Ch 3 Quadratic Functions

June 3, 2019 8:54 AM

Basic quadratic: $y = x^2$

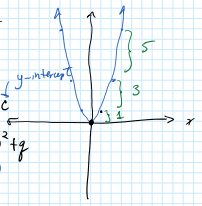
standard form: $y = ax^2 + bx + c$

vertex form: $y = a(x-p)^2 + q$

vertex (p, q)

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

vertex $(-3, -4)$



Graphing

vertex (p, q)

- axis of symmetry
- domain
- range

- p, horizontal translation

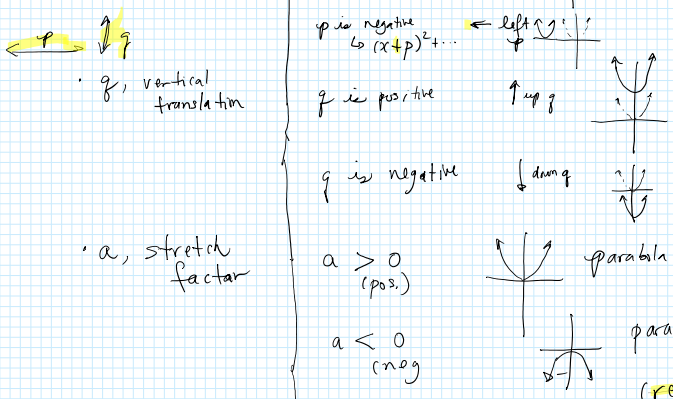
p is positive → $(x-p)^2 \ldots$ → right p

p is negative → $(x+p)^2 + \ldots$ ← left p

- q, vertical translation

q is positive ↑ up q

q is negative ↓ down q



- a, stretch factor

$a > 0$ (pos.) parabola opens up

$a < 0$ (neg.) parabola opens down. (reflection about x-axis)

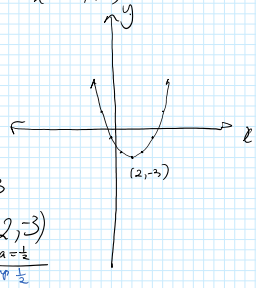
$|a| < 1$ vertically compressed by a factor of a

"fatter"

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

↳ vertex $(2, -3)$

$a=1$ up 1	$\times \frac{1}{2}$	$a=\frac{1}{2}$ up $\frac{1}{2}$
3	$\times \frac{1}{2}$	$\frac{3}{2} = 1.5$
5	$\times \frac{1}{2}$	$\frac{5}{2} = 2.5$
7		etc
⋮		

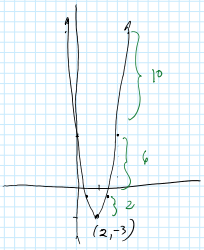


$|a| > 1$ $y = 2(x-2)^2 - 3$

↳ vertex $(2, -3)$

Vertically expanded "skinnier"

$a=1$	$\times 2$	$a=2$
1		2
3		6
5		10
⋮		



Convert to Vertex Form

i) $a = 1$

$y = x^2 + 6x + 15$

$y = ax^2 + bx + c$

$\frac{b}{2} = \frac{6}{2} = 3 \rightarrow 3^2 = 9$

$y = x^2 + 6x + 9 - 9 + 15$

$y = (x+3)^2 + 6$

ii) $a \neq 1$

$y = 2x^2 - 4x + 1$

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

$\frac{b}{2} = \frac{-2}{2} = -1 \rightarrow (-1)^2 = 1$

$y = 2[(x^2 - 2x + 1) - 1] + 1$

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

$y = (x+3)^2 + 6$

Vertex $(-3, 6)$

$y = 2[(x^2-2x+1)-1]+1$

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

$y = 2(x-1)^2 - 1$

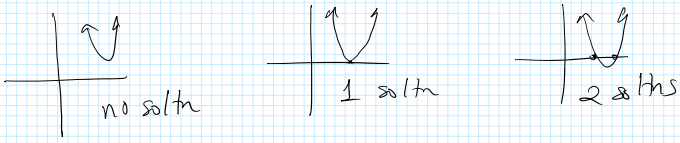
Vertex $(1, -1)$

$(x+3)^2 = (x+3)(x+3) = x^2+6x+9$

Ch 4 Solving Quadratic Equations

~~*~~ Set 1 side equal to Zero!

Solve graphically — x-intercepts = roots = solution



Solve by factoring

- difference of squares $y = 25x^2 - 100$

  ↳ $a^2 - b^2 = (a+b)(a-b)$ $y = (5x+10)(5x-10)$

  $5x+10=0$ or $5x-10=0$

  $5x = -10$ or $x = 2$

  $x = -2$

- $x^2 - 6x = 27$

  $-27 \quad -27$

  $x^2 - 6x - 27 = 0$

  $3 \times -9 = ac = -27$

  $3 + -9 = b = -6$

x	x
3	-9

$ax \mid ax$

$(x+3)(x-9) = 0$

$x = -3$ or $x = 9$

- $4x^2 + 11x + 6 = 0$

  $8 \times 3 = ac = 24$

  $8 + 3 = b = 11$

4x	4x
8	3

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

$x+2=0$ or $4x+3=0$

$x = -2$ or $x = -\frac{3}{4}$

Solve by completing the square

$x^2 + 18x + 32 = 0$

$\frac{b}{2} = \frac{18}{2} = 9 \rightarrow 9^2 = 81$

$x^2 + 18x + 81 - 81 + 32 = 0$

$(x+9)^2 - 49 = 0$

$+49 \quad +49$

$\sqrt{(x+9)^2} = \sqrt{49}$

$x + 9 = \pm 7$

$x + 9 = 7$ or $x + 9 = -7$

$-9 \quad -9 \quad -9 \quad -7$

$x = -2$ or $x = -16$