Graphing Polynomials and Tracing to Find the Roots

A polynomial $y = f(x)$ is an expression of the sums of several terms that contain different powers of the same originals. The roots are found at the intersection of the x-axis and the graph, i. e. when $y = 0$.

Example

Draw a graph of a polynomial and approximate the roots by using the Zoom-in and Trace features.

1. Graph the polynomial $y = x^3 - 3x^2 + x + 1$.
2. Approximate the left-hand root.
3. Approximate the middle root.
4. Approximate the right-hand root.

Before Starting There may be differences in the results of calculations and graph plotting depending on the setting. Return all settings to the default value and delete all data.

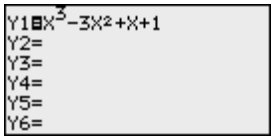
Set the zoom to the decimal window: [ZOOM] [A] ([ENTER] [ALPHA] [▼]) [7]

Setting the zoom factors to 5 : [ZOOM] [B] [ENTER] [5] [ENTER] [5] [ENTER] [2nd F] [QUIT]

Step & Key Operation	Display	Notes

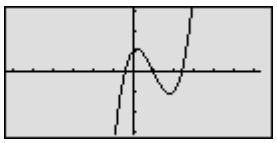
1-1 Enter the polynomial $y = x^3 - 3x^2 + x + 1$.

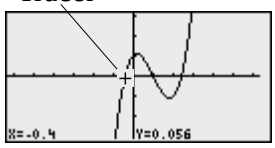
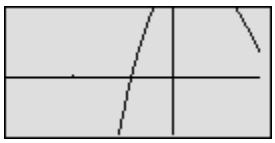
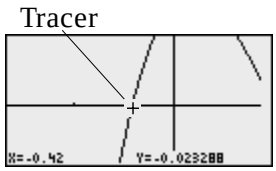
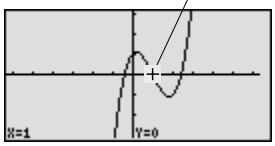
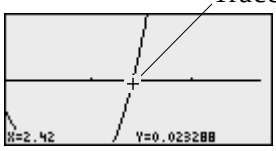
[Y=] [X/θ/T/n] [a^b] [3] [▶] [—] [3]
[X/θ/T/n] [X^2] [+] [X/θ/T/n] [+] [1]



1-2 View the graph.

[GRAPH]



Step & Key Operation	Display	Notes
2-1 Move the tracer near the left-hand root. TRACE ◀ (repeatedly)	Tracer 	Note that the tracer is flashing on the curve and the x and y coordinates are shown at the bottom of the screen.
2-2 Zoom in on the left-hand root. ZOOM A 3		
2-3 Move the tracer to approximate the root. TRACE ◀ or ▶ (repeatedly)	Tracer 	The root is : $x \fallingdotseq -0.42$
3-1 Return to the previous decimal viewing window. ZOOM H 2		
3-2 Move the tracer to approximate the middle root. TRACE ▶ (repeatedly)	Tracer 	The root is exactly $x = 1$. (Zooming is not needed to find a better approximate.)
4 Move the tracer near the right-hand root. Zoom in and move the tracer to find a better approximate. ▶ (repeatedly) ZOOM A 3 TRACE ▶ or ◀ (repeatedly)	Tracer 	The root is : $x \fallingdotseq 2.42$

The calculator allows the roots to be found (or approximated) visually by graphing a polynomial and using the Zoom-in and Trace features.