Essential Question: How do we solve quadratic equations?

Do Now: Solve the quadratic equation below.

$3x^2 - 48 = 0$

$3(x^2-16)=0$

$3(x-4)(x+4)=0$

$x-4=0$	$x+4=0$
$x=4$	$x=-4$

$\{-4,4\}$

Think about this...

Is there another way to solve the quadratic equation from the Do Now?

Solving Quadratic Equations by Taking Square Roots ($ax^2 + c = 0$)

1) **Isolate x^2**
2) **Take the square root of both sides of the equation**
3) **Check solution set with the original equation**

$3x^2 - 48 = 0$

$\frac{3x^2}{3} = \frac{48}{3}$

$x^2 = 16$

$\sqrt{x^2} = \pm\sqrt{16}$

$x = \pm 4$

Examples:

1) $x^2 = 64$

$\sqrt{x^2} = \pm\sqrt{64}$

$x = \pm 8$

$\{-8,8\}$

check:

$x^2 = 64$

$(-8)^2 = 64$

$64 = 64$ ✓

$x^2 = 64$

$(8)^2 = 64$

$64 = 64$ ✓

2) $x^2 - 36 = 0$

$+36 \quad +36$

$\sqrt{x^2} = \pm\sqrt{36}$

$x = \pm 6$

$\{-6,6\}$

check:

$x^2-36=0$

$(-6)^2-36=0$

$36-36=0$

$0=0$ ✓

$x^2-36=0$

$6^2-36=0$

$36-36=0$

$0=0$ ✓

3) $\frac{3x^2}{3} = \frac{300}{3}$

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

$x = \pm 10$

$\{-10,10\}$

check

$3(-10)^2=300$

$3(100)=300$

$300=300$ ✓

$3(10)^2=300$

$3(100)=300$

$300=300$ ✓

4) $2x^2 - 30 = 68$

$+30 \quad +30$

$\frac{2x^2}{2} = \frac{98}{2}$

$x^2 = 49$

$\sqrt{x^2} = \pm\sqrt{49}$

$x = \pm 7$

$\{-7,7\}$

check

$2(-7)^2-30=68$

$2(49)-30=68$

$98-30=68$

$68=68$ ✓

$2(7)^2-30=68$

$2(49)-30=68$

$98-30=68$

$68=68$ ✓

5) $x^2 + 5 = 8$

$-5 \quad -5$

$\sqrt{x^2} = \pm\sqrt{3}$

$x = \pm\sqrt{3}$

check

$x^2+5=8$

$(\sqrt{3})^2+5=8$

$\sqrt{9}+5=8$

$3+5=8$

$8=8$ ✓

$x^2+5=8$

$(-\sqrt{3})^2+5=8$

$\sqrt{9}+5=8$

$3+5=8$

6) $10x^2 - 20 = 0$

$\frac{10x^2}{10} = \frac{20}{10}$

$x^2 = 2$

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

$x = \pm\sqrt{2}$

$\{\sqrt{2},-\sqrt{2}\}$

Let's take a look at some more complex quadratic equations.

Remember, when you take the square root of a number, you must use ±

7) $(d+4)^2 = 16$

$\sqrt{(d+4)^2} = \pm\sqrt{16}$

$d+4 = \pm 4$

$d = -4 \pm 4$

$-4+4$ $\quad$ $-4-4$

0 $\quad$ -8

check:

$(0+4)^2 = 16$

$4^2 = 16$

$16 = 16$ ✓

$(-8+4)^2 = 16$

$(-4)^2 = 16$

$16 = 16$ ✓

8) $(y-5)^2 = 49$

$\sqrt{(y-5)^2} = \pm\sqrt{49}$

$y-5 = \pm 7$

$y = 5 \pm 7$

$5+7$ $\quad$ $5-7$

12 $\quad$ -2

check:

$(y-5)^2 = 49$

$(12-5)^2 = 49$

$7^2 = 49$

$49 = 49$ ✓

$(y-5)^2 = 49$

$(-2-5)^2 = 49$

$(-7)^2 = 49$

$49 = 49$ ✓

9) $3(x+1)^2 + 2 = 29$

$\quad -2 \quad -2$

$\frac{3(x+1)^2}{3} = \frac{27}{3}$

$(x+1)^2 = 9$

$\sqrt{(x+1)^2} = \pm\sqrt{9}$

$x+1 = \pm 3$

$x = -1 \pm 3$

$-1+3$ $\quad$ $-1-3$

2 $\quad$ -4

check

$3(x+1)^2+2 = 29$

$3(2+1)^2+2 = 29$

$3(3)^2+2 = 29$

$3(9)+2 = 29$

$27+2 = 29$

$29 = 29$ ✓

$3(x+1)^2+2 = 29$

$3(-4+1)^2+2 = 29$

$3(-3)^2+2 = 29$

$3(9)+2 = 29$

$27+2 = 29$

$29 = 29$ ✓

10) $\frac{4(m-9)^2}{4} = \frac{52}{4}$

$(m-9)^2 = 13$

$\sqrt{(m-9)^2} = \pm\sqrt{13}$

$m-9 = \pm\sqrt{13}$

$m = 9 \pm \sqrt{13}$

$9+\sqrt{13}$ $\quad$ $9-\sqrt{13}$

check

$4(9+\sqrt{13}-9)^2 = 52$

$4(\sqrt{13})^2 = 52$

$4(13) = 52$

$52 = 52$ ✓

$4(9-\sqrt{13}-9)^2 = 52$

$4(-\sqrt{13})^2 = 52$

$4(13) = 52$

$52 = 52$ ✓

TAKE AWAY

Quadratic Equations in the form of $ax^2 + c = 0$ can be solved by taking the square root. Quadratic equations in the form of $ax^2 + bx + c = 0$ are solved by factoring and using the zero product property.