**11.3 Solving Radical Equations** Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Explore.** Investigating Solutions of Square Root Equations

**When solving quadratic equations, you have learned that the number of real solutions depends upon the values in the equation, with different equations having 0, 1, or 2 real solutions. How many real solutions does a square root equation have? In this exploration, you will investigate graphically the numbers of real solutions for different square root equations.**

**Remember** that you can graph the two sides of an equation as separate functions to find solutions of the equation*: a solution is any \_\_\_\_ - value where the two graphs intersect.*

**A.** Given the equation $\sqrt{x-3}=2$, complete the following:

 **a.** Give the two equations that will be graphed to find the solution.

 $y\_{1}=$

 $y\_{2}=$

 **b.** Graph your equations on a graphing calculator with a window of $-4\leq x\leq 16$ and $-2\leq y\leq 8$.

 Sketch the graph below.

 **c.** How many solutions does the equation have? How do you know?

 **d.** Now, change the equation to $\sqrt{x-3}=-1$ and repeat a.-c.

|  |  |
| --- | --- |
| **Equation** | **# Solutions** |
| $$\sqrt{2x-3}=\sqrt{x}$$ |  |
| $$\sqrt{2x-3}=\sqrt{2x+3}$$ |  |

**B.** Fill out each table by graphing the equations on your calculator. Tell the number of solutions for each equation.

|  |  |
| --- | --- |
| **Equation** | **# Solutions** |
| $$\sqrt{4x-4}=x+1$$ |  |
| $$ \sqrt{4x-4}=\frac{1}{2}x$$ |  |
| $$\sqrt{4x-4}=2x-5$$ |  |

**Reflect.** For a square root equation of the form $\sqrt{bx-h}=c$, what can you conclude about the number of solutions based on the sign of c?

**Solving Square Root and** $\frac{1}{2}$**- Power Equations**

***Learning Target G:*** *I can solve square root and* $\frac{1}{2}-$ *power equations algebraically.*

A radical equation contains a variable within a radical or a variable raised to a (non-integer) rational power. To solve a square root equation, or, equivalently, an equation involving the power of $\frac{1}{2}$, you can square both sides of the equation and solve the resulting equation.

Because opposite numbers have the same square, squaring both sides of an equation may introduce an apparent solution that is not an actual solution (an extraneous solution).

**Solve each equation. Check for extraneous solutions.**

**A)** $2+\sqrt{x+10}=x$ **B)** $\left(x+6\right)^{\frac{1}{2}}-\left(2x-4\right)^{\frac{1}{2}}=0$

**C)** $\left(x+5\right)^{\frac{1}{2}}-2=1$

**D)** The graphs of each side of the equation in part A are shown on the graphing calculator screen below. How can you tell from the graph that one of the two solutions you found algebraically is extraneous?

**Solving Cube Root and** $\frac{1}{3}$ **– Power Equations**

***Learning Target H:*** *I can solve cube root and* $\frac{1}{3}-$ *power equations algebraically.*

You can solve radical equations that involved roots other than square roots by raising both sides to the index of the radical. So, to solve a cube root equation, or, equivalently, and equation involving the power $\frac{1}{3}$, you can cube both sides of the equation and solve the resulting equation.

**Solve each equation.**

**A)** $\sqrt[3]{x+2}+7=5$ **B)** $\sqrt[3]{x-5}=x+1$

**C)** $2\left(x-50\right)^{\frac{1}{3}}=-10$

**Reflect.** Can a cube root equation have an extraneous solution?

**Solving a Real-World Problem**

***Learning Target I:*** *I can solve a real-world problem modeled by a radical function.*

**A)** **Driving.** The speed *s* in miles per hour that a car is traveling when it goes into a skid can be estimated by using the formula $s=\sqrt{30fd}$, where *f* is the coefficient of friction and *d* is the length of the skid marks in feet.

After an accident a driver claims to have been traveling the speed limit of 55 mi/h. The coefficient of friction under the conditions at the time of the accident was about 0.6, and the length of the skid marks is 190 ft. Is the driver telling the truth about the car’s speed? Explain.

**B)** Construction. The diameter *d* in inches of a rope needed to lift a weight of *w* tons is given by the formula $d=\frac{\sqrt{15w}}{π}$. How much weight can be lifted with a rope with diameter of 1.0 inch?