Solving Equations by Taking Square Roots

EX: ① Simplify $\sqrt{100} = \boxed{10, -10 \text{ OR } \pm 10}$

Square rooting a number is NOT cutting it in half. You're trying to figure out what number times itself equals the number under the radical sign.

EX: ② Simplify $\sqrt{60} = \sqrt{4 \cdot 15} = \boxed{\pm 2\sqrt{15}}$

$1^2 = 1$, $2^2 = 4$, $3^2 = 9$, $4^2 = 16$, $5^2 = 25$, $6^2 = 36$, $7^2 = 49$, $8^2 = 64$

EX: ③ Solve $4x^2 - 5 = 2$

$$4x^2 - 5 + 5 = 2 + 5$$
$$4x^2 = 7$$
$$\frac{4x^2}{4} = \frac{7}{4}$$
$$x^2 = 7/4$$
$$\sqrt{x^2} = \sqrt{7/4}$$

The opposite of squaring something is square rooting it.

$$\boxed{x = \pm\frac{\sqrt{7}}{2}}$$ Answer in radical form

$$\boxed{x \approx \pm 1.32}$$ Answer in decimal form

EX: ④ Solve $3(x-5)^2 = 18$

I can't distribute the 3 because the exponent of 2 is blocking it.

$$\frac{3(x-5)^2}{3} = \frac{18}{3}$$
$$(x-5)^2 = 6$$
$$\sqrt{(x-5)^2} = \sqrt{6}$$

I can't add 5 to both sides because the exponent is blocking it.

$$x - 5 = \pm\sqrt{6}$$
$$x - 5 + 5 = \pm\sqrt{6} + 5$$

$$\boxed{x = 5 \pm \sqrt{6}}$$ Answer in radical form

$$\boxed{x \approx 7.45 \text{ and } x \approx 2.55}$$ Answer in decimal form

Lesson 22-1 Homework

1. Use the Product Property of Radicals, the Quotient Property of Radicals, or both to simplify the expression.
   $\pm\sqrt{96}$

Solve each equation. Give the answer in radical form, and then use a calculator to approximate the solution to two decimal places, if necessary.

2. $5x^2 - 21 = 39$
3. $6x^2 - 21 = 33$
4. $5 - 2x^2 = -3$
5. $7x^2 + 10 = 18$
6. $5(x - 9)^2 = 15$
7. $(x + 15)^2 = 81$
8. $3(x + 1)^2 = 27$
9. $(x - 12)^2 = 54$

Solving Equations by Completing the Square

$ax^2 + bx + c = 0$

Follow these steps to solve a quadratic equation by Completing the Square:

#1 If the a-value is a # other than 1, then divide everything by the a-value

#2 Move the c-value to the right side of the equation

#3 Take the b-value & divide it by 2, then square that answer $\left(\frac{b}{2}\right)^2$ Then add that # to both sides of the equation

This is the step where we created a factorable expression.

#4 Factor the left side of the equation. It will be a perfect-square trinomial. $(x+10)^2$

#5 Square root both sides of the equation

#6 Use inverse operations to isolate the variable

EX: ① $5x^2 + 30x - 10 = 0$

$a = 5$
$b = 30$
$c = -10$

$\div 5 \quad \div 5 \quad \div 5 \quad \div 5$

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

$+2 \quad +2$

$x^2 + 6x = 2$

$\left(\frac{6}{2}\right)^2 = (3)^2 = 9$

$+9 \quad +9$

$x^2 + 6x + 9 = 11$

$(x+3)^2 = 11$

what # times itself equals +9 & plus itself equals +6?

+3

$\sqrt{(x+3)^2} = \sqrt{11}$

$x + 3 = \pm\sqrt{11}$

$-3 \quad -3$

$\boxed{x = -3 \pm \sqrt{11}}$ Answer in radical form

$x \approx 0.32$ and $x \approx -6.32$ Answer in decimal form

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EX: ② Complete the square to form a perfect-square trinomial.

(a) $x^2 - 12x$

$\left(\frac{-12}{2}\right)^2 = (-6)^2 = 36$

$x^2 - 12x + 36$

$(x-6)^2$

what # times itself equals +36 & plus itself equals -12?

-6

(b) $x^2 + 8x$

$\left(\frac{8}{2}\right)^2 = (4)^2 = 16$

$x^2 + 8x + 16$

$(x+4)^2$

what # times itself equals +16 & plus itself equals +8?

+4

Lesson 22-2 Homework

Complete the square to form a perfect-square trinomial.

1. $x^2 + 26x$
2. $x^2 - 18x$
3. $x^2 - 2x$
4. $x^2 - 24x$

Solve each equation by completing the square.

5. $x^2 + 8x = 33$
6. $x^2 - 6x = 8$
7. $x^2 + 12x = 5$
8. $x^2 - 14x = 95$
9. $\frac{1}{2}x^2 + 4x = 10$
10. $\frac{1}{2}x^2 - 5x = 18$

Using the Quadratic Formula to Solve Equations

$ax^2+bx+c=0$

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

There once was a negative boy who couldn't decide if he wanted to go to the radical party. The boy was a square. He missed out on four awesome chicks. The party was all over at 2 AM.

Ex: ① $\underset{a}{2}x^2\underset{b}{+3}x\underset{c}{-5}=0$

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

$$x=\frac{-3\pm\sqrt{3^2-4(2)(-5)}}{2\cdot 2}$$

$$x=\frac{-3\pm\sqrt{9+40}}{4}$$

$$x=\frac{-3\pm\sqrt{49}}{4}$$

$$x=\frac{-3\pm 7}{4}$$

$$x=\frac{-3+7}{4} \qquad x=\frac{-3-7}{4}$$

$$x=\frac{4}{4} \qquad x=\frac{-10}{4}$$

$$\boxed{x=1} \qquad \boxed{x=-2.5}$$

There is a special part of the quadratic equation called the discriminant. b^2-4ac The discriminant can tell you how many answers there are to a quadratic equation.

- If b^2-4ac equals a positive #, then there are 2 answers
- If b^2-4ac equals zero, then there is 1 answer
- If b^2-4ac equals a negative #, then there are no answers

Ex: ② How many solutions does this equation have?

$\underset{a}{2}x^2\underset{b}{-6}x\underset{c}{+15}=0$

$b^2-4ac=-84$

$(-6)^2-4(2)(15)$

$36-120$

-84

$\boxed{\text{No answers}}$

Lesson 22-3 Homework

Determine how many real solutions each quadratic equation has.

1. $4x^2 + 4x + 1 = 0$
2. $x^2 - x + 3 = 0$
3. $x^2 - 8x - 9 = 0$

Solve using the quadratic formula. Leave irrational answers in radical form.

4. $10x + 4 = 6x^2$
5. $x^2 + x - 20 = 0$
6. $4x^2 = 4 - x$
7. $9x^2 + 3x - 2 = 0$
8. $14x + 3 = -8x^2$
9. $x^2 + 3x + 1 = 0$