

Section 1.3

Solving Equations in One Variable Using a Graphing Utility

Objective

1. Solve equations in one variable algebraically and verify results using a graphing calculator and the Zero or Intersect feature.
2. Use a graphing calculator to approximate solutions to equations that cannot be solved algebraically by using the Zero or Intersect feature on the graphing calculator.

Using the Zero Feature of the Calculator

Step 1: Write the equation in the form {expression in x } = 0.

Step 2: Graph $Y_1 =$ {expression in x }.

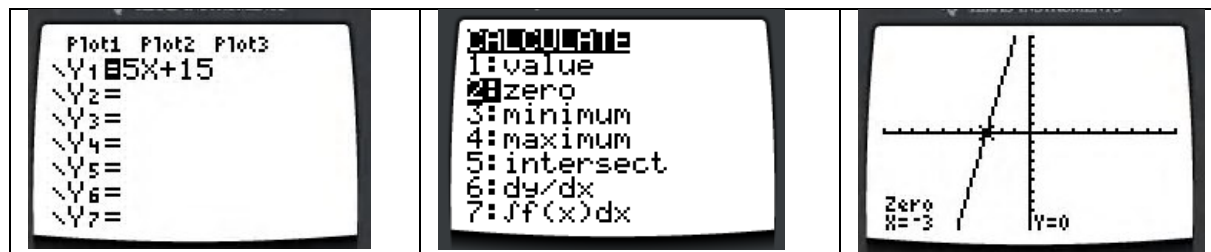
Step 3: Use ZERO to determine the x -intercept of the graph.

Example: Solve $5x + 15 = 0$ algebraically. Verify solutions using the graphing calculator.

$$5x + 15 = 0$$

$$\frac{5x}{5} = \frac{-15}{5}$$

$$x = -3$$



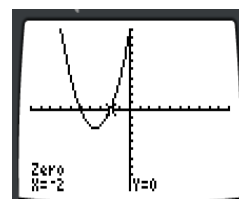
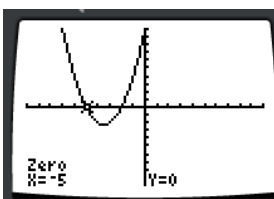
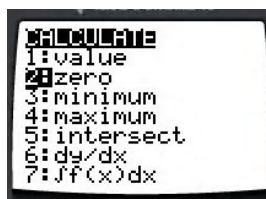
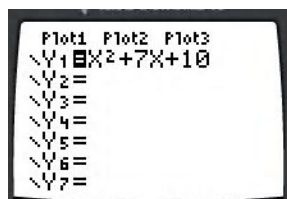
Example: Solve $x^2 + 7x + 10 = 0$ algebraically. Verify solutions using the graphing calculator.

$$x^2 + 7x + 10 = 0$$

$$(x+2)(x+5) = 0$$

$$x+2 = 0 \quad \text{or} \quad x+5 = 0$$

$$x = -2 \quad \text{or} \quad x = -5$$



Example: Solve $2x - 1 = 3(2 - x)$ algebraically. Verify solutions using the graphing calculator.

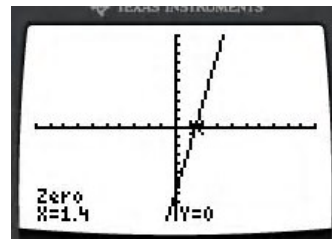
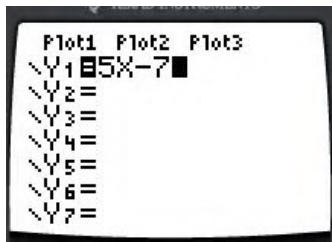
$$2x - 1 = 3(2 - x)$$

$$\begin{array}{r} 2x - 1 = 6 - 3x \\ +3x \qquad +3x \end{array}$$

$$\begin{array}{r} 5x - 1 = 6 \\ +1 \qquad +1 \end{array}$$

$$\frac{5x}{5} = \frac{7}{5}$$

$$x = \frac{7}{5} = 1.4$$



Example: Solve $x^3 + 2x^2 = 9x + 18$ algebraically. Verify solutions using the graphing calculator.

$$x^3 + 2x^2 = 9x + 18$$

Bring everything to the left.

$$x^3 + 2x^2 - 9x - 18 = 0$$

Factor by grouping.

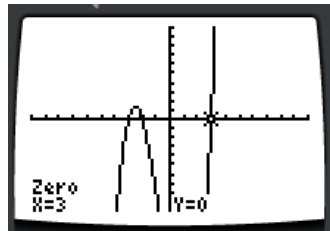
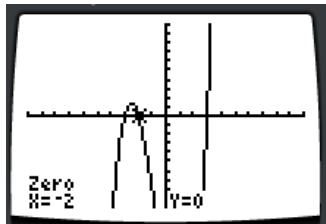
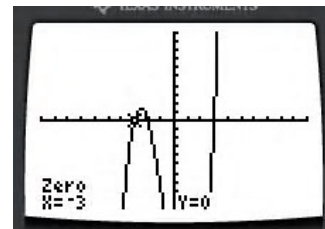
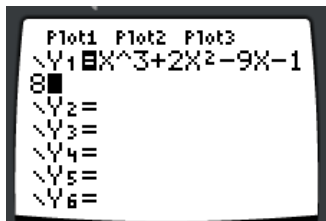
$$x^2(x+2) - 9(x+2) = 0$$

$$(x+2)(x^2-9) = 0$$

$$(x+2)(x+3)(x-3) = 0$$

$$x+2=0 \quad \text{or} \quad x+3=0 \quad \text{or} \quad x-3=0$$

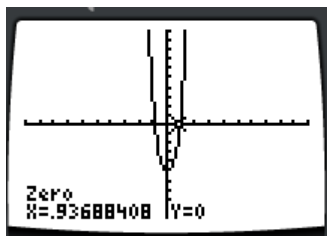
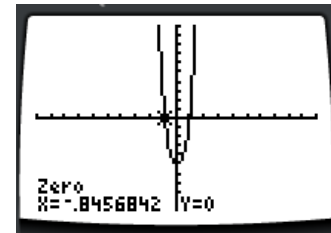
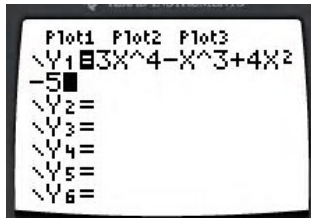
$$x=-2 \quad \text{or} \quad x=-3 \quad \text{or} \quad x=3$$



Sometimes it is not possible to factor an expression, so you have to approximate solutions.

Example: Solve $3x^4 - x^3 + 4x^2 - 5 = 0$.

You could try to factor by grouping, but it won't work.



Solutions: $.937$ and $-.846$

Using the Intersect Feature of the Calculator

Step 1: Graph $Y_1 = \{\text{expression on left side of the equation}\}$

$Y_2 = \{\text{expression on right side of the equation}\}$

Step 2: Use INTERSECT to determine the x-coordinate of each point of intersection.

Example: Solve $3x(2 - x) = 2x - 1$ algebraically and verify solutions using the intersect feature.

$$3x(2 - x) = 2x - 1$$

$$6x - 3x^2 = 2x - 1$$

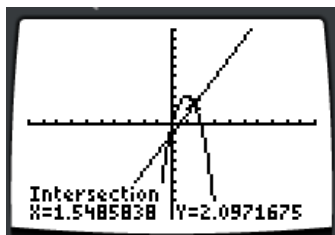
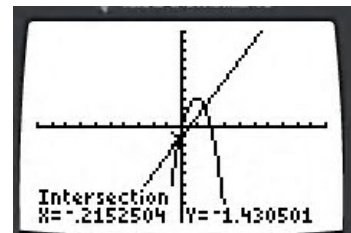
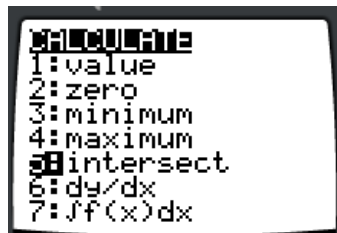
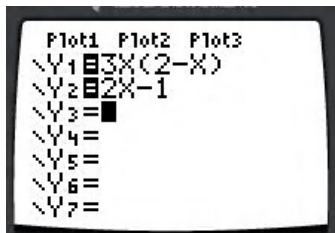
$$0 = 3x^2 - 4x - 1$$

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

$$x = \frac{4 \pm \sqrt{16 + 12}}{6} = \frac{4 \pm \sqrt{28}}{6} = 1.549 \text{ and } -0.215$$

Bring everything to the right

Not factorable. Use the quadratic formula.



Example: Solve $\sqrt{x+1} = 2$ algebraically and verify results using the intersect feature.

$$\sqrt{x+1} = 2 \quad \downarrow \text{square both sides}$$

$$x+1 = 4$$

$$-1 \quad -1$$

$$x = 3$$

