Zero Product Property: If $a \times b = 0$, then $a = 0$ and/or $b = 0$

ex. $(x-5)(x+3)=0$ then $(x-5)=0$ and/or $(x+3)=0$

so $x=5$ or $x=-3$

Steps to Solve by Factoring:

1. Solve for y (and plug in y = 0) (everything on one side)
2. Factor (don't forget the GCF!)
3. Set each factor each to zero and solve

$$x^2 - 13x + 36 = 0$$

	x	-4
x	x^2	$-4x$
-9	$-9x$	36

36: 1, 36 | 2, 18 | −4, −9 : −13

$(x-4)(x-9)=0$

$x-4=0$ $\quad x-9=0$

$+4\ +4 \quad +9\ +9$

$x=4 \quad x=9$

$\{4, 9\}$

ac: ax^2, x, x, c — add to b

2. $x^2 - 3x - 10 = 0$

	x	2
x	x^2	$2x$
-5	$-5x$	-10

-10: 2, −5 : −3

$(x+2)(x-5)=0$

$x+2=0 \quad x-5=0$

$x=-2 \quad x=5$

$\{-2, 5\}$

3. get everything on one side

$3x^2 = 12x$

$-12x \quad -12x$

$3x^2 - 12x = 0$ gcf

$3x(x-4)=0$

$\frac{3x}{3}=\frac{0}{3} \quad x-4=0$

$+4\ +4$

$x=0 \quad x=4$

$\{0, 4\}$

4. $6x^2 + 5 = -17x$

$+17x \quad +17x$

$6x^2 + 17x + 5 = 0$

	$3x$	$+1$
$2x$	$6x^2$	$2x$
$+5$	$15x$	5

30: 2, 15 : 17

$(3x+1)(2x+5)=0$

$3x+1=0 \quad 2x+5=0$

$\{-\frac{1}{3}, -\frac{5}{2}\}$

Given the roots of the function, find the equation.

WORK BACKWARDS

5. $x : \{-3, \frac{5}{2}\}$ $\quad 2x^2 + x - 15 = 0$

$x=-3 \quad 2 \cdot x = \frac{5}{2} \cdot 2$ "solve for zero"

$+3\ +3 \quad 2x = 5$

$x+3=0 \quad -5\ -5$

$2x-5=0$

multiply factors

$(x+3)(2x-5)=0$

6. $x : \{-2, 5\}$

$x=-2 \quad x=5$

$+2 \quad -5$

$x+2=0 \quad x-5=0$

$(x+2)(x-5)=0$

$x^2 - 3x - 10 = 0$

By Factoring

190 feet

By Square Roots...

By Quadratic Formula

Steps to Solve by Square Roots:

1. Get the squared term alone.
2. Take the square root of both sides (2nd x^2)
3. Don't forget the ±!
4. Finish solving (if necessary)
5. You should have TWO answers

OPPOSITE of SQUARE = √SQ. ROOT.

1. $\frac{2(x-10)^2}{2} = \frac{200}{2}$

$\sqrt{(x-10)^2} = \sqrt{100}$

$x - 10 = \pm 10$

$+10 \quad +10$

$x = 10 \pm 10$

$\{20, 0\}$

Use this method... When there is ONLY a squared term!

2. $\sqrt{x^2} = \sqrt{225}$

$x = \pm 15$

$\{-15, 15\}$

3. $4x^2 - 25 = 0$

$+25 \quad +25$

$\frac{4x^2}{4} = \frac{25}{4}$

$\sqrt{x^2} = \sqrt{\frac{25}{4}}$

$x = \pm \frac{5}{2}$

4. $x^2 + 100 = 0$

$-100 \quad -100$

$\sqrt{x^2} = \sqrt{-100}$

ERROR

NO SOLUTION

5. $x^2 + 5 = 5$

$-5 \quad -5$

$\sqrt{x^2} = \sqrt{0}$

$x = 0$

6. $\frac{4(x+2)^2}{4} = \frac{324}{4}$

$\sqrt{(x+2)^2} = \sqrt{81}$

$x + 2 = \pm 9$

$-2 \quad -2$

$x = -2 \pm 9$

$\{-11, 7\}$

7. $0 = -2x^2 + 80$

$-80 \quad -80$

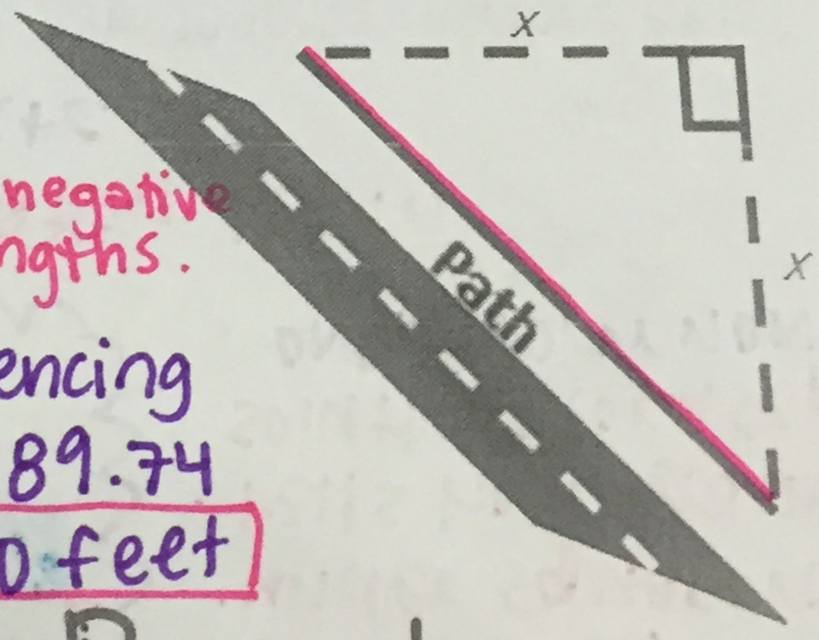
$\frac{-80}{-2} = \frac{-2x^2}{-2}$

$\sqrt{40} = \sqrt{x^2}$

$\pm 6.32 = x$

Round to 2 decimals

8. A zookeeper is buying fencing to enclose a pen at the zoo. The pen is an isosceles right triangle. There is already a fence on the side that borders a path. The area of the pen will be 4500 square feet. The zookeeper can buy the fencing in whole feet only. How many feet of fencing should he buy?



$A_\Delta = \frac{1}{2}bh$

$4500 = \frac{1}{2}x \cdot x$

$2 \cdot 4500 = \frac{1}{2}x^2 \cdot 2$

$\sqrt{9000} = \sqrt{x^2}$

$94.87 = x$

no negative lengths.

2 SIDES need fencing

$2(94.87) = 189.74$

190 feet

By Square Roots...

By Quadratic Formula

Quadratic Formula: ALWAYS WORKS

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

Discriminant
- under square root
- tells how many solutions (or use pic)
  ONE, TWO, or NONE

Finds x-intercepts if equation is in standard form $y = ax^2 + bx + c$

Using the discriminant, determine how many solutions exist.

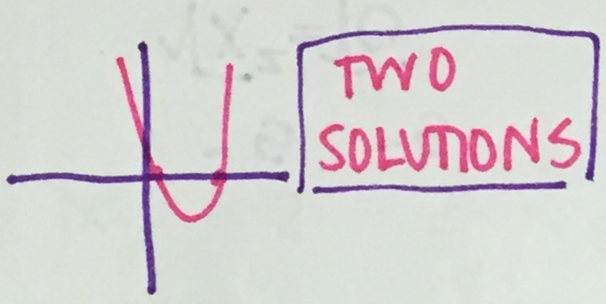
1. $x^2 - 4x + 3 = 0$

$a=1 \quad b=-4 \quad c=3$

$b^2 - 4ac$

$(-4)^2 - 4(1)(3)$

4



2. $x^2 = -2x - 1$

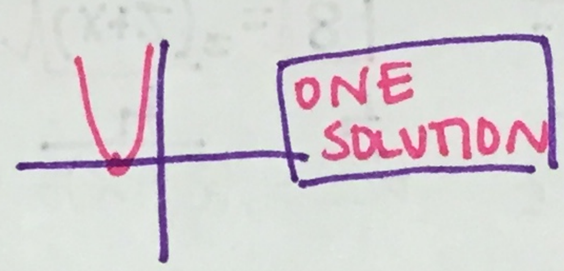
$+2x+1 \quad +2x \quad +1$

$x^2 + 2x + 1 = 0$

$a=1 \quad b=2 \quad c=1$

$(2)^2 - 4(1)(1)$

0



3. $x^2 + 2 = 2x$

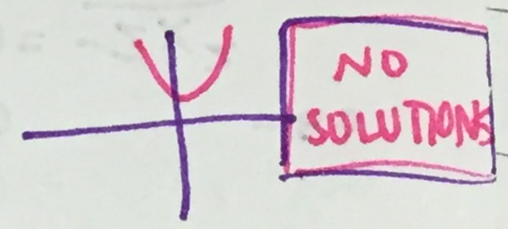
$-2x \quad -2x$

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

$a=1 \quad b=-2 \quad c=2$

$(-2)^2 - 4(1)(2)$

-4



SOLVE using Quadratic formula $y = ax^2 + bx + c$

4. $2x^2 = 7x - 3$

$2x^2 - 7x + 3 = 0$

$a = 2 \quad b = -7 \quad c = 3$

$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(3)}}{2(2)}$

$= \frac{7 \pm \sqrt{25}}{4} = \frac{7 \pm 5}{2}$ ← TWO answers

$\{6, 1\}$

5. $x^2 - 7 - 4x = 0$

$x^2 - 4x - 7 = 0$

$a = 1 \quad b = -4 \quad c = -7$

$x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(-7)}}{2(1)}$

$x = \frac{4 \pm \sqrt{44}}{2}$ ← not a perfect square... leave as square root or approximate as a decimal

$\{5.32, -1.32\}$

CAN USE CALCULATOR

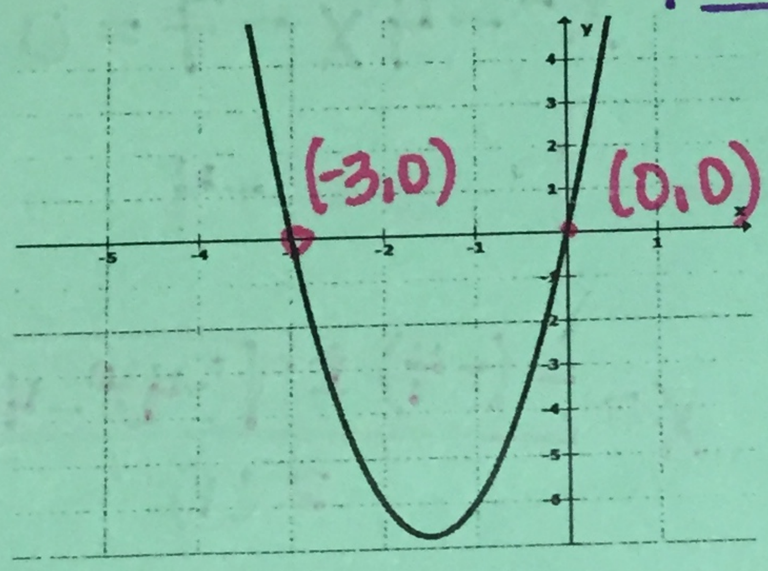
Fraction → ALPHA Y= ENTER

By Quadratic Formula

The roots, zeroes, or x-intercepts are also called the solutions of the equation.

1. Find the zeroes of the graph below.

(x-intercepts) $\{-3, 0\}$

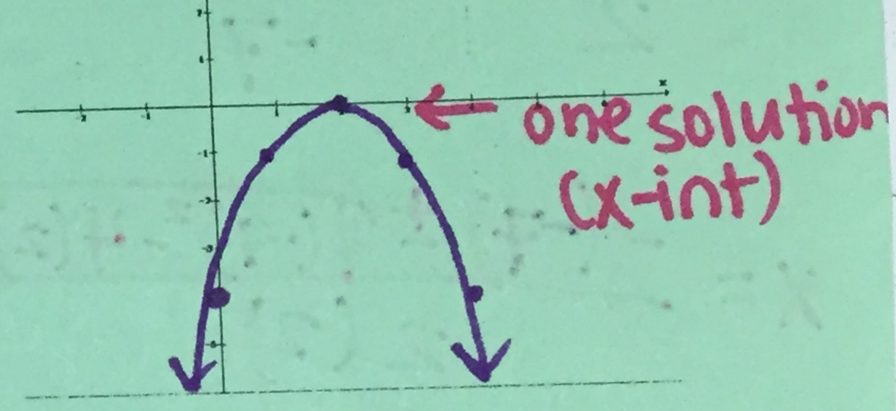


2. Sketch the graph of $-x^2 + 4x = 4$

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

What are the x & y intercept(s)? use calculator

x-int: (2,0) y-int: (0,-4)



3. Complete the table that includes the solution(s) of the quadratic equation.

$x^2 - 6x = 0$

2nd GRAPH

LOOK for Y=0

x	-1	0	1	2	5	6
y	7	0	-5	-8	-5	0

Quadratics can have ONE, TWO, or NO solutions.

Solve the following equations using your calculator.

4. $f(x)=5x^2+29x+20$ $\{-0.8, -5\}$

5. $-x^2-5=-4x$ NO solution

6. $x^2=-4$ $\{-2, 2\}$

$x^2+4=0$

By Graphing

Calculator Steps

1. Solve for y or for zero. Enter that equation into y =
2. Plug in $y_2 = 0$
3. Graph
4. Press 2nd TRACE 5: Intersect
5. Find BOTH intersections

or look for y=0 in table