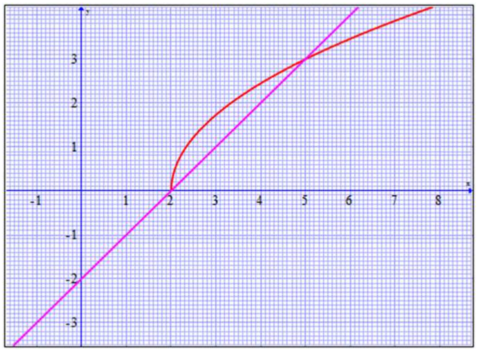
2.3 Solving Radical Equations



Focus On ...

• relating the roots of radical equations and the x-intercepts of the graphs of radical functions

• determining approximate solutions of radical equations graphically

Finding Solution

- You can solve many types of equations algebraically and graphically.
- Algebraic solutions can produce , graphical solutions do not
- Algebraic solutions are generally exact, but graphical solutions are often approximate.

You can solve equations graphically by identifying the x intercepts of the graph of the corresponding function.

Example 1

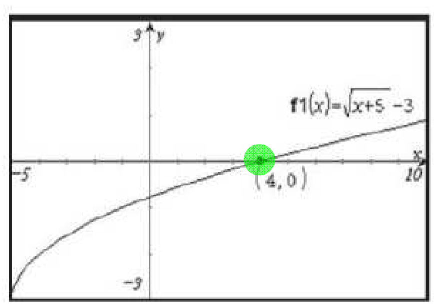
Relate Roots and *x*-Intercepts

a) Determine the root(s) of $\sqrt{x+5} - 3 = 0$ algebraically.

b) Using a graph, determine the x-intercept(s) of the graph of $y = \sqrt{x+5} - 3$.

c) Describe the connection between the root(s) of the equation and the x-intercept(s) of the graph of the function.

Graph



$\sqrt{x+5} - 3 = 0$

$y_1 = \sqrt{x+5} - 3$ $\quad$ $y_2 = 0$

Example 2

Solve a Radical Equation Involving an Extraneous Solution

Solve the equation $\sqrt{x + 5} = x + 3$ algebraically and graphically.

$1 \quad -1$

$\sqrt{x+5} = x+3$

$2 = 2$

$x+5 = x^2+6x+9$

$0 = x^2+5x+4$

$0 = (x+4)(x+1)$

Extraneous

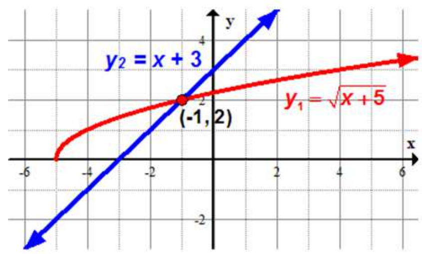
$x+4=0$ $\qquad$ $x+1=0$ ✓

$x=-4$ $\qquad$ $x=-1$

Graphically

$\underbrace{\sqrt{x+5}}_{y=\sqrt{x+5}} = \underbrace{x+3}_{y=x+3}$

Graph Solution

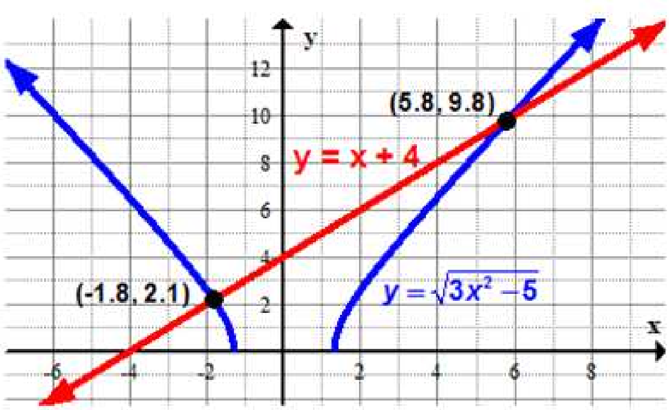


Example 3

Approximate Solutions to Radical Equations

a) Solve the equation $\sqrt{3x^2 - 5} = x + 4$ graphically. Express your answer to the nearest tenth.

b) Verify your solution algebraically.



$\sqrt{3(5.8)^2-5} = 5.8+4$

$9.79 = 9.8$

$\sqrt{3(-1.8)^2-5} = -1.8+4$

$2.17 = 2.2$

Example 4

Solve a Problem Involving a Radical Equation

An engineer designs a roller coaster that involves a vertical drop section just below the top of the ride. She uses the equation $v = \sqrt{(v_0)^2 + 2ad}$ to model the velocity, v, in feet per second, of the ride's cars after dropping a distance, d, in feet, with an initial velocity, v_0, in feet per second, at the top of the drop, and constant acceleration, a, in feet per second squared. The design specifies that the speed of the ride's cars be ...m of the vertical drop section. If the initial velocity of the coaster at the top of the drop is ... nd the only acceleration is due to gravity ..., what vertical drop distance should be used, to the nearest foot?

$$V=\sqrt{V_0^2+2ad}$$

120 10 32 ?

Solve for 'd'

$$V^2=V_0^2+2ad$$

$$V^2-V_0^2=2ad$$

$$\frac{V^2-V_0^2}{2a}=d$$

Solution

Substitute the known values into the formula. Then, graph the functions that correspond to both sides of the equation and determine the point of intersection.

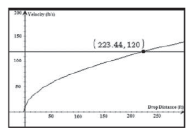
$$v = \sqrt{(v_0)^2 + 2ad}$$

$$120 = \sqrt{(10)^2 + 2(32)d}$$

$$120 = \sqrt{100 + 64d}$$

What two functions do you need to graph?

The intersection point indicates that the drop distance should be approximately 223 ft to result in a velocity of 120 ft/s at the bottom of the drop.



ASSIGNMENT

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 # Level 2

 # Level 3

 # Level 4

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