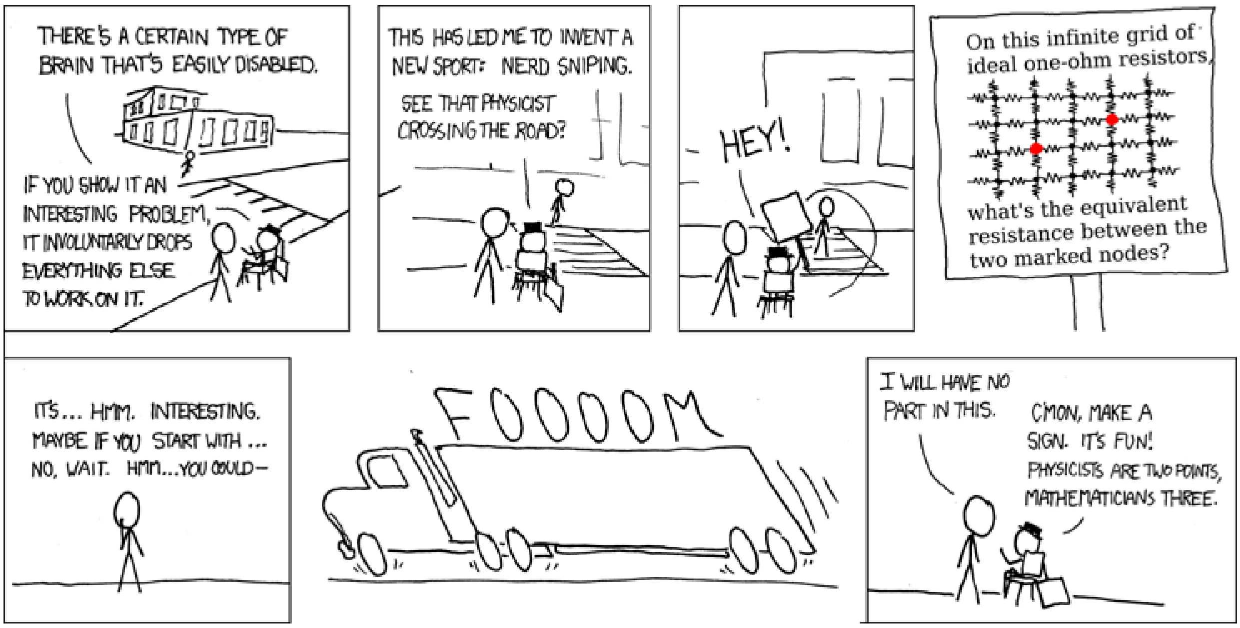
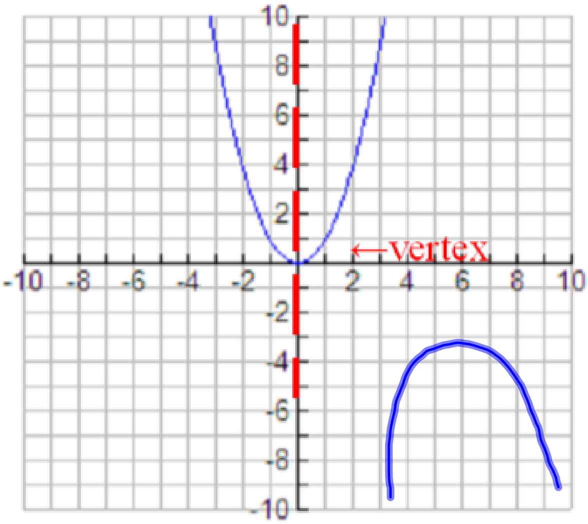
3.1

Quadratic Functions


THERE'S A CERTAIN TYPE OF BRAIN THAT'S EASILY DISABLED.
IF YOU SHOW IT AN INTERESTING PROBLEM, IT INVOLUNTARILY DROPS EVERYTHING ELSE TO WORK ON IT.
THIS HAS LED ME TO INVENT A NEW SPORT: NERD SNIPING.
SEE THAT PHYSICIST CROSSING THE ROAD?
HEY!
On this infinite grid of ideal one-ohm resistors, what's the equivalent resistance between the two marked nodes?
IT'S... HMM. INTERESTING. MAYBE IF YOU START WITH ... NO, WAIT. HMM...YOU COULD—
FOOOOM
I WILL HAVE NO PART IN THIS.
C'MON, MAKE A SIGN. IT'S FUN! PHYSICISTS ARE TWO POINTS, MATHEMATICIANS THREE.

Quadratic Functions

- $y=ax^2 + bx + c$
- A polynomial of degree 2 (the highest exponent is a 2)
- The graph is U-shaped (parabola)



$y = x^2$

Vertex – highest or lowest point

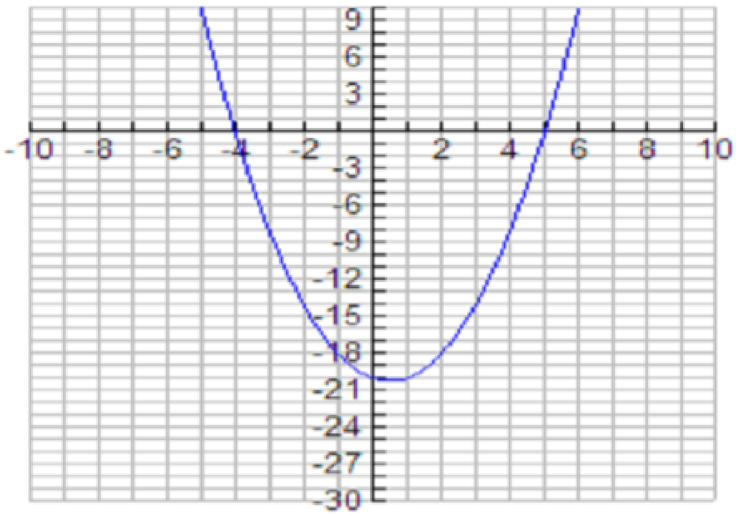
-Opens up

Axis of symmetry- the vertical line through the vertex

Solving Quadratics

- 5 ways
  - Graphing
  - Square root method
  - Factoring
  - Completing the square
  - Quadratic formula

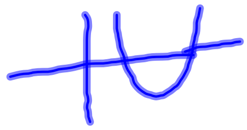
Solution?

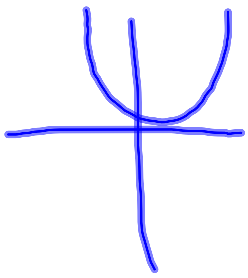


The solution
is where the graph
crosses the x-axis

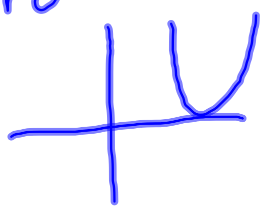
Discriminant:

pos. & perfect



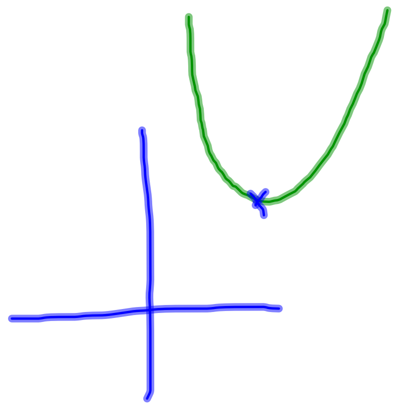


zero



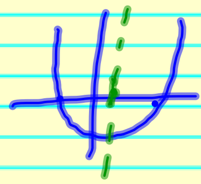
$$f(x) = x^2$$

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



3 Forms of Quadratic Functions

- General form: $y=ax^2 +bx +c$
  - Vertex : (-b/2a, plug in)
  - Axis of symmetry: $x=-b/2a$
- Standard form: $y= a(x-h)^2 + k$
  - Vertex: (h,k)
  - Also known as vertex form
- x-intercept form: $y= a(x – p)(x – q)$ → factored
  - Vertex: found by indentifying x-coordinate of vertex will be halfway between the x-intercepts
  - X-intercepts: (p,0) (q,0)



General Form:

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

pos: up
neg: down

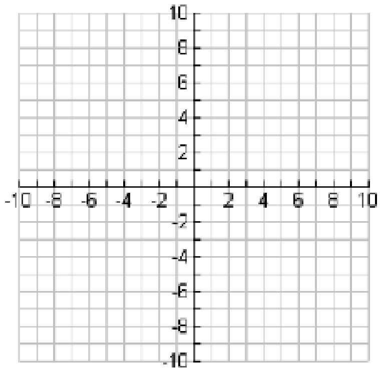
axis of symmetry : $x = \frac{-b}{2a}$

vertex : $\left(\frac{-b}{2a}, \text{plug in}\right)$

y int : $(0, c)$

Graph:

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



Graph: $f(x) = x^2 - 8x + 4$

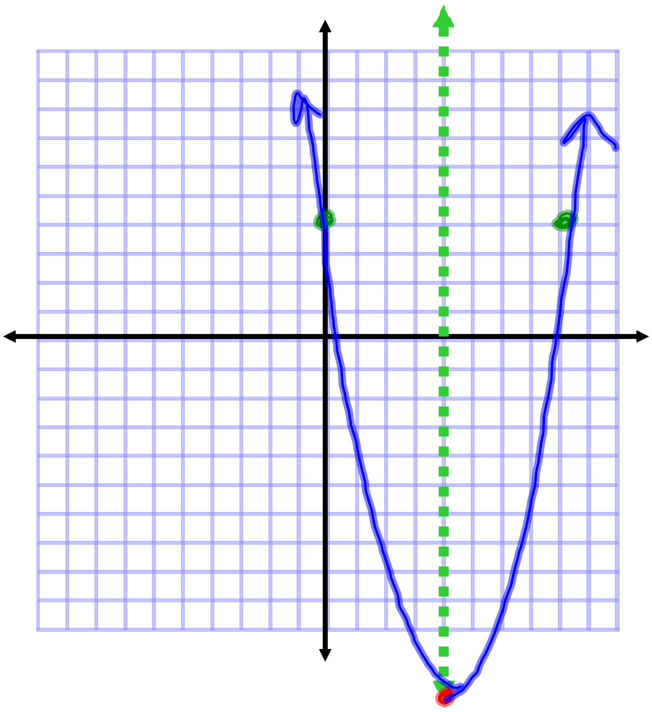
up

axis of sym: $x = 4$

vertex: $(4, -12)$

$4^2 - 8(4) + 4$

y int: $(0, 4)$



Vertex form:

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

up / down

(pos) (neg)

vertex: (h, k)

Put in vertex form:

$$f(x) = x^2 - 6x - 11$$

$$f(x) = (x^2 - 6x + 9) - 11 - 9$$

$$f(x) = (x-3)^2 - 20$$

vertex: $(3, -20)$

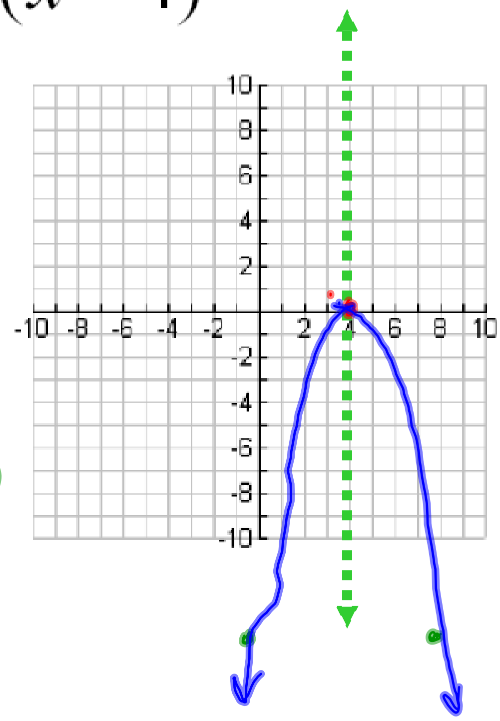
Graph:

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

vertex: (4,0)

line of sym: x=4

y int: (0,-16)



Graph: $f(x) = x^2 - 8x + 4$

Write the standard form of the equation of the parabola that has the indicated vertex and whose graph passes through the given point.

- Vertex: (-2, 5); point (0,9)

$y = a(x+2)^2 + 5$

$9 = a(2)^2 + 5$

$a = 1$

$y = (x+2)^2 + 5$

Sketch the graph of

$f(x) = -x^2 + 6x - 8$

and identify the vertex and x-intercepts.

$f(x) = -(x^2 - 6x + 9) \quad -8 \quad +9$

$f(x) = -(x-3)^2 + 1$

$0 = -(x-3)^2 + 1$

$1 = (x-3)^2$

$\pm 1 = x - 3$

$2, 4 = x$

vertex: $(3, 1)$

y int: $(0, -8)$

x int: $(2, 0)$ $(4, 0)$

HW: Pg 270

#1-8, 12, 17-20, 39, 44, 78