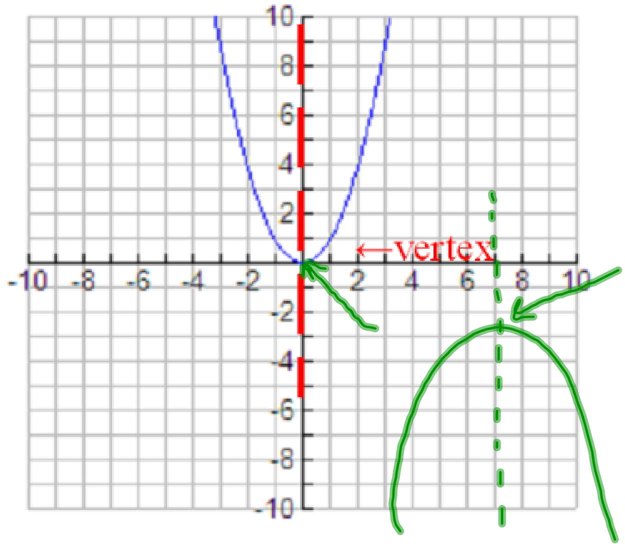
3.1

Quadratic Functions


...SIGHHHHHH...
CALVIN, PAY ATTENTION!
AUGH
THERE'S NO HEAD REST ON THIS CHAIR! I SHOULD SUE FOR WHIPLASH!

Quadratic Functions

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



$y = x^2$

<u>Vertex</u> – highest or lowest point

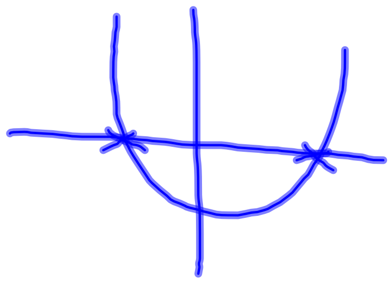
-Opens up

<u>Axis of symmetry</u>- the vertical line through the vertex

Solution?

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

y



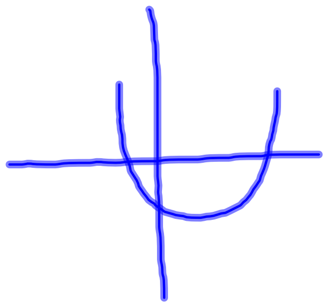
Solving Quadratics

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

$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

Discriminant

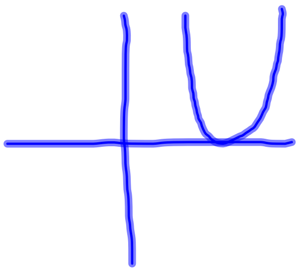
b^2-4ac



2 real sol.

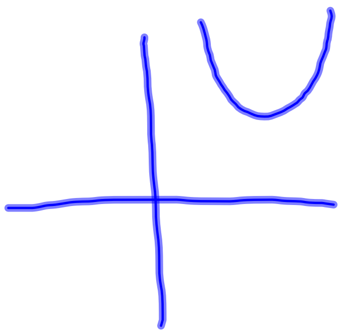
pos: 2 irrat. sol.

pos. & perfect: 2 real rational



1 repeated real sol.

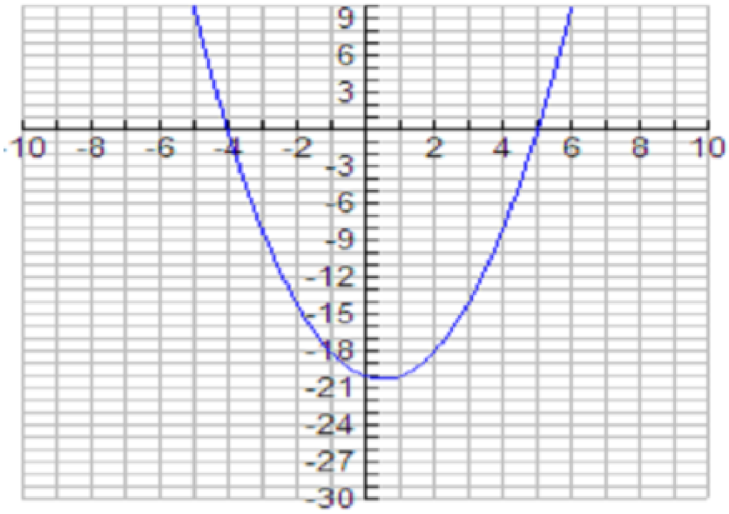
zero: 1 sol.



2 non-real sol.

neg: 0 real sol.

Solution?



The solution
is where the graph
crosses the x-axis

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: $y= a(x - p)(x - q)$**
  - Vertex: found by indentifying x-coordinate of vertex will be halfway between the x-intercepts
  - X-intercepts: (p,0) (q,0)

$y=x^2$

(FACT)(ORING)

Factoring: the process of writing a polynomial as a product of factors. $18 = 2 \cdot 3^2$

If a polynomial cannot be factored using integer coefficients, then it is **prime** or **irreducible over the integers.**

$$(x+6)(x-4)$$

$$x^2 + 6x - 4x - 24$$

$$x^2 + 2x - 24$$

mult. first terms

added outer/inner

mult. last terms

Factor:

a) $10x^3 + 6x$

$2x \rightarrow$ GCF

$2x(5x^2 + 3)$

b) $-3x^2 + 6x - 9$

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

$4 - 4(1)(3) = -8$

c) $\underbrace{(x - 3)(3x)} + \underbrace{(x - 3)\,5}$

$(x-3)(3x+5)$

Factoring special polynomials:

Difference of two squares:

$$u^2 - v^2 = (u - v)(u + v)$$

$$(u+v)(u+v) = u^2 + 2uv + v^2$$

a) $x^2 - 25$ $= (x-5)(x+5)$

b) $4a^2 - 9$ $= (2a+3)(2a-3)$

c) $5 - 20x^2$ $= 5(1-4x^2)$

$5(1-2x)(1+2x)$

d) $16v^4 - 81$ $= (4v^2+9)(4v^2-9)$

$= (4v^2+9)(2v+3)(2v-3)$

Factoring special polynomials:

Perfect square trinomial:

$$u^2 + 2uv + v^2 = (u + v)^2$$

$$u^2 - 2uv + v^2 = (u - v)^2$$

a) $\underline{x}^2 + 8x + \underline{16} = (x+4)^2$

$1 \qquad 4$

b) $\underline{16}a^2 + 24a + \underline{9} = (4a+3)^2$

$4 \qquad 3$

c) $\underline{v}^2 - 10v + \underline{25} = (v-5)^2$

$1 \qquad 5$

Other factoring:

a) $\underline{x^2} \underset{\text{add}}{\underline{-7}}x + \underset{\text{mult}}{\underline{12}}$

$(x - 3)(x - 4)$

$2x^2 + x - 15$

$1 - 4(2)(-15) = 121$ ✓

$(2x - 5)(x + 3)$

$$2y^3 - 7y^2 - 15y$$

$$y(2y^2 - \underset{\text{add}}{7}y \underset{\text{mult}}{-15})$$

$$49 - 4(2)(-15)$$

$$= 169 \checkmark$$

$$\boxed{y(2y + 3)(y - 5)}$$

$-5u^2 - 13u + 6$

$-(5u^2 + 13u - 6)$

$\boxed{-(5u-2)(u+3)}$

$169 - 4(5)(-6) =$

$= 289$ ✓

HW:

-Finish 1st assignment on pg 38

-Add: Pg 38 # 52-64 evens,

101, 113-116