Methods For Solving Quadratic Equations

1. graphing
2. factoring
3. completing the square
4. using a formula

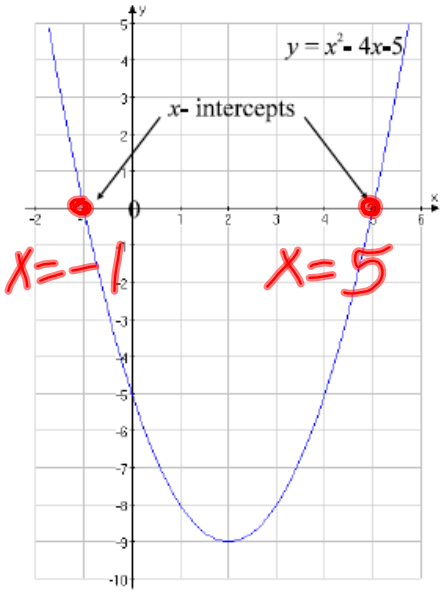
$y = x^2 - 4x - 5$

* squared means 2 answers.

Solving by Graphing

Ex. Solve the equation $x^2 - 4x - 5 = 0$.

- The graph of the corresponding function $y = x^2 - 4x - 5$ is shown at the right.
- Locate the x-intercepts on the graph and note the corresponding values of 'y'. What do you notice?
- The x-intercepts are called the "*zeros*" of the function because they result in the value of 'y' equaling 0. In other words, the *zeros* of the function are the *roots* of the corresponding equation.



Solving $ax^2 + bx + c = 0$ by Factoring

Ex. Solve: $3x^2 - 6x = 0$

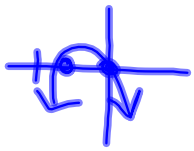
$3x(x-2)=0$

$\frac{3x}{3} = \frac{0}{3}$ | $x-2=0$

$x=0$ | $x=0+2$

$x=2$

Ex. Solve: $-10x^2 = 5x$



$-10x^2 - 5x = 0$

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

$\frac{-5x}{-5} = \frac{0}{-5}$ | $2x+1=0$

$x=0$ | $2x=-1$

$x=-\frac{1}{2}$

Solving $ax^2 + bx + c = 0$ by Factoring

Ex. Solve: $x^2 - 6x + 9 = 0$

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

$x-3=0$ $x-3=0$

$x=3$ $x=3$

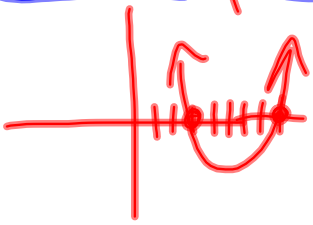
Ex. Solve: $m^2 - 11m = -24$

$m^2-11m+24=0$

$(m-8)(m-3)=0$

$m-8=0$ $m-3=0$

$m=8$ $m=3$



Ex. Solve: $2x^2 + x - 15 = 0$

$2x - 15 = -30$

multiplies -30

add $+1$

1×30
2×15
3×10
5×6

	$2x$	-5
x	$2x^2$	$-5x$
3	$6x$	-15

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

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

$x = -3$ $\quad$ $\frac{2x}{2} = \frac{5}{2}$ $\quad$ $x = 2.5$

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Product

Ex. Solve: $x^2 + 6x + 5 = 0$

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

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

$x=-1$ $\quad$ $x=-5$

Ex. Solve: $6u(u+3) = 2(u^2 - u - 10) - 5$

get rid of brackets

$6x^2 + 18x = 2x^2 - 2x - 20 - 5$

$6x^2 - 2x^2 + 18x + 2x + 20 + 5 = 0$

$4x^2 + 20x + 25 = 0$

	$2x$	5
$2x$	$4x^2$	$10x$
5	$10x$	25

mult. 100
add 20

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

$2x+5=0$

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

$x = -\frac{5}{2}$ $\quad$ $x = -\frac{5}{2}$

Ex. Use the method of completing the square to find the zeros of the quadratic function $y = 2x^2 + 4x - 6$.

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

$6 = 2x^2 + 4x$

$2 + 6 = 2(x^2 + 2x + 1)$

$1+1 \quad 1\times1$

$\frac{8}{2} = \frac{2(x+1)^2}{2}$

$\sqrt{4} = \sqrt{(x+1)^2}$

* when you take $\sqrt{}$ use $\pm$ for 2 answers

$\pm 2 = x + 1$

$2 - 1 = x$

$1 = x$

$-2 - 1 = x$

$-3 = x$

Ex. Solve: $t^2 + 2t - 5 = 0$

$x^2 + 2x + 1 = 5 + 1$

$1+1 \quad 1\times1$

$\sqrt{(x+1)^2} = \sqrt{6}$

$x + 1 = \pm 2.4$

$x + 1 = 2.4$

$x = 2.4 - 1$

$x = 1.4$

$x + 1 = -2.4$

$x = -2.4 - 1$

$x = -3.4$

Using a Formula to Solve $ax^2 + bx + c = 0$

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

Ex. Solve the equation $x^2 - 6x = 0$ using the quadratic formula.

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Exercises: Solving $ax^2 + bx + c = 0$ by Graphing and Factoring

5. Solve.

a. $x^2 + 8x = 3x + 24$
b. $5x^2 - x = 18$
c. $t^2 - 81 = 0$
d. $r(r - 9) = 2(r - 14)$
e. $p^2 - 5p = 6$
f. $2v^2 - 24v + 72 = 0$

a) $x^2+8x=3x+24$

$x^2+8x-3x-24=0$

$x^2+5x-24=0$

$(x-3)(x+8)=0$

$x-3=0$ $\quad x+8=0$

$x=3$ $\quad x=-8$

1×24
2×12
-3×8
4×6

b) $5x^2-x=18$

$5x^2-1x-18=0$

-90 $\quad 5x \quad 9$

x	$5x^2$	$9x$
-2	$-10x$	-18

$(x-2)(5x+9)=0$

$x-2=0$ $\quad 5x+9=0$

$x=2$ $\quad 5x=-9$

$x=-\frac{9}{5}$

c. $t^2 - 81 = 0$ $t=9$ $t=-9$

d. $r(r-9) = 2(r-14)$

$r^2 - 9r = 2r - 28$

$r^2 - 9r - 2r + 28 = 0$

$r^2 - 11r + 28 = 0$

$(r-7)(r-4) = 0$

$r-7=0$ $r-4=0$

$r=7$ $r=4$

e. $p^2 - 5p = 6$

f. $2v^2 - 24v + 72 = 0$

1x6
2x3

e) $p^2 - 5p - 6 = 0$

$(p-6)(p+1) = 0$

$p-6=0$ $\quad$ $p+1=0$

$p=6$ $\quad$ $p=-1$

f) $v^2 - 12v + 36 = 0$

$(v-6)(v-6) = 0$

$v=6$ $\quad$ $v=6$

bjhbrjhrb

Exercises: Solving $ax^2 + bx + c = 0$ Using the Method of Completing the Square.

1. Solve each of the following quadratic equations by the method of completing the square.

a. $x^2 - 3x - 28 = 0$
b. $x^2 - 2x = 15$
c. $x^2 - 4x - 3 = 0$
d. $x^2 + 2x - 6 = 0$
e. $14x = -72 + x^2$
f. $x^2 - x - 12 = 0$

a) $x^2 - 3x - 28 = 0$

$x^2 - 3x + 2.25 = 28 + 2.25$

$-1.5 + -1.5 \quad -1.5 \times -1.5$

$\sqrt{(x - 1.5)^2} = \sqrt{30.25}$

$x - 1.5 = \pm 5.5$

$x - 1.5 = 5.5$

$x = 5.5 + 1.5$

$x = 7$

$x - 1.5 = -5.5$

$x = -5.5 + 1.5$

$x = -4$

$14x + 72 - x^2 = 0$

$-1 \quad -1 \quad -1 \quad -1$

$x^2 - 14x - 72 = 0$

b) $x^2 - 2x = 15$

$x^2 - 2x \underset{-1+-1}{+1} = 15 \underset{-1\times-1}{+1}$

$\sqrt{(x-1)^2} = \sqrt{16}$

$x - 1 = \pm 4$

$x - 1 = 4$

$x = 4 + 1$

$x = 5$

$x - 1 = -4$

$x = -4 + 1$

$x = -3$