LEARNING OBJECTIVE: We will find positive solutions for equations involving square roots and cube roots. (G8M7L5)

ACTIVATING PRIOR KNOWLEDGE:
We can solve linear equations (solve for $x$)

<table>
<thead>
<tr>
<th>$-2(5x - 3) = x + 28$</th>
<th>$27x - 15 = 6x - 78$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-10x + 6 = x + 28$</td>
<td>$-6x + 6x$</td>
</tr>
<tr>
<td>$-x$</td>
<td>$21x - 15 = -78$</td>
</tr>
<tr>
<td>$-11x + 6 = 28$</td>
<td>$+15 +15$</td>
</tr>
<tr>
<td>$-6$</td>
<td>$21x = -63$</td>
</tr>
<tr>
<td>$11x = 22$</td>
<td>$\frac{-63}{21}$</td>
</tr>
<tr>
<td>$x = -2$</td>
<td>$x = -3$</td>
</tr>
</tbody>
</table>

CONCEPT DEVELOPMENT:
Solving non-linear equations has some of the same elements...our goal remains the same in solving equations:

Solve for the variable
Find “$x$”

We can simplify the expressions until we have the form of $x^2 = p$ or $x^3 = p$ and then take the square root or cube root of both sides of the equation to solve for $x$.

Example:

$x^3 + 9x = \frac{1}{2}(18x + 54)$

$x^3 + 9x = 9x + 27$

$\sqrt[3]{x^3 + 9x} = \sqrt[3]{27}$

$x = 3$
**Guided Practice:**

**Steps to Solving Equations Involving Square Roots and Cube Roots**

1. Use the properties of equality to transform the equation to the form of $x^2 = p$ or $x^3 = p$.
2. Solve for $x$ by taking the square root (or cube root) of both sides of the equation.
3. Check your work by substituting the positive solution for your unknown value into the exercise.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>$x^2 + 4x = 4(x + 16)$</td>
<td>$x = 8$</td>
</tr>
<tr>
<td>$x^2 - 14 = 5x + 67 - 5x$</td>
<td>$x = \pm 9$</td>
</tr>
<tr>
<td>$x(x + 4) - 3 = 2(2x + 39)$</td>
<td>$x = 9$</td>
</tr>
<tr>
<td>$x(x - 1) = 121 - x$</td>
<td>$x = 11$</td>
</tr>
</tbody>
</table>
A square yard has a side length $2x - 1$ and an area of 121 square yards. What is the value of $x$?

$ \sqrt{(2x-1)^2} = \sqrt{121}$

$2x - 1 = 11$

$2x = 12$

$x = 6$

A square has a side length of $3x$ and an area of 324 square inches. What is the value of $x$?

$\sqrt{(3x)^2} = \sqrt{324}$

$x = 18$

$\frac{3x}{3} = 10$

$x = 10$

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

$x = 10$

$(4x)^3 = 1,728$

$\sqrt[3]{(4x)^3} = \sqrt[3]{1,728}$

$4x = 12$

$x = 3$

$-3x^3 + 14 = -67$

$\frac{-3x^3}{-3} = \frac{-67}{-3}$

$x^3 = 27$

$x = 3$
### Solving Equations Involving Square Roots and Cube Roots

<table>
<thead>
<tr>
<th>Equation 1</th>
<th>Equation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(x(2x^2 - 5) + 3x = -2x + 1024)</td>
<td>(216 + x = x(x^2 - 5) + 6x)</td>
</tr>
<tr>
<td>(2x^3 - 5x + 3x = -2x + 1024)</td>
<td></td>
</tr>
<tr>
<td>(2x^3 - 2x = -2x + 1024)</td>
<td></td>
</tr>
<tr>
<td>(\frac{2}{3}x^3 = \frac{1024}{2})</td>
<td></td>
</tr>
<tr>
<td>(\frac{2}{3}x^3 = 512)</td>
<td></td>
</tr>
<tr>
<td>(x = 8)</td>
<td></td>
</tr>
</tbody>
</table>

\[
(6\sqrt{2x})^2 - 2x = \frac{1}{2} (144 - 4x) \\
(6\sqrt{2x})^2 - 2x = 72 - 2x \\
36(2x)^2 - 2x = 72 - 2x \\
72x - 4x^2 = 72 - 2x + 2x \\
4x = 40 \\
\boxed{x = 10}
\]

\[
(2\sqrt{x})^2 - 6x - 29 = 9 - 6x + 29 \\
4x - 6x - 2 = -6x + 38 \\
-2x - 2 = -6x + 38 \\
\boxed{x = 10}
\]
**INDEPENDENT PRACTICE:**
No ind Prac. Can give out homework

**CLOSURE:**
Solve for $x$:

\[
\frac{1}{2}(2x^2 + 10) = 30
\]

**NOTES:**
Aligns to lesson 5 grade 8 module 7. Homework should be problem set from lesson 5.