

3.2a - Relating Standard and Factored Forms (Day 1)

Example 1: Compare the following functions using tables of values and graphs.

$$f(x) = (40 - x)(10 + x)$$

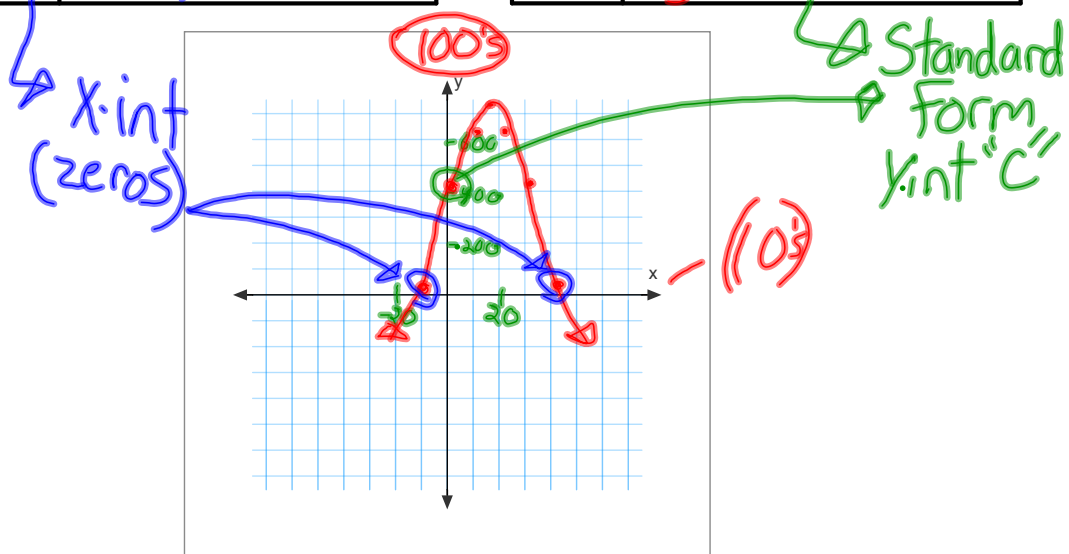
f(x) factored form

x	f(x) = (40 - x)(10 + x)
-10	f(-10) = 0
0	f(0) = 400
10	f(10) = 600
15	f(15) = 625 <i>vertex</i>
20	f(20) = 600
30	f(30) = 400
40	f(40) = 0

$$g(x) = -x^2 + 30x + 400$$

$$g(-10) = -(-10)^2 + 30(-10) + 400$$

x	g(x) = -x^2 + 30x + 400
-10	g(-10) = 0
0	g(0) = 400
10	g(10) = 600
15	g(15) = 625
20	g(20) = 600
30	g(30) = 400
40	g(40) = 0



The maximum is 625 when $x = 15$

The function $f(x)$ is in factored form. *(xints)*
 The function $g(x)$ is in standard form. *(y int)*

Expand and simplify $f(x) = (40 - x)(10 + x)$

$$\begin{aligned} f(x) &= 400 + 40x - 10x - x^2 \\ &= -x^2 + 30x + 400 \\ f(x) &= g(x) \end{aligned}$$

Example 2: Determine the coordinates of the vertex of $f(x) = 2x^2 - 5x - 12$, and sketch the graph of $f(x)$.

Solution:

Step 1: Factor.

$$f(x) = 2x^2 - 5x - 12 \quad a \neq 1$$

$$= 2x^2 + 3x - 8x - 12$$

$$= x(2x+3) - 4(2x+3)$$

$$= (2x+3)(x-4)$$

$r+s = -5$
 $rs = 2x(-12) = -24$

 $1x - 24$
 $2x - 12$
 $3x - 8$
 $4x - 6$

Step 2: Find the x-intercepts.

The x-intercepts occur when $y = 0$.

Set each factor equal to zero to find the x-intercepts.

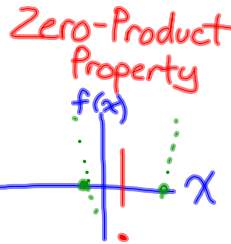
$$0 = (2x+3)(x-4)$$

$$2x+3=0 \quad | \quad x-4=0$$

$$2x = -3 \quad | \quad x = 4$$

$$x = -\frac{3}{2}$$

$$x = -1.5$$



Step 3: Find the axis of symmetry.

I know the axis of symmetry is in the middle of the x-intercepts.

$$x = \frac{-1.5 + 4}{2}$$

$$= 1.25$$

Step 4: Find the vertex.

I know the x-value of the vertex is the same as the axis of symmetry.

$$f(1.25) = 2(1.25)^2 - 5(1.25) - 12$$

$$= -15.125$$

\therefore vertex is $(1.25, -15.125)$

Summary

Standard Form of a Quadratic Function:

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

where c is

Word Problems
"initial value"

Factored Form of a Quadratic Function:

$$f(x) = a(x-r)(x-s)$$

where r and s are

If $a > 0$, then

If $a < 0$, then

x intercepts
it opens up
zeros
it opens down

Word Problems
x - break even point
* - object hits the ground

Homework: p. 139-140 #2,3,4ace,5ace

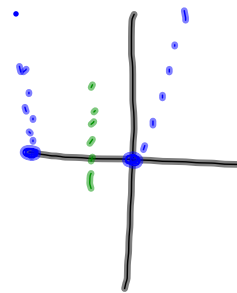
$$2a) f(x) = 2x^2 + 12x$$

★ change standard \rightarrow factored form find vertex

$$\begin{aligned} f(x) &= 2x^2 + 12x \\ &= 2x(x+6) \end{aligned}$$

★ find zeros (let $y=0$)

$$\begin{aligned} 0 &= 2x(x+6) \\ 2x &= 0 \quad | \quad x+6 = 0 \\ x &= 0 \quad | \quad x = -6 \end{aligned}$$



\therefore zeros are 0, -6

★ find axis of symmetry

$$\begin{aligned} x &= \frac{0-6}{2} \quad \therefore \text{AoS is} \\ x &= -3 \quad \quad \quad x = -3 \end{aligned}$$

★ sub $x = -3$ into $f(x)$

$$\begin{aligned} f(-3) &= 2(-3)^2 + 12(-3) \\ &= 18 - 36 \\ &= -18 \end{aligned}$$

$$\therefore V(x,y) = (-3, -18)$$

