

4. The Graphing Calculator

Use the rational root theorem to list the possible roots & determine the actual roots.

1. $y = 2x^3 - 3x^2 - 2x + 2$

$\frac{p}{q} = \frac{\pm 1, \pm 2}{\pm 1, \pm 2}$
 $\frac{1}{1}, \frac{2}{1}, \frac{-1}{1}, \frac{-2}{1}, \frac{1}{2}, \frac{2}{2}, \frac{-1}{2}, \frac{-2}{2}$

Use Synthetic Division
 $(2x^3 - 3x^2 - 2x + 2) \div (x - 2) = 2x^2 + x - 1$
 $(2x^2 + x - 1) \div (x + 1) = 2x - 1$
 $(2x - 1) \div (x - \frac{1}{2}) = 2$
 Roots: $x = 2, -1, \frac{1}{2}$

Graphing calculator directions:
 1. Press Y=
 2. Enter the equation
 3. Press ZOOM then 6 for ZOOM-ZSTD
 4. Press WINDOW to set the viewing window
 5. Press GRAPH to see the graph

2. $y = 3x^3 + 2x^2 - 5x + 2$

$\frac{p}{q} = \frac{\pm 1, \pm 2}{\pm 1, \pm 2, \pm 3}$
 $\frac{1}{1}, \frac{2}{1}, \frac{-1}{1}, \frac{-2}{1}, \frac{1}{2}, \frac{2}{2}, \frac{-1}{2}, \frac{-2}{2}, \frac{1}{3}, \frac{2}{3}, \frac{-1}{3}, \frac{-2}{3}$

Use Synthetic Division
 $(3x^3 + 2x^2 - 5x + 2) \div (x - 1) = 3x^2 + 5x - 2$
 $(3x^2 + 5x - 2) \div (x + 2) = 3x - 1$
 $(3x - 1) \div (x - \frac{1}{3}) = 3$
 Roots: $x = 1, -2, \frac{1}{3}$

Graphing calculator directions:
 1. Press Y=
 2. Enter the equation
 3. Press ZOOM then 6 for ZOOM-ZSTD
 4. Press WINDOW to set the viewing window
 5. Press GRAPH to see the graph

3. $y = x^3 - 2x^2 + 3x - 6$

$\frac{p}{q} = \frac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1}$
 $\pm 1, \pm 2, \pm 3, \pm 6$

Use Synthetic Division
 $(x^3 - 2x^2 + 3x - 6) \div (x - 3) = x^2 + x - 2$
 $(x^2 + x - 2) \div (x + 2) = x - 1$
 $(x - 1) \div (x - 1) = 1$
 Roots: $x = 3, -2, 1$

Graphing calculator directions:
 1. Press Y=
 2. Enter the equation
 3. Press ZOOM then 6 for ZOOM-ZSTD
 4. Press WINDOW to set the viewing window
 5. Press GRAPH to see the graph

4. $y = 2x^3 + 3x^2 + 5x + 2$

$\frac{p}{q} = \frac{\pm 1, \pm 2}{\pm 1, \pm 2}$
 $\frac{1}{1}, \frac{2}{1}, \frac{-1}{1}, \frac{-2}{1}, \frac{1}{2}, \frac{2}{2}, \frac{-1}{2}, \frac{-2}{2}$

Use Synthetic Division
 $(2x^3 + 3x^2 + 5x + 2) \div (x + 2) = 2x^2 - x + 1$
 $(2x^2 - x + 1) \div (x + 1) = 2x - 2$
 $(2x - 2) \div (x - 1) = 2$
 Roots: $x = -2, 1, 1$

Graphing calculator directions:
 1. Press Y=
 2. Enter the equation
 3. Press ZOOM then 6 for ZOOM-ZSTD
 4. Press WINDOW to set the viewing window
 5. Press GRAPH to see the graph

What if none of the roots are rational?

$y = x^3 - 3x^2 + 25x - 24 = 0$
 $\frac{p}{q} = \frac{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24}{\pm 1}$



Graphing Calculator Directions

1. Graph the function
2. Press the calc key ($\text{2ND} \rightarrow \text{7}$)
3. Choose zero
4. Move the cursor to the left of the zero
5. Move the cursor to the right of the zero
6. Repeat with other
7. The root will be at the bottom of the screen