Quadratic Functions:

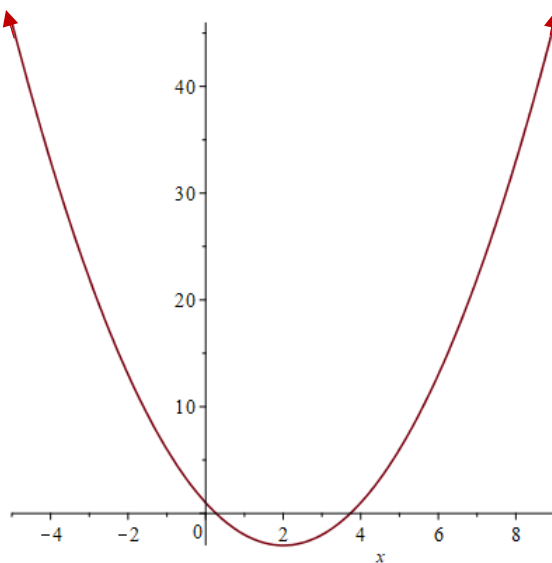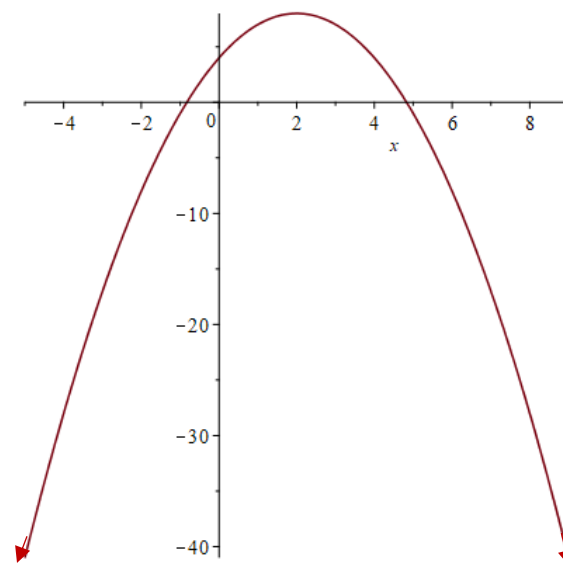## General Form:

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

Standard Form:

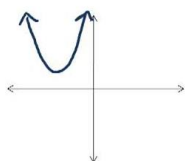$$f(x) = a(x-h)^2 + k \; ; \; a \neq 0$$

Intercept Form:

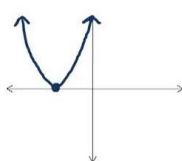$$f(x) = a(x-x_1)(x-x_2) \; ; \; a \neq 0, x_1 \text{ and } x_2 \text{ are real numbers}$$
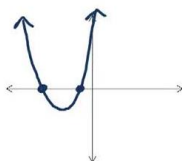
Finding the Zeros of a Quadratic Function

No X-Intercepts   One X-Intercept   Two X-Intercepts
No Zeros   One Zero   Two Zeros

FUN with QUADRATICS

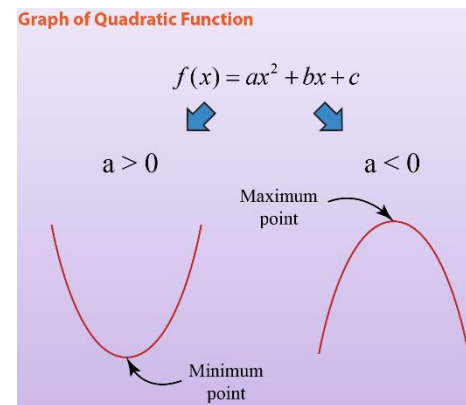**General Form:**

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

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 if $a > 0$ and a maximum if $a < 0$.

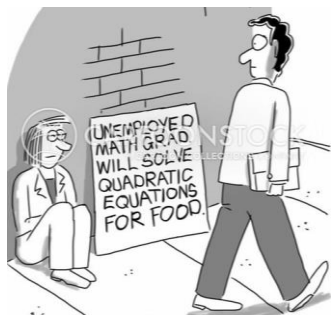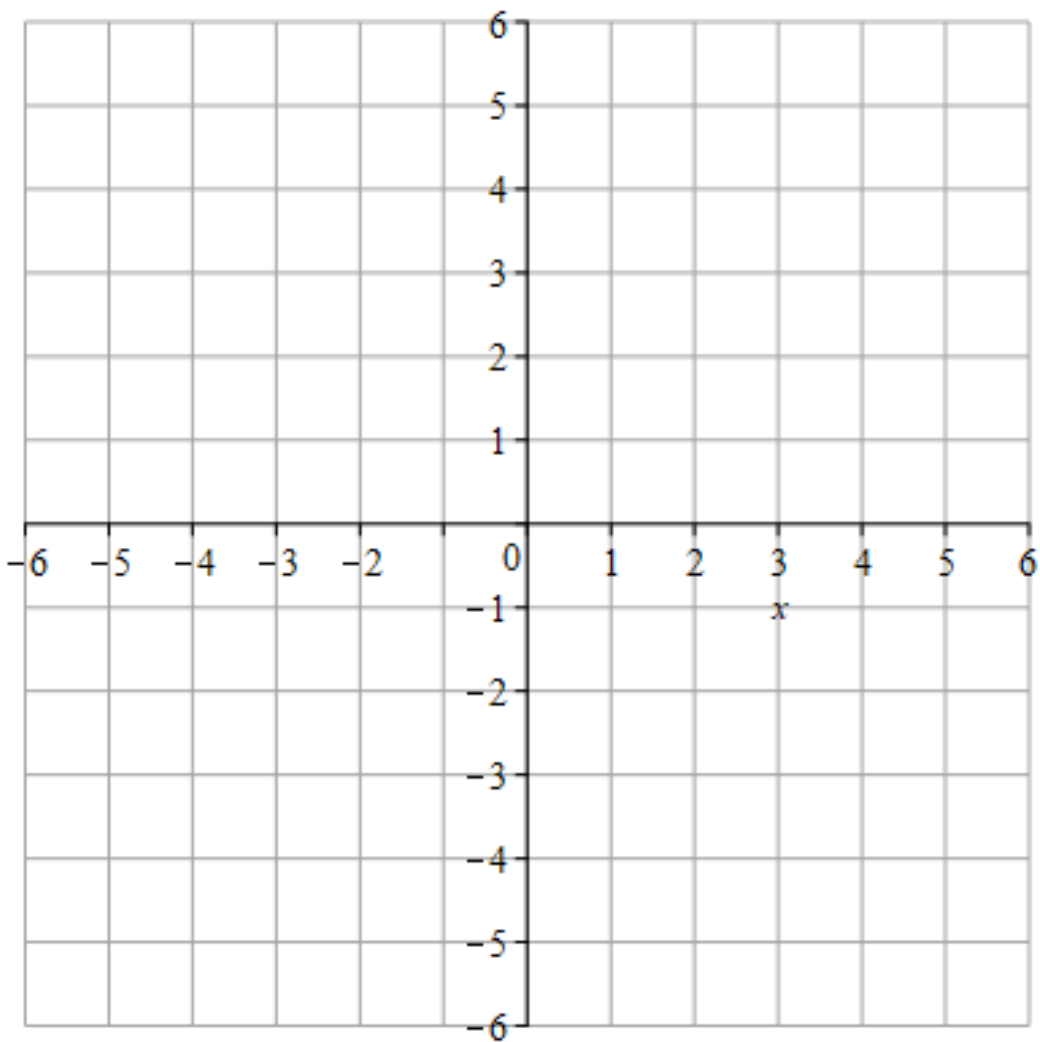**Intercept Form:**

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

x_1 and x_2 **are x-intercepts and the x-coordinate of the vertex is** $\dfrac{x_1 + x_2}{2}$.

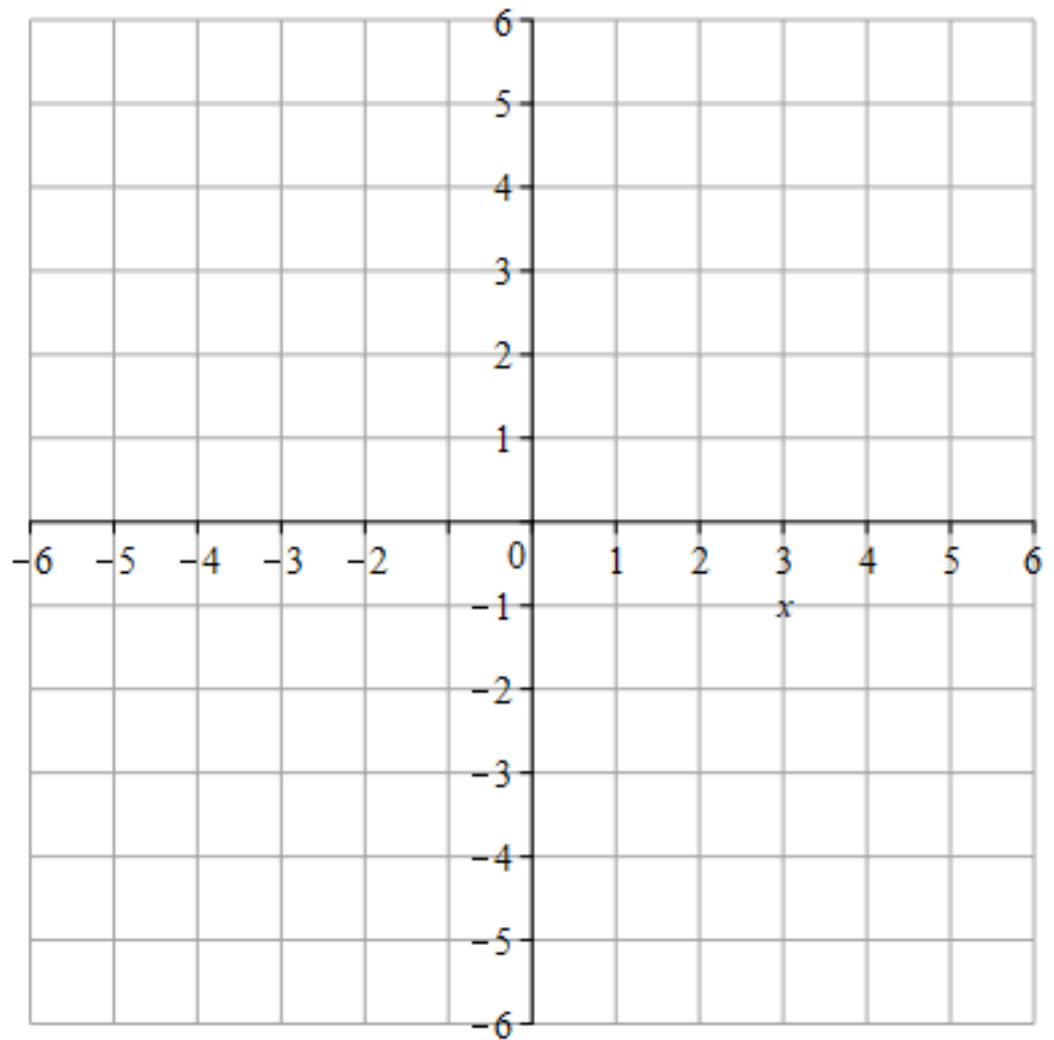**Graph the following quadratic functions. Indicate the vertex and all the intercepts.**

1. $f(x) = -x^2 + 4x$

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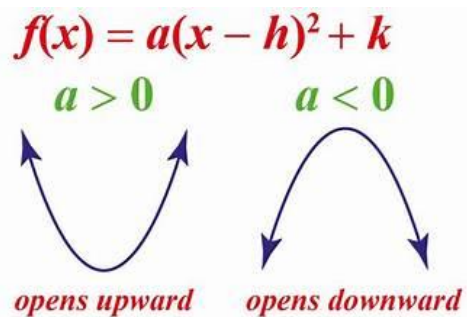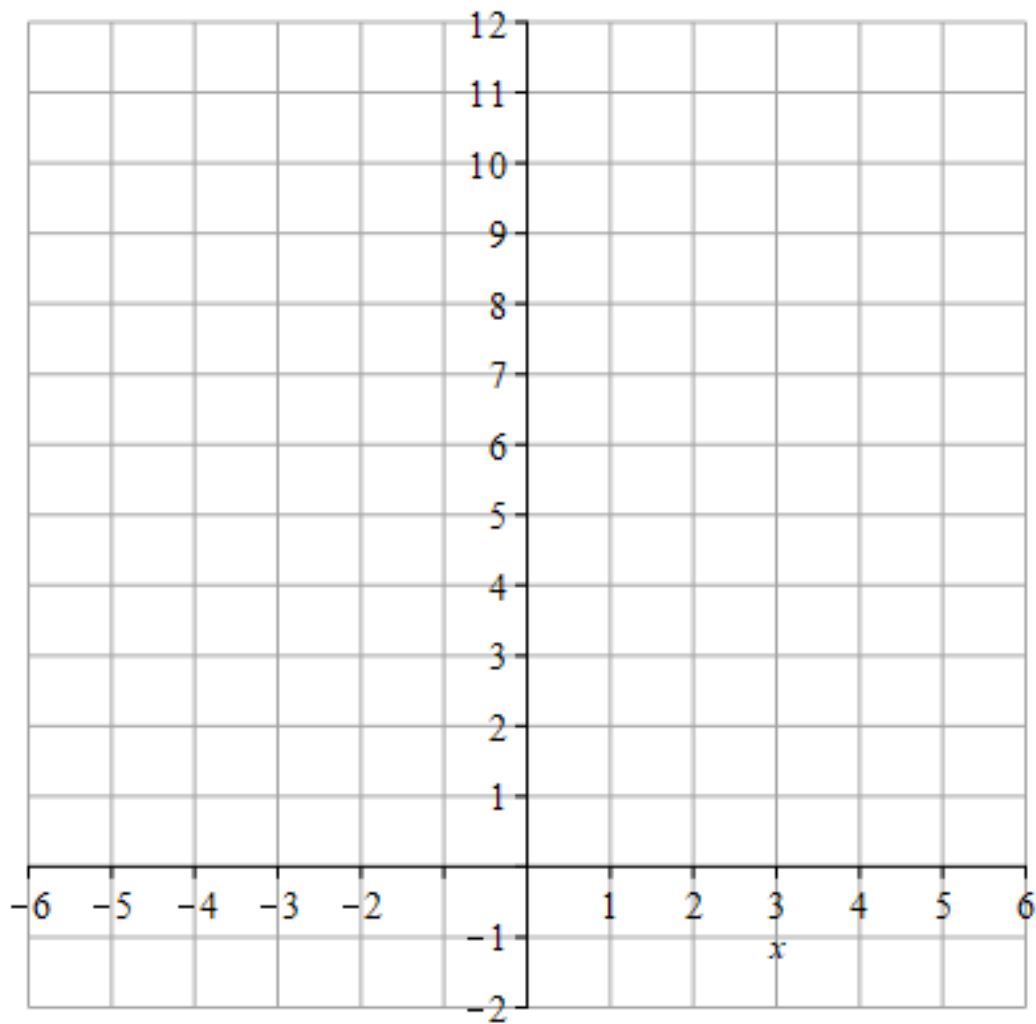
2. $f(x) = x^2 - 2x - 3$

{Convert to intercept form by factoring.}
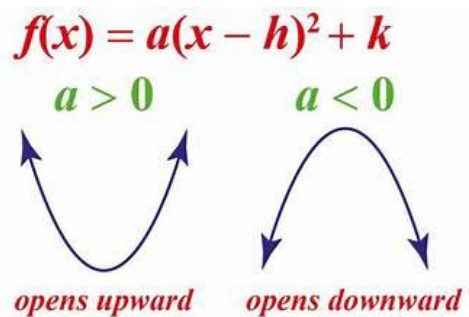

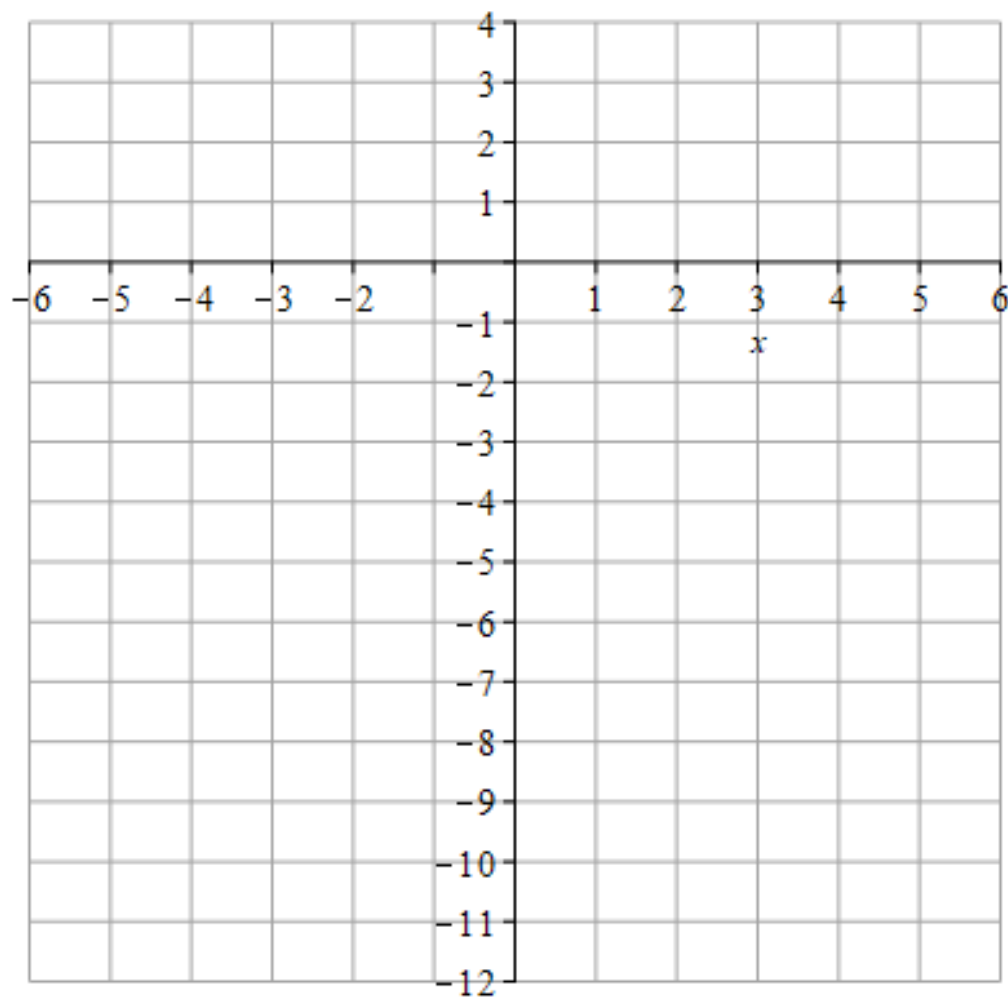"In Roman numerals that's 100!"

3. $f(x) = (x-2)^2 + 4$

{It's in standard form.}

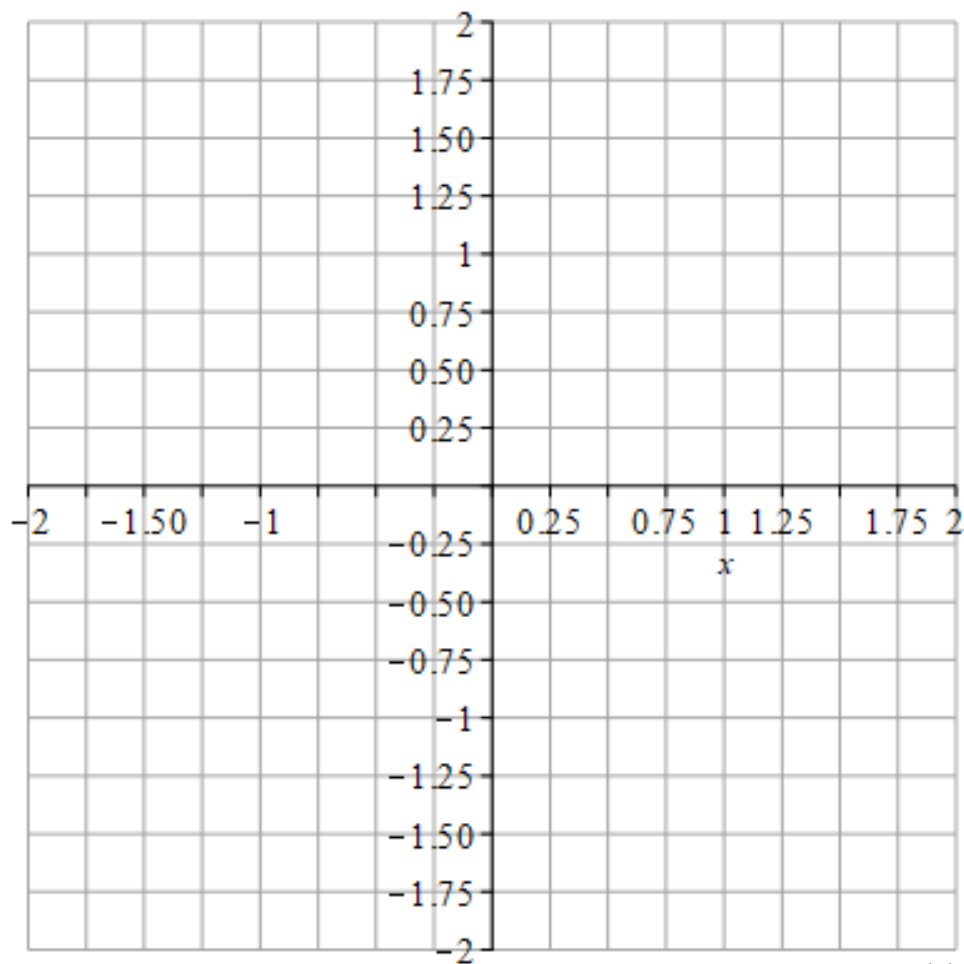$$f(x) = a(x-h)^2 + k$$

$a > 0 \qquad a < 0$

opens upward   opens downward

4. $f(x) = -2(x+2)^2 + 2$

{It's in standard form.}

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

$a > 0$ $a < 0$

opens upward   opens downward
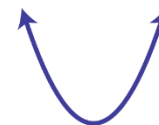
5. $f(x) = 4x^2 - 2x + 1$

{Convert to standard form by completing the square.}

Parabola $f(x) = ax^2 + bx + c$
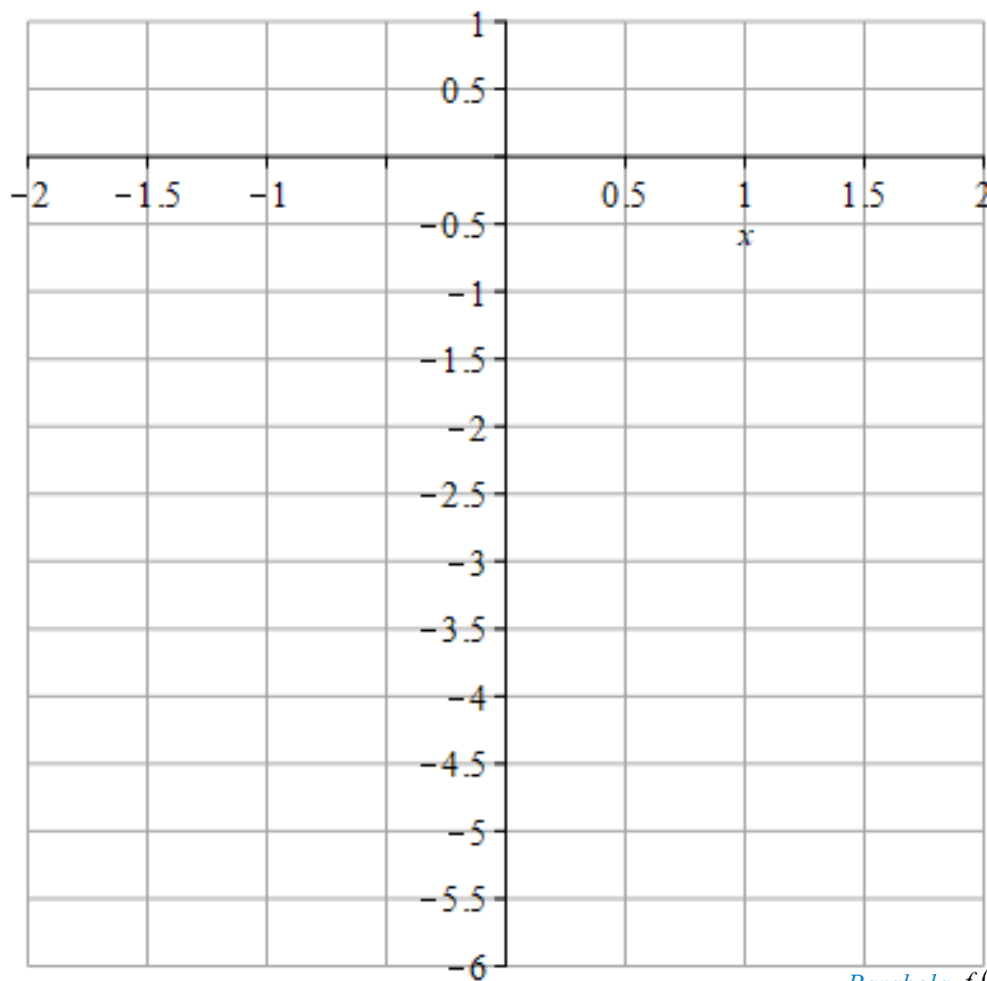
$a > 0$ $a < 0$

opens upward   opens downward

6. $f(x) = -2x^2 + 2x - 3$

{Convert to standard form by completing the square.}

Parabola $f(x) = ax^2 + bx + c$
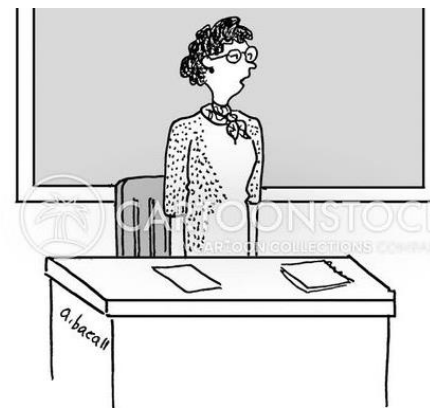
$a > 0$ $a < 0$

opens upward   *opens downward*

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 $(0,-4)$.
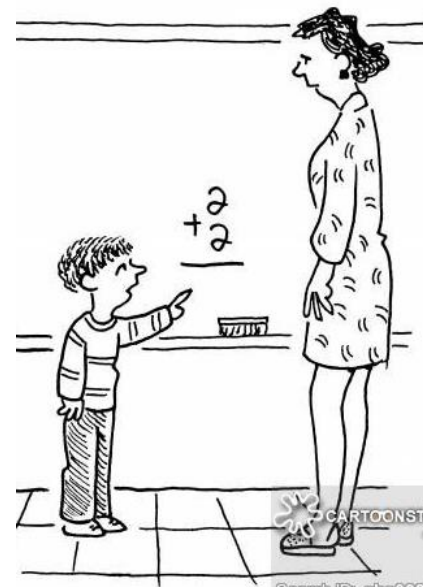
$$\{f(x)=a(x-x_1)(x-x_2)\}$$

"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 $(-1,4)$.
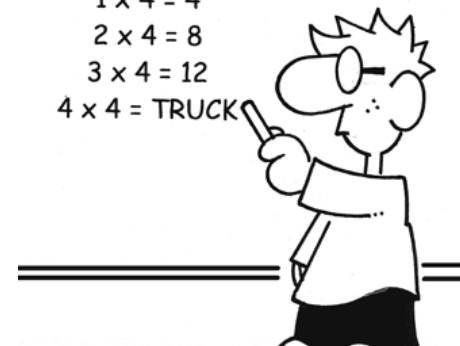
$$\{f(x) = ax^2 + bx + c\}$$

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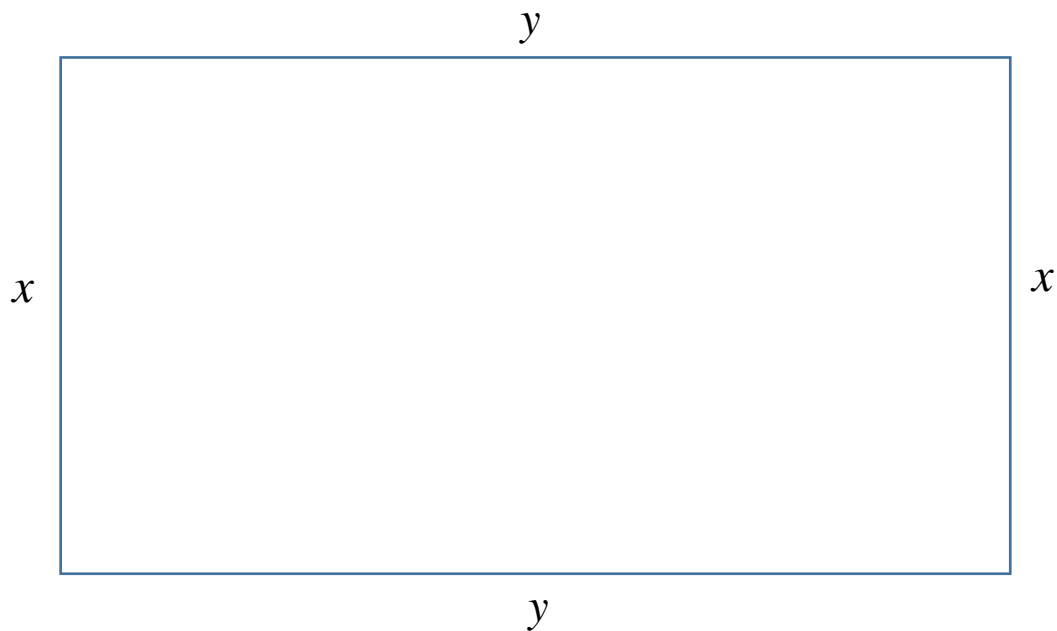
$$\{f(x) = a(x-h)^2 + k\}$$

Word Problems:

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

y

x x

y

$$2x + 2y = 3000$$
$$x + y = 1500$$

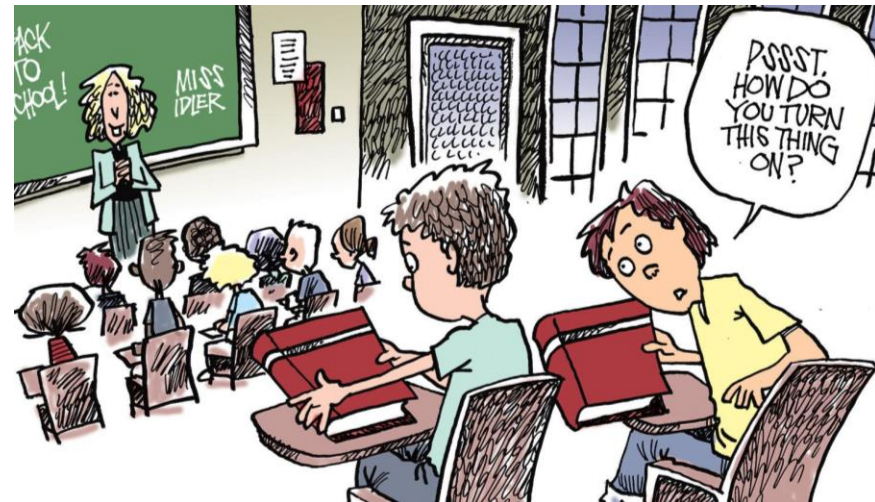**a) Express the enclosed area, A, as a function of x.**

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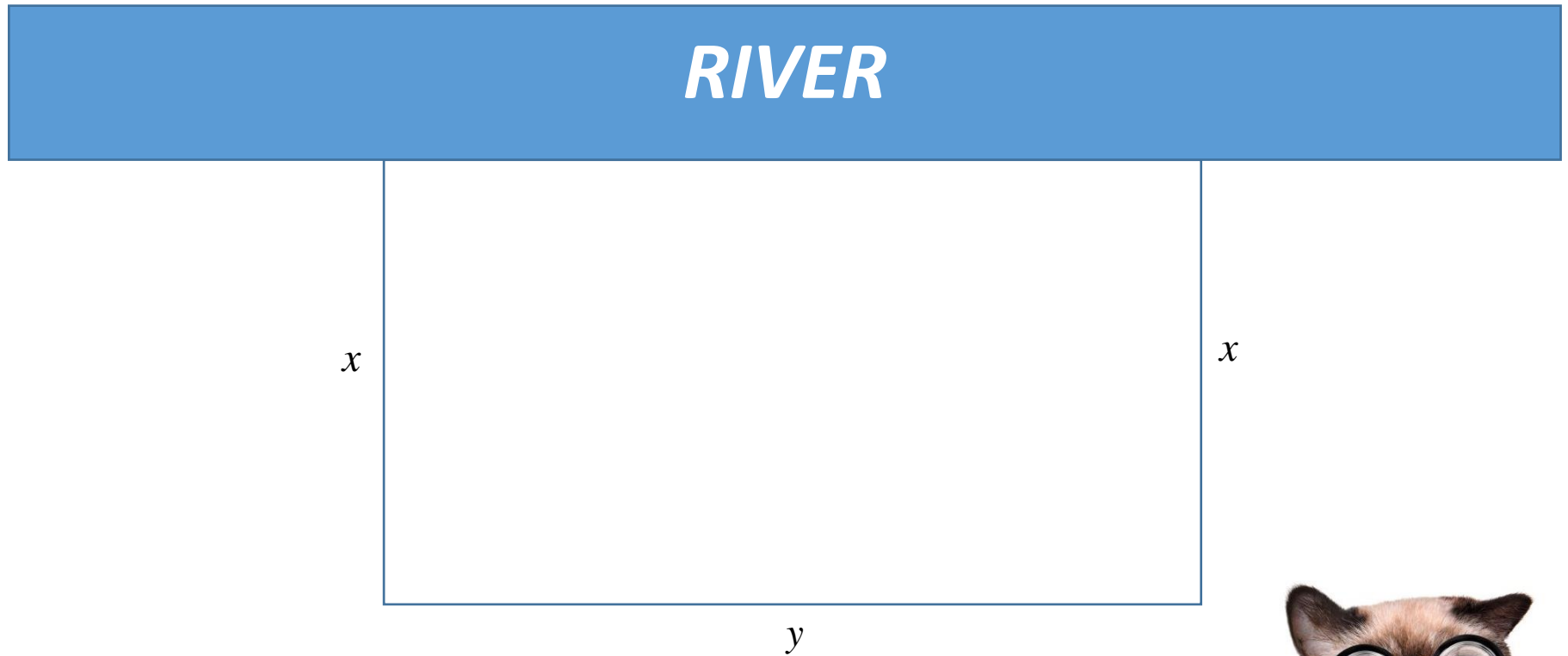A COMMERCIAL SPOT ON TV."

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.
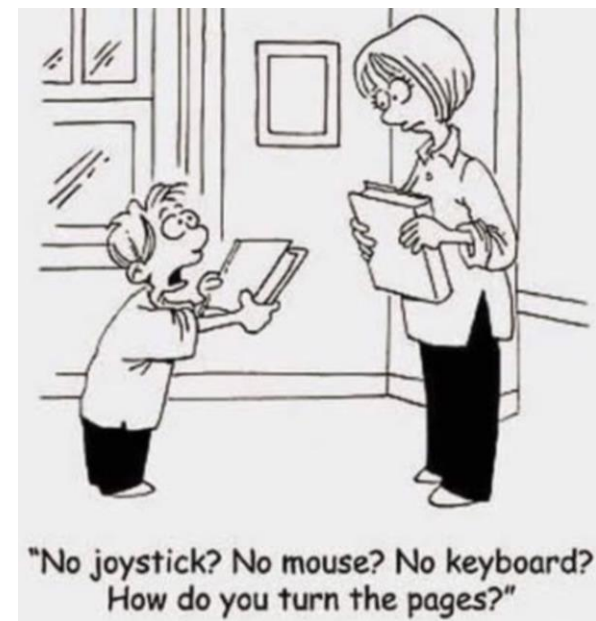
RIVER

x

x

y

$$2x + y = 2000$$

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

"No joystick? No mouse? No keyboard?
How do you turn the pages?"

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?