What does the graph of a quadratic function look like?

Quadratic Function	$f(x) = ax^2 + bx + c$ Standard Form Parent Function: *make transformations from THIS table!  	x	y	1st diff	2nd diff	 |---|---|---|---| | -3 | 9 | -5 | 2 | | -2 | 4 | -3 | 2 | | -1 | 1 | -1 | 2 | | 0 | 0 | 1 | 2 | | 1 | 1 | 3 | 2 | | 2 | 4 | 5 | 2 | | 3 | 9 | | | *notice how the second differences are the same $y = ax^2$ $y = x^2$ (0,0)
Parabola	shape of the graph of quadratic function -- U
Vertex	Turning point/ center of graph (x,y)
Axis of Symmetry	x= # vertical line that cuts graph in symmetric halves
Minimum	vertex when a>0 $y \geq 0$
Maximum	Vertex when a <0 $y \leq 0$ $y = ax^2$
Transformations	stretch-- $\|a\|>1$ compression-- $0<\|a\|<1$
Domain & Range	Domain: $\mathbb{R}$ Range is limited by max/min
How to find equation	plug point in to equation $y = ax^2$ and solve for a $(-2,-8)$ x y $y = ax^2$ $-8 = a(-2)^2$ $\frac{-8}{4} = \frac{a(4)}{4}$ $-2 = a$ $y = -2x^2$

What information can you obtain from the vertex form of a quadratic function?

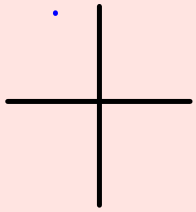
How to graph:

Make a table of values, plot a few points, draw curve!

find vertex

x	$x^2 \to 2x^2$
−2	4 → 8
−1	1 → 2
0	0 → 0
1	1 → 2
2	4 → 8

ex: $f(x) = 2x^2$



Vertex Form

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

"parameters"

a, h, k

Vertex (h, k)

Axis of Symmetry $x = h$

Max/Min $y \le k$ or $y \ge k$

horizontal translation → right/left (opposite!)

vertical translation → up/down

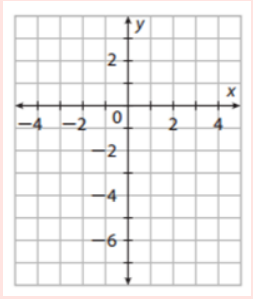
vertical reflection ($a < 0$, $-x^2$)

stretch/compress ($|a| > 1$, $2x^2$; $0 < |a| < 1$, $\frac{1}{2}x^2$)

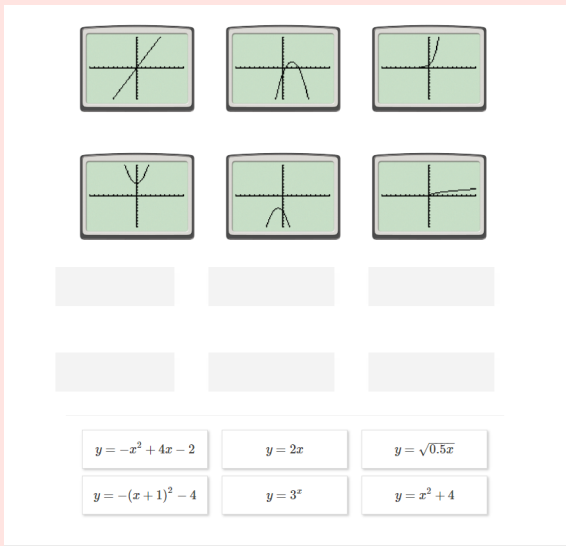
Graphing ex:

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

1) up or down?
2) find vertex (x or y) (min/max)
3) make table w/ vertex in middle
4) Graph!



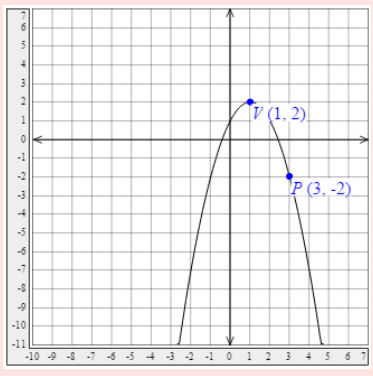
CHECK IN:



How do you convert a function from vertex form to standard form?

Vertex (from standard form)	$f(x)= ax^2 + bx + c$ $y = a(x-h)^2 + k$ y int? vertex? $f(x) = x^2 + 4x - 17$, $x = \frac{-b}{2a}$ (plug in to find f(x)) f(x)= *plug in!*
vertex--> standard	*simplify!* $y = 3(x - 5)^2 + 4$
How to write equation when vertex is NOT at origin	1) find vertex and one other point 2) plug in to vertex form and solve for a! 3) rewrite!

x	y
−1	61
1	13
2	7
3	13
5	61



How are zeros, intercepts, and factors connected?

Graphing Quadratic functions	1) Rewrite in standard form (or vertex) 2) Find/ Identify the vertex 3) Find the y intercept 4) Find a couple more points (use a table) $y+5 = x^2 - 4x$
Solving quadratic functions	when function (y) = 0
Factored form	$y = (x-a)(x-b)$ factors are x-a AND x-b zeros are **a** and **b** the "zeros" are when the function (y) = 0
Zero product Property	$(x-a)(x-b) = 0$ AKA the x intercepts *to find the zeros, it's "opposite constant OVER coefficient"
Factored --> Standard	simplify! $y = -2(x-3)(x+2)$
To graph:	1) plot zeros (x int) 2) Write in standard form 3) plot y int 4) Find (& plot) vertex! $x = \frac{-b}{2a}$ (plug in to find f(x))
Factoring by grouping	$x(x-5) + 3(x-5) = 0$ $2x(x-1) + 4x - 4 = 0$

GRAPHING: *Key Features*

Vertex (axis of symmetry, max/min) x = y

Intercepts-- x & y y=c x=0

*When all else fails, make a table w/ vertex in mid

Domain & Range → ℝ (−∞, ∞) → limited by min/m

1) Standard

$y = ax^2 + bx + c$

- Vertex ⇒ $x = \frac{-b}{2a}$, plug in for y
- Intercepts ⇒ y = c (0, c)
  x → "Solve" (y=0) factor!

2) Vertex

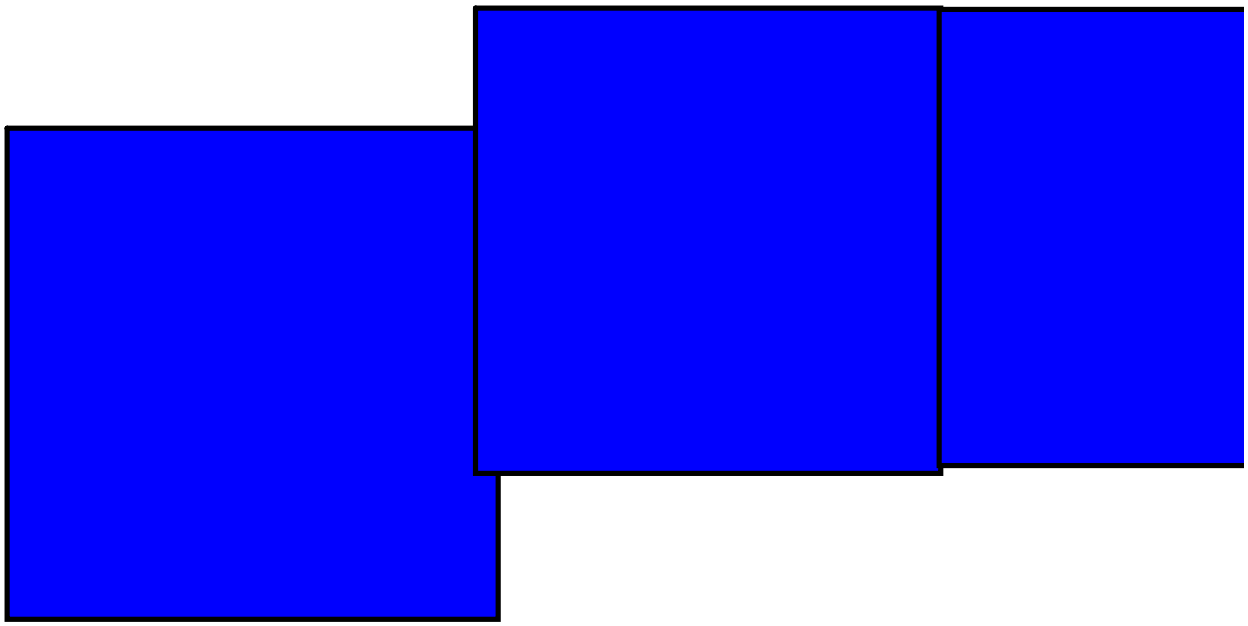
$y = a(x-h)^2 + k$

- Vertex ⇒ (h, k)
- Intercepts ⇒
  y → convert to standard f
  x → factor!

3) Factored

$y = (x-a)(x-b)$

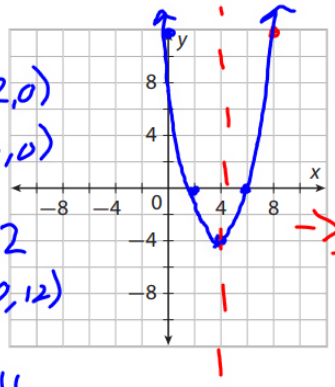
- Vertex ⇒ Convert to standard
- Intercepts ⇒ y
  x = a (a, 0)
  b (b, 0)



Page 957--graphing from factored form

Identify the x-intercepts and the axis of symmetry of each parabola. • Extra Practice

1. $y = (x - 2)(x - 6)$



$x = 4$

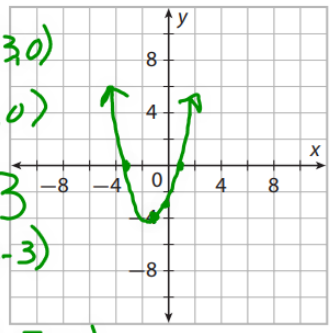
1) $x = 2\ (2,0)$
$x = 6\ (6,0)$

2) $x^2 - 8x + 12$
$y = 12\ (0,12)$

3) $x = \frac{-(-8)}{2(1)} = 4$

$(4)^2 - 8(4) + 12$
$16 - 32 + 12$
$y = -4$
$(4, -4)$

2. $y = (x + 3)(x - 1)$



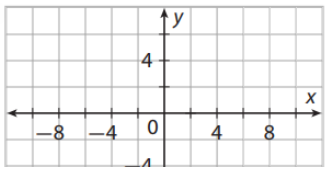
1) $x = -3\ (-3,0)$
$x = 1\ (1,0)$

2) $x^2 + 2x - 3$
$y = -3\ (0,-3)$

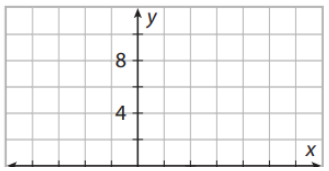
3) $x = \frac{-(2)}{2(1)} = -1$

$(-1)^2 + 2(-1) - 3$ $(-1,-4)$
$1 - 2 - 3$
$y = -4$

3. $y = (x - 5)(x + 2)$



4. $y = (x - 5)(x - 5)$



1) x int (lock)
2) y int convert to standard Form (lock)
3) Vertex $x = \frac{-b}{2a}$ plug in to find y

How do you factor (& solve) trinomials?

#1

To factor trinomials

ALWAYS CHECK FOR GCF FIRST!

$ax^2 + bx + c$

ac

b

what multiplies to ac & add/sub to b?

if ac is ⊕, same sign (add)
if ac is ⊖, diff signs (sub)
look @ b

1) multiply a & c
2) Figure out what adds/ subtracts to b
3) Write b as sum/ diff of those two factors
4) Factor by grouping!
5) Check by FOIL or BOX

$x^2 + 10x + 24$

$3x^2 - 2x - 5$

To solve:

21. Match the equation to its solutions.

a. $x^2 - 3x - 18 = 0$ _____ 3 and 6

b. $x^2 - 9x + 18 = 0$ _____ −3 and −6

c. $x^2 + 3x - 18 = 0$ _____ 3 and −6

d. $x^2 + 9x + 18 = 0$ _____ −3 and 6

olve!

10. $x^2 - 18x = -56$

$-12x^2 = 34x - 28$

Projectile Motion Formula

$y = -16t^2 + V + H$

How can knowing special cases help you solve quadratic equations?

Difference of squares	$a^2 - b^2 = (a-b)(a+b)$ $49x^2 - 36 = (7x-6)(7x+6)$ $(7x)^2 - (6)^2$
Perfect square trinomials	$a^2 + 2ab + b^2 = (a+b)^2$ $a^2 - 2ab + b^2 = (a-b)^2$ $49x^2 + 84x + 36 = (7x+6)^2$ $(7x)^2 + 2(7x)(6) \quad (6)^2$

When would you use each method of solving quadratic equations?

Quadratic Formula	**8.** $2x^2 = 8x - 7$ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Discriminant	$b^2 - 4ac$ if -, no solution if 0, one solution if +, 2 solutions