Day 08 Solving Radical Equations Notes & HW

Name Master E

Date ______ Block 1

When you square a binomial, you get a trinomial! $(a+b)^2 = a^2+2ab+b^2$ $(a-b)^2 = a^2-2ab+b^2$

## How to Solve a Simple Radical Equation:

1. Isolate the radical.
2. Raise both sides of the equation to the power of the index.
3. Simplify.
4. Check for extraneous solutions.

**1.** $\sqrt{x} = \frac{1}{9}$

$\left(\sqrt{x} = \frac{1}{9}\right)^2$

$x = \frac{1}{81}$

✓: $\sqrt{\frac{1}{81}} = \frac{1}{9}$ ☺

**2.** $\sqrt[4]{2x} - 13 = -9$

$+13 \quad +13$

$\left(\sqrt[4]{2x} = 4\right)^4$

$2x = 256$

$x = 128$

✓: $\sqrt[4]{2(128)} - 13 = -9$

$\sqrt[4]{256} - 13 = -9$

$4 - 13 = -9$ ☺

**3.** $\sqrt{x-5} - 7 = 0$

$\left(\sqrt{x-5} = 7\right)^2$

$x - 5 = 49$

$x = 54$

✓: $\sqrt{54-5} - 7 = 0$

$\sqrt{49} - 7 = 0$

$7 - 7 = 0$ ☺

**4.** $\sqrt[3]{x+40} = -5$

$\left(\sqrt[3]{x+40} = -5\right)^3$

$x + 40 = -125$

$x = -165$

✓: $\sqrt[3]{-165+40} = -5$

$\sqrt[3]{-125} = -5$

$-5 = -5$ ☺

**5.** $2\sqrt[3]{1-3x} + 4 = 6$

$2\sqrt[3]{1-3x} = 2$

$\left(\sqrt[3]{1-3x} = 1\right)^3$

$1 - 3x = 1$

$-3x = 0$

$x = 0$

✓: $2\sqrt[3]{1-3(0)} + 4 = 6$

$2\sqrt[3]{1} + 4 = 6$

$2 + 4 = 6$ ☺

**6.** $\sqrt[4]{3x-5} - 1 = 2$

$\left(\sqrt[4]{3x-5} = 3\right)^4$

$3x - 5 = 81$

$3x = 86$

$x \approx 28.7$

✓: $\sqrt[4]{3\left(\frac{86}{3}\right) - 5} - 1 = 2$

$\sqrt[4]{86-5} - 1 = 2$

$\sqrt[4]{81} - 1 = 2$

$3 - 1 = 2$ ☺

* **7.** $(x-4)^2 = (\sqrt{2x})^2$

$x^2 - 8x + 16 = 2x$

$x^2 - 10x + 16 = 0$

$(x-8)(x-2) = 0$

$x = 8, 2$

FA: $x = 8$

✓: $8 - 4 = \sqrt{2 \cdot 8}$

$4 = \sqrt{16}$ ☺

$2 - 4 = \sqrt{2 \cdot 2}$

$-2 \neq \sqrt{4}$ NO

* **8.** $\left(\sqrt{3x+13} = x+5\right)^2$

$3x + 13 = x^2 + 10x + 25$

$0 = x^2 + 7x + 12$

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

FA: $x = -3, -4$

✓: $\sqrt{3(-3)+13} = -3+5$

$\sqrt{-9+13} = 2$

$\sqrt{4} = 2$ ☺

$\sqrt{3(-4)+13} = -4+5$

$\sqrt{-12+13} = 1$

$\sqrt{1} = 1$ ☺

## How to Solve an Equation with Rational Exponents:

1. Isolate the variable or expression that is raised to the power.
2. Raise both sides of the equation to the reciprocal power of the rational exponent.
3. Simplify.
4. Check for extraneous solutions.

**9.** $x^{\frac{1}{3}} - \frac{2}{5} = 0$

$\left(x^{\frac{1}{3}} = \frac{2}{5}\right)^3$

$x = \left(\frac{2}{5}\right)^3$

$x = \frac{8}{125}$

✓: $\left(\frac{8}{125}\right)^{\frac{1}{3}} - \frac{2}{5} = 0$

$\frac{2}{5} - \frac{2}{5} = 0$ ☺

**10.** $3(x+1)^{\frac{4}{3}} = 48$

$\left((x+1)^{\frac{4}{3}} = 16\right)^{\frac{3}{4}}$

$x + 1 = \pm 2^3$

$x + 1 = -8$

$x + 1 = 8$

$x = -9$

$x = 7$

✓: $3(-9+1)^{\frac{4}{3}} = 48$

$3(-8)^{\frac{4}{3}} = 48$

$3(16) = 48$ ☺

$3(7+1)^{\frac{4}{3}} = 48$

$3(8)^{\frac{4}{3}} = 48$

$3 \cdot 16 = 48$ ☺

**11.** $-(3x+4)^{\frac{1}{2}}+3=0$

$-(3x+4)^{\frac{1}{2}}=-3$

$\left((3x+4)^{\frac{1}{2}}=3\right)^2$

$3x+4=9$

$3x=5$

$x=\frac{5}{3}$

✓: $-(3(\frac{5}{3})+4)^{\frac{1}{2}}+3=0$

$-(5+4)^{\frac{1}{2}}+3=0$

$-(9)^{\frac{1}{2}}+3=0$

$-3+3=0$ :)

**12.** $2(x+1)^{\frac{3}{2}}=50$

$\left((x+1)^{\frac{3}{2}}=25\right)^{\frac{2}{3}}$

$x+1=8.55$

$x\approx 7.55$

✓ this w/ a graph!

## How to Solve an Equation with Two Radicals:

1. Isolate one of radical on *each side* of the equation.
2. Raise *both sides* to the power of the index.
3. Simplify and solve for the variable.
4. Check for extraneous solutions

**13.** $\left(\sqrt{x-4}=\sqrt{2x-3}\right)^2$

$x-4=2x-3$

$-4=x-3$

$-1=x$

✓: $\sqrt{-1-4}=\sqrt{2(-1)-3}$

$\sqrt{-5}=\sqrt{-5}$

imaginary

FA: ∴ No real soln.

**14.** $\left(\sqrt[4]{6x-5}=\sqrt[4]{x+10}\right)^4$

$6x-5=x+10$

$5x-5=10$

$5x=15$

$x=3$

✓: $\sqrt[4]{6(3)-5}=\sqrt[4]{3+10}$

$\sqrt[4]{18-5}=\sqrt[4]{13}$

$\sqrt[4]{13}=\sqrt[4]{13}$ :)

**15.** $\left(2\sqrt[3]{10-3x}=\sqrt[3]{2-x}\right)^3$

$8(10-3x)=2-x$

$80-24x=2-x$

$80=2+23x$

$78=23x$

$x\approx 3.39$

✓ w/ a graph

**16.** $\sqrt{x+2}-7=\sqrt{x+9}$

$(\sqrt{x+2})^2=(\sqrt{x+9}+7)^2$

$x+2=x+9+14\sqrt{x+9}+49$

$2=14\sqrt{x+9}+58$

$-56=14\sqrt{x+9}$

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

$16=x+9 \Rightarrow x=7$

$\varnothing$

✓ on graph

**17.** $\left(\sqrt[4]{6x+25}=3\sqrt[4]{x}\right)^4$

$6x+25=81x$

$25=75x$

$\frac{1}{3}=x$

✓ on graph

✓ using $\frac{1}{3}$ STO→ x

**18.** $\sqrt{x+9}-\sqrt{x}=\sqrt{3}$

$(\sqrt{x+9})^2=(\sqrt{x}+\sqrt{3})^2$

$x+9=x+2\sqrt{3x}+3$

$9=2\sqrt{3x}+3$

$6=2\sqrt{3x}$

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

$9=3x$

$3=x$

✓'d using 3→STO→x

11. $-(3x+4)^{\frac{1}{2}}+3=0$

$-(3x+4)^{\frac{1}{2}}=-3$

$((3x+4)^{\frac{1}{2}}=3)^2$

$3x+4=9$

$3x=5$

$x=\frac{5}{3}$

✓: $-(3(\frac{5}{3})+4)^{\frac{1}{2}}+3=0$

$-(5+4)^{\frac{1}{2}}+3=0$

$-(9)^{\frac{1}{2}}+3=0$

$-3+3=0$ ☺

12. $2(x+1)^{\frac{3}{2}}=50$

$((x+1)^{\frac{3}{2}}=25)^{\frac{2}{3}}$

$x+1=8.55$

$x\approx 7.55$

✓ this w/ a graph!

## How to Solve an Equation with Two Radicals:

1. Isolate one of radical on *each side* of the equation.
2. Raise *both sides* to the power of the index.
3. Simplify and solve for the variable.
4. Check for extraneous solutions

13. $(\sqrt{x-4}=\sqrt{2x-3})^2$

$x-4=2x-3$

$-4=x-3$

$-1=x$

✓: $\sqrt{-1-4}=\sqrt{2(-1)-3}$

$\sqrt{-5}=\sqrt{-5}$

imaginary

ES: ∴ No real soln.

14. $(\sqrt[4]{6x-5}=\sqrt[4]{x+10})^4$

$6x-5=x+10$

$5x-5=10$

$5x=15$

$x=3$

✓: $\sqrt[4]{6(3)-5}=\sqrt[4]{3+10}$

$\sqrt[4]{18-5}=\sqrt[4]{13}$

$\sqrt[4]{13}=\sqrt[4]{13}$ ☺

15. $(2\sqrt[3]{10-3x}=\sqrt[3]{2-x})^3$

$8(10-3x)=2-x$

$80-24x=2-x$

$80=2+23x$

$78=23x$

$x\approx 3.39$

✓ w/ a graph

16. $\sqrt{x+2}-7=\sqrt{x+9}$

$(\sqrt{x+2})^2=(\sqrt{x+9}+7)^2$

$x+2=x+9+14\sqrt{x+9}+49$

$2=14\sqrt{x+9}+58$

$-56=14\sqrt{x+9}$

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

$16=x+9 \Rightarrow x=7$

$\varnothing$

✓ on graph

17. $(\sqrt[4]{6x+25}=3\sqrt[4]{x})^4$

$6x+25=81x$

$25=75x$

$\frac{1}{3}=x$

✓ on graph

✓ using $\frac{1}{3}$ STO→ x

18. $\sqrt{x+9}-\sqrt{x}=\sqrt{3}$

$(\sqrt{x+9})^2=(\sqrt{x}+\sqrt{3})^2$

$x+9=x+2\sqrt{3x}+3$

$9=2\sqrt{3x}+3$

$6=2\sqrt{3x}$

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

$9=3x$

$3=x$

✓'d using 3→STO→x