

6-3 Quadratic Equations

$3(0) = 0$, $a(0) = 0$, and $b(0)=0$ Knowing this, think about what $ab=0$ says about a or b.

If $ab=0$ then $a=0$ or $b=0$. Both a and b don't have to be zero, but one of them must be zero.

Think about the equation $5(x-3)=0$ 5 can't be zero, so $x-3$ must then be zero. $x-3=0$ so $x=3$.

For the equation $(x-4)(x-3)=0$, either $x-4$ is zero, or $x-3$ is zero. $x-4=0$ or $x-3=0$ so $x=4$ or 3

To solve a quadratic equation:

- 1) Get 0 on one side. Put the equation in standard form. ($ax^2 + bx + c = 0$)
- 2) Factor
- 3) Set each factor equal to zero.
- 4) Solve each smaller equation.

A **Quadratic Equation** is of the form $ax^2 + bx + c = 0$ and $a \neq 0$

Examples: $3x^2 + 5x + 8 = 0$
 $4x^2 = 8x + 7$ $3 = 5x - x^2$

Example: $x^2 = 2(x + 24)$

- 1) Get 0 on one side. Put the equation in standard form. ($ax^2 + bx + c = 0$)

$$x^2 = 2(x + 24)$$

Distribute.

$$x^2 = 2x + 48$$

Subtract $2x$ from both sides.

$$x^2 - 2x = 48$$

Subtract 48 from both sides.

$$x^2 - 2x - 48 = 0$$

- 2) Factor

$$(x-8)(x+6) = 0$$

- 3) Set each factor equal to zero.

$$x-8 = 0 \quad \text{or} \quad x+6 = 0$$

- 4) Solve each smaller equation.

$$x = 8 \quad \text{or} \quad x = -6$$

Practice: Follow the steps for these three problems.

$$x^2 + 6x = -8$$

1) Get 0 on one side.
Put the equation in standard form.
($ax^2 + bx + c = 0$)

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

$$x^2 = 1$$

2) Factor

3) Set each factor equal to zero.

4) Solve each smaller equation.

Sometimes one or more steps are already done. $(x-5)(x+5)=0$ is already factored. Start at step 4.

a) $(x - 4)(x - 7) = 0$

$(x - 8)(x - 10) = 0$

$(x - 3)(x - 1) = 0$

b) $(x + 4)(x + 7) = 0$

$(x + 8)(x + 10) = 0$

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

c) $(x + 14)(x + 25) = 0$

$(x + 11)(x + 34) = 0$

$(x + 12)(x + 7) = 0$

d) $(x - 4)(x + 1) = 0$ $(x + 8)(x - 7) = 0$ $(x + 3)(x - 8) = 0$
e) $(x - 3)(x + 7) = 0$ $(x - 5)(x + 10) = 0$ $(x + 3)(x - 2) = 0$
f) $(2x + 14)(x + 25) = 0$ $(x + 11)(2x + 34) = 0$ $(3x + 12)(x + 7) = 0$
g) $(3x - 9)(5x + 2) = 0$ $(x - 8)(7x - 10) = 0$ $(5x - 30)(2x - 10) = 0$
h) $(-x + 4)(x + 81) = 0$ $(x - 4)(2x + 10) = 0$ $(2x + 30)(8x + 16) = 0$
i) $(x + 9)(x - 9) = 0$ $(3x + 11)(x - 4) = 0$ $(x + 2)(x - 2) = 0$

Practice: This set of problems will need to be factored first.

j) $x^2 - 100 = 0$ $x^2 - 4x + 4 = 0$ $x^2 - 9 = 0$ $x^2 + 2x + 1 = 0$
k) $x^2 + 10x + 25 = 0$ $x^2 - 36 = 0$ $x^2 - 10x + 25 = 0$ $x^2 - 16 = 0$
l) $x^2 - 1 = 0$ $x^2 - 2x + 1 = 0$ $x^2 + 4x + 4 = 0$ $x^2 + 20x + 100 = 0$
m) $x^2 - 20x + 100 = 0$ $x^2 + 18x + 81 = 0$ $x^2 - 64 = 0$ $x^2 - 18x + 81 = 0$
n) $5x^2 - 500 = 0$ $8x^2 - 32x + 32 = 0$ $7x^2 - 63 = 0$ $10x^2 + 20x + 10 = 0$
o) $3x^2 + 30x + 75 = 0$ $5x^2 - 180 = 0$ $2x^2 - 20x + 50 = 0$ $3x^2 - 48 = 0$
p) $x^2 + 4x - 21 = 0$ $x^2 - 5x + 4 = 0$ $x^2 + 8x + 15 = 0$ $x^2 + 6x - 7 = 0$
q) $x^2 + 9x + 18 = 0$ $x^2 - 5x + 6 = 0$ $x^2 - 2x - 8 = 0$ $x^2 - x - 6 = 0$

Practice: Get the equation in standard form first.

r) $x^2 + 7x = -10$ $x^2 = -10x + 11$ $x^2 + 9x + 14 = 0$ $x^2 + 8x + 12 = 0$
s) $x^2 - 4x - 12 = 0$ $x^2 = -26x - 25$ $-12x + 32 = -x^2$ $x^2 - 9x + 20 = 0$
t) $5x^2 = 5(x+6)$ $8x^2 - 40x = -32$ $7x^2 + 60x = -3x - 126$ $10x^2 - 12x - 87 = 8x - 7$
u) $3x^2 = -30x - 75$ $5x^2 = 180$ $2x^2 - 20x = -50$ $3x^2 + 30x + 48 = 0$

Sometimes you must FOIL a set of binomials before getting all parts to the same side.

Example: $(x-5)(2x+3) = x(x-9)$

$2x^2 - 7x - 15 = x^2 - 9x$	Foil
$x^2 + 2x - 15 = 0$	Get zero on one side.
$(x+5)(x-3) = 0$	Factor.
$x = -5$ or $x = 3$	Set each factor to zero and solve.

Practice:

v) $(3x + 7)(2x - 1) = x + (5x - 6)(x + 2)$ $(2x - 2)(x + 4) = (x + 9)^2 - 124$
w) $3x + (x - 4)(2x + 3) = (x + 2)(x - 2) + 7$ $(2x - 5)(3x - 1) = 5x^2 - 17x + 69$

Notice there are two answers to each quadratic equation.