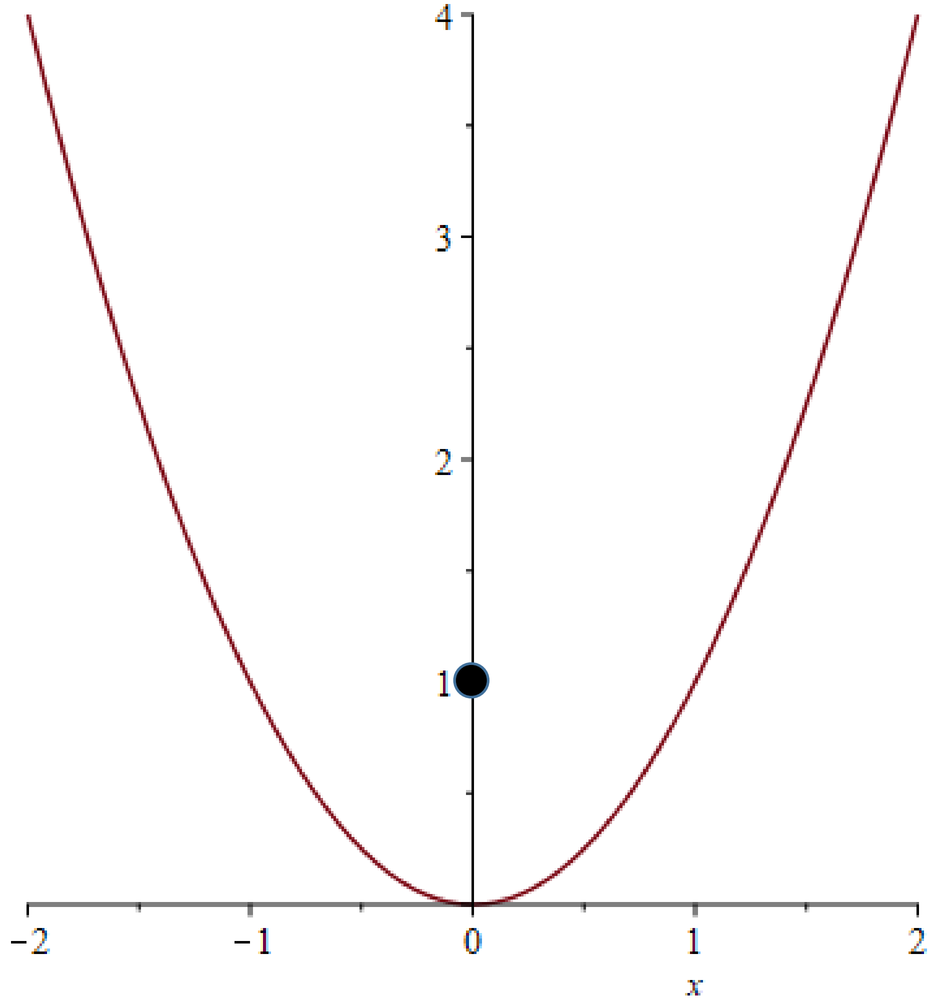
When you're at the closest point, the angle formed must be a right angle, so the slope from $(1,1)$ to $(x,x+1)$ would have to be the negative reciprocal of the slope of the line $y = x+1$.

$$\{\text{slope from } (1,1) \text{ to } (x,x+1)\}\frac{x+1-1}{x-1} = -1\{\text{negative reciprocal of the slope}\}$$

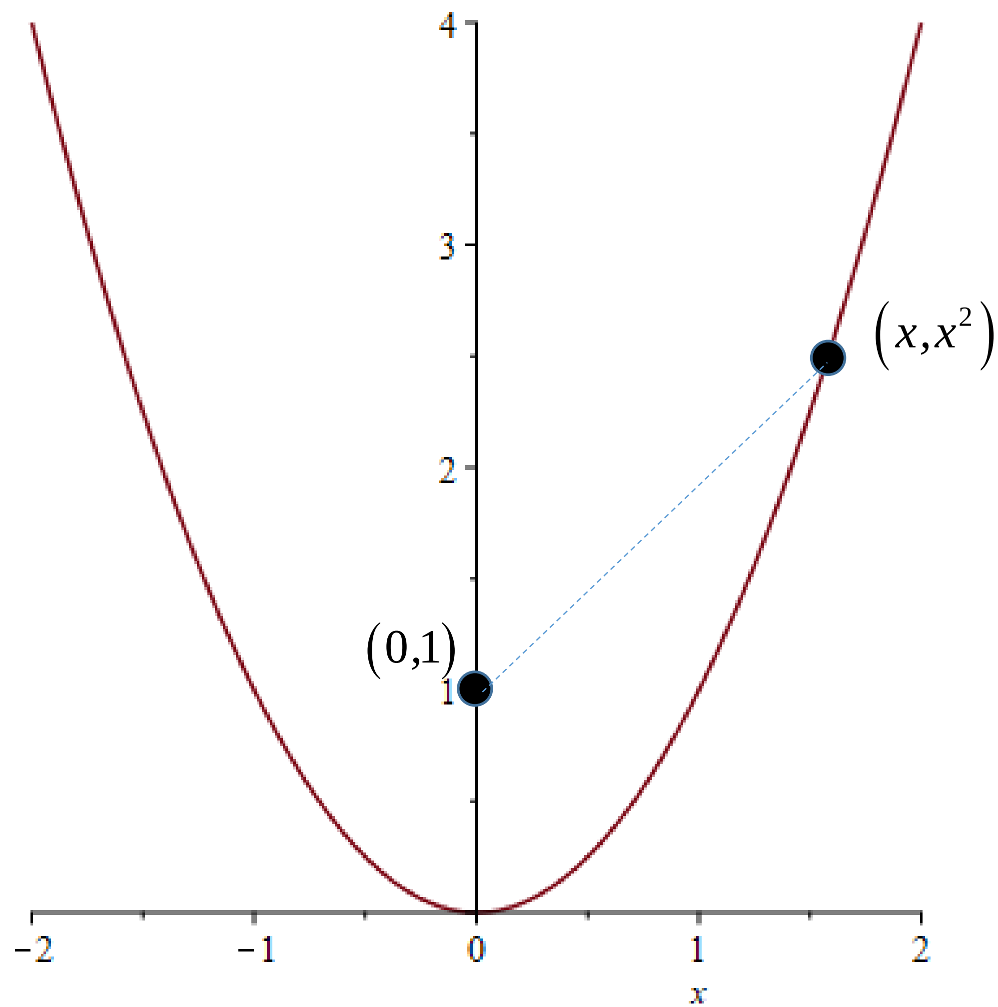


"Listen, we can try to figure out where I went wrong, but I think we just enjoy that we came out ahead and leave it at that."

5. Find the point(s) on the parabola $y = x^2$ closest to the point $(0,1)$.



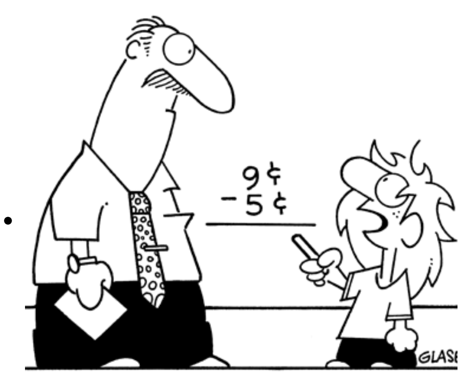
a) Express the distance from a point on the parabola (x, x^2) to the point $(0,1)$ as a function of *x*.



$$\sqrt{x^2+\left(x^2-1\right)^2}$$

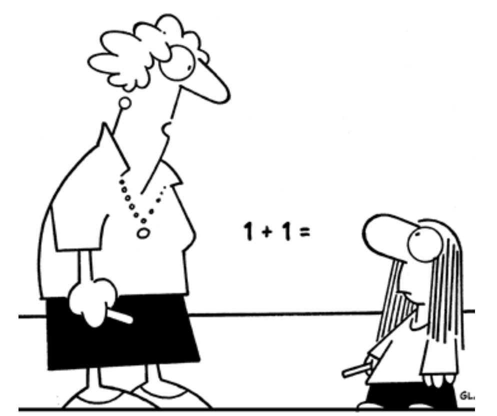
$$\sqrt{x^4-x^2+1}$$

b) Express the square of the distance as a nice quadratic function in x^2.



"If the brightest minds on Wall Street can't figure out the economy, then what do you expect from *me?*"

c) Use completing the square to find the point(s) on the parabola closest to $(0,1)$.



"Yes, this will be useful to you later in life."