Unit 1
Day 11

1.5 Characteristics of Quadratic Graphs...

Standard Form:
$y = ax^2 + bx + c$

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

* where $a \neq 0$

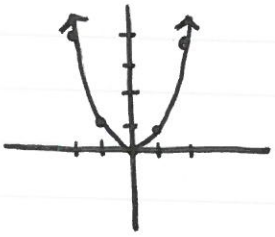
The graph of a quadratic is a parabola.
The axis of symmetry is a line that divides a parabola into matching halves

If $a > 0$, parabola opens up.

If $a < 0$, parabola opens down

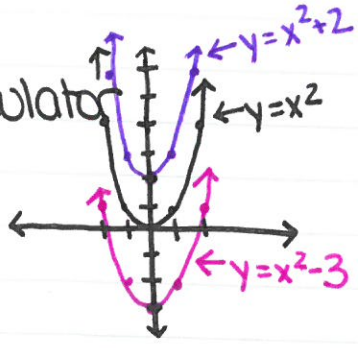
Let's graph $y = x^2$.

x	y
-2	4
-1	1
0	0
1	1
2	4



* plot at least 5 points
* this is a parent graph
  - the "most basic" quadratic

Use your calculator to graph:
$y = x^2$
$y = x^2 + 2$
$y = x^2 - 3$



$y = x^2 + k$
k shifts the graph up or down.

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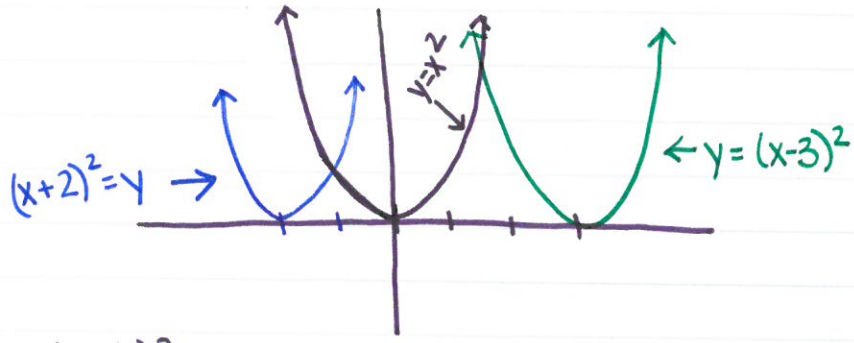
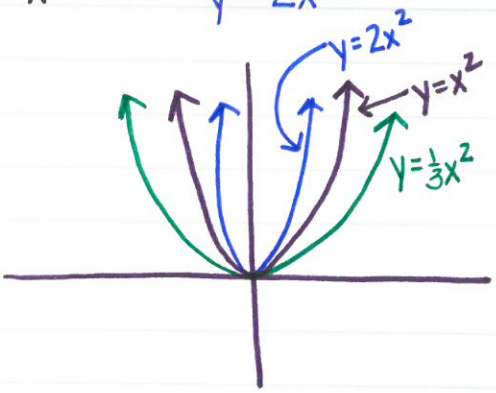
Graph $y = x^2$ $y = (x+2)^2$ $y = (x-3)^2$



$y = (x+h)^2$

"h" shifts the graph left or right.

Graph $y = x^2$ $y = 2x^2$ $y = \frac{1}{3}x^2$



$y = a \cdot x^2$

"a" vertically stretches or shrinks the graph.

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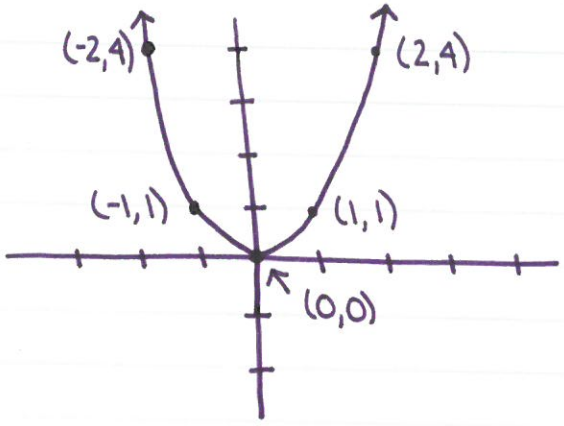
$y = x^2$



Sketch by hand; Be sure to plot at least 5 points.

① $y = x^2 + 1$

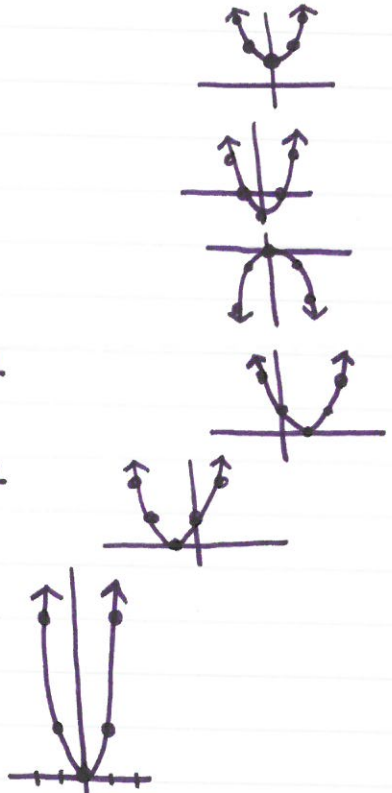
② $y = x^2 - 1$

③ $y = -x^2$

④ $y = (x-1)^2$

⑤ $y = (x+1)^2$

⑥ $y = 3 \cdot x^2$



* encourage graph paper ☺

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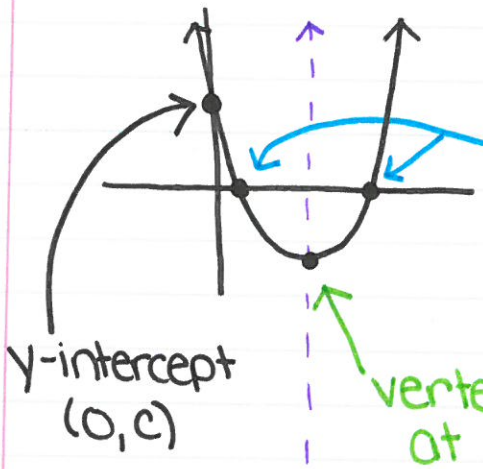
Day 12

1.6 Graphing & Solving Quadratics



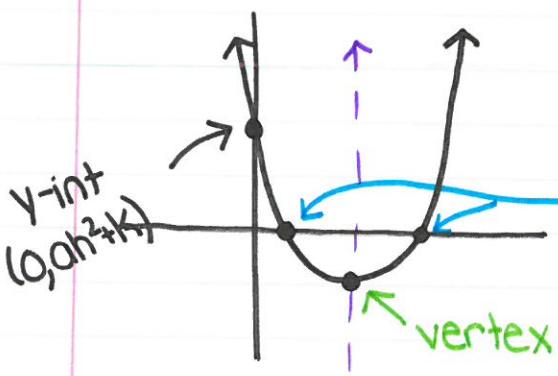
$y = ax^2 + bx + c$

roots, x-intercepts, solutions
(solve $0 = ax^2 + bx + c$)
↳ we have 5 ways to do this!!

y-intercept
$(0, c)$

vertex
at $x = -b/2a$... plug this in to find y.

↓ ← axis of symmetry... line $x = -b/2a$



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

y-int
$(0, ah^2+k)$

roots, x-int, sol'n (set y=0... solve)

vertex at (h, k)

↓ ← axis of symmetry... line $x = h$

Graph the following. Be sure to plot at least 5 points.

① $y = 2(x-3)^2 + 1$

② $y = \frac{1}{2}(x+2)^2 - 3$

③ $y = x^2 - 4x - 5$

④ $y = -x^2 + 8x - 15$

⑤ $y = (x-4)^2 - 2$

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*Post Quiz

Writing an Equation from a Graph...

3 methods... they all work... choose what works for you.

I. If you know the vertex and another point:

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

* plug in the vertex $(2,9) = (h,k)$

$y = a(x-2)^2 + 9$

* plug in another point $(4,1) = (x,y)$ ← It's your choice... they all work!

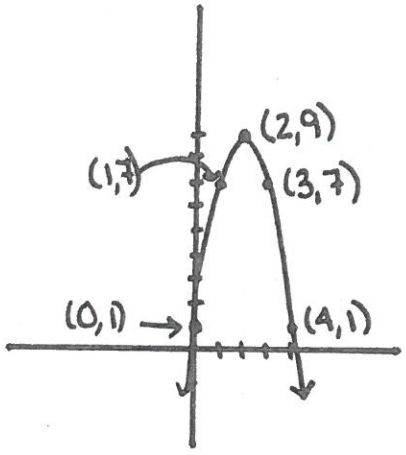
$1 = a(4-2)^2 + 9$

$1 = a \cdot 2^2 + 9$

$-8 = 4a$

$-2 = a$

$y = -2(x-2)^2 + 9$



II. If you know the roots & another point:

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

* plug in the roots

$y = a(x+1)(x-3)$

* plug in another point $(2,-6) = (x,y)$ ← It's your choice... just don't reuse a root!

$-6 = a(2+1)(2-3)$

$-6 = a \cdot 3 \cdot -1$

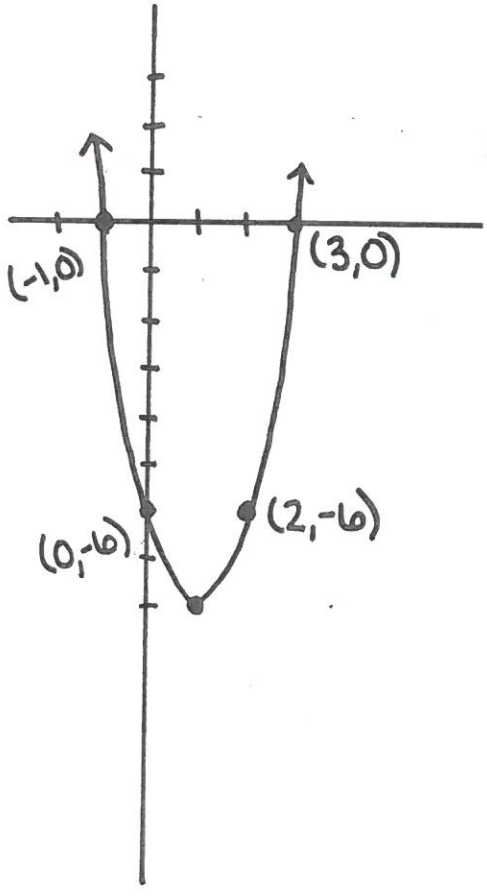
$-6 = -3a$

$2 = a$

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

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

$y = 2x^2 - 4x - 6$



III. If you have 3 points: $(-1,6)$, $(0,5)$, $(1,10)$

$y = ax^2 + bx + c$

* If one point has a zero, plug that one in ☺

$(0,5) = (x, y)$

$5 = a \cdot 0 + b \cdot 0 + c \quad c = 5$ ← Now, I know $y = ax^2 + bx + 5$ ☺

* plug in each other point... use systems of equations:

$y = ax^2 + bx + 5$

$(-1,6)$ $\qquad$ $(1,10)$

$6 = a \cdot 1 + b \cdot -1 + 5 \qquad 10 = a \cdot 1 + b \cdot 1 + 5$

$1 = a - b \qquad 5 = a + b$

↘ ↙

$1 = a - b$

$5 = a + b$

$6 = 2a$

$3 = a$

Plug $a = 3$ into either $1 = a - b$ or $5 = a + b$

$1 = 3 - b \qquad 5 = 3 + b$

$2 = b \qquad 2 = b$

So, $a = 3$, $b = 2$, $c = 5$

Answer: $y = 3x^2 + 2x + 5$

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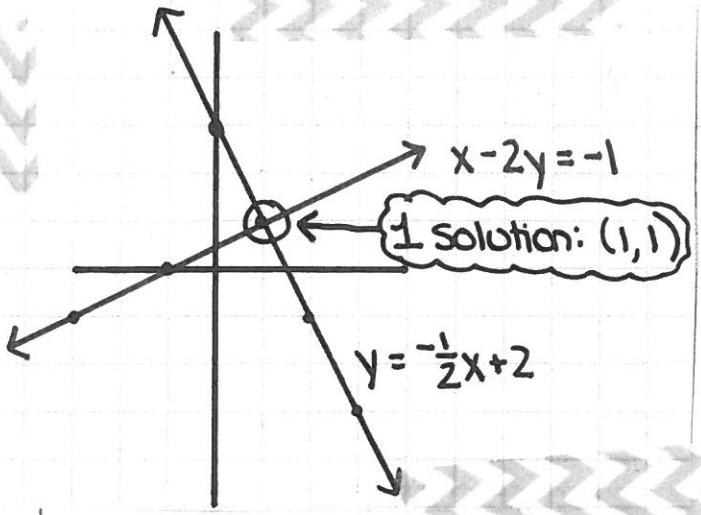
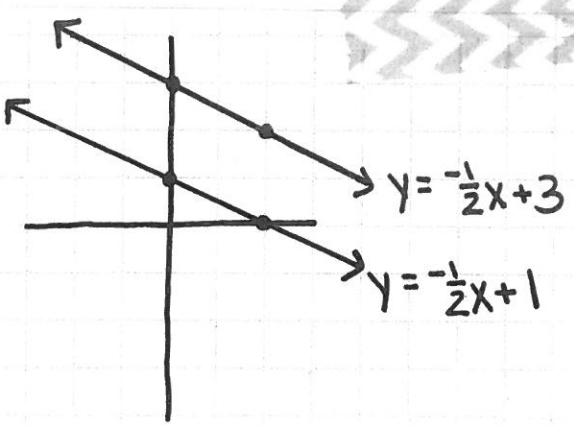
1.7 Quadratic Systems

Review: Solving Linear Systems... 3 scenarios:



Lines Intersect...

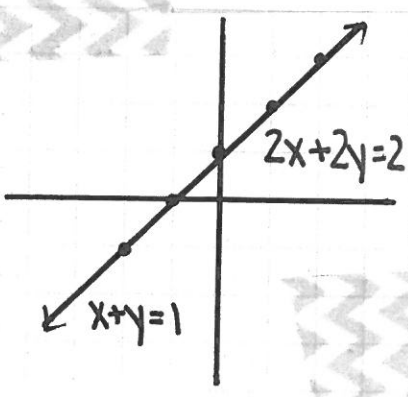
1 Solution



Lines are parallel..

No Intersection

0 solutions



Same Line...

Infinite "Intersections"

Infinite Solutions

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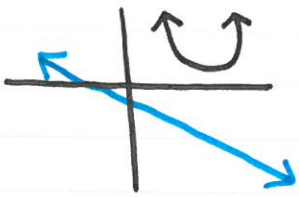
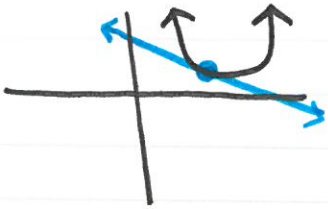
cont'd

Solving Systems with Quadratics

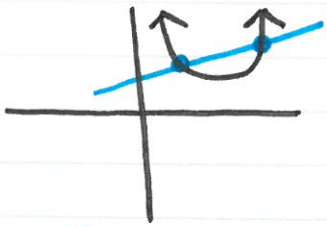
Line & Parabola:



No Solution

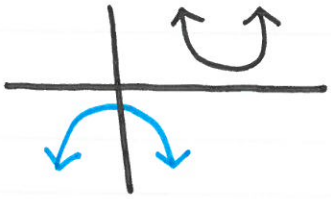


1 Solution

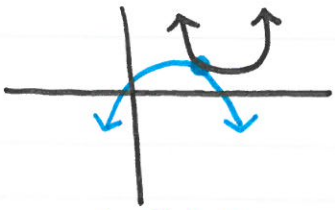


2 Solutions

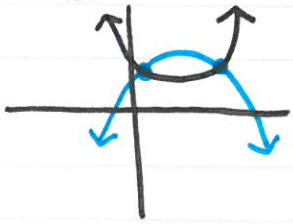
Parabola & Parabola ← could also have infinite if the parabolas are the same.



No Solution



1 Solution

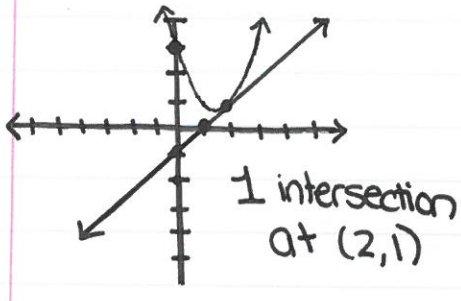


2 Solutions

*Can use "graph" & "intersect" to solve... or...

Algebra ☺... Find the solution(s) of the following:

ex. $y = x-1$
$y = x^2-3x+3$



1 intersection at (2,1)

$y = x-1$
$y = x^2-3x+3$

Substitution

$x-1 = x^2-3x+3$

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

$0 = (x-2)^2$

$x-2=0$

$x=2$ → plug in x... $y = x-1$

$y=1$ $y = 2-1$

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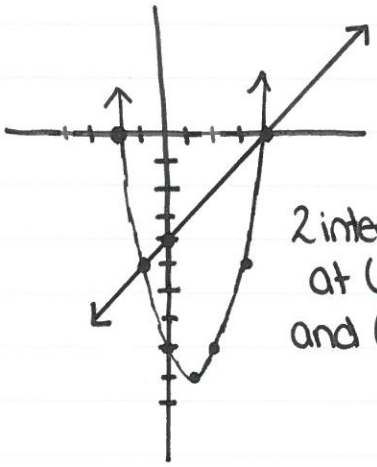
ex. $y = x-4$
$y = x^2-2x-8$



2 intersections at (4,0) and (-1,-5)

$y = x-4$
$y = x^2-2x-8$

Substitution

$x-4 = x^2-2x-8$
$0 = x^2-3x+4$
$0 = (x-4)(x+1)$
$x-4=0 \quad x+1=0$

$x=4$	$x=-1$
$y=0$	$y=-5$

to get y, plug x into either equation

Practice - Solve using algebra. Check by graphing.

① $y = x^2+3x$
$y = 12x^2+3x$

② $y = (x-3)^2+2$
$y = -x^2+6x-5$

③ $y = (x+2)^2$
$y = 4-x^2$

④ $y = x^2+2$
$y = -x^2+1$

⑤ $y = x^2-11x-36$
$y = -12x+36$

⑥ $y = 3x+4$
$y = -x^2$

1. (0,0)
2. (2,3); (4,3)
3. (0,4); (-2,0)
4. no soln
5. (-9,144); (8,-60)
6. no soln