

Polynomials – 2

This week we continue exploring polynomial functions. From asymptotes, lines approaching but never reaching a curve, to complex numbers with imaginary parts, we will take a look at the strange world of functions.

This file includes eActivities on:

Asymptote - Charging off in so many directions, how do we know where to find them?

Complex Number - Where all real numbers originate.

Function in Complex - What does the complex function look like when graphed?

Quadratic Formula - Our old friend, the quadratic formula.

Asymptote

Ever approaching but never reaching.

Asymptote
End Behavior of Asymptotes

<Example-1>

$$f(x) = \frac{x^2+3}{x^2+1}$$

$$= \frac{x^2+1+2}{x^2+1}$$

$$= \frac{2}{x^2+1} + 1$$

$$\lim_{x \rightarrow \pm\infty} \left(\frac{x^2+3}{x^2+1} \right) = 1$$

Calculator
Graph
y=1 is the asymptote.

<Example-2>

$$f(x) = \frac{x^3+3}{x^2-1}$$

$$\lim_{x \rightarrow \infty} \left(\frac{x^3+3}{x^2-1} \right)$$

$$\lim_{x \rightarrow -\infty} \left(\frac{x^3+3}{x^2-1} \right)$$

$$f(x) = \frac{x^3+3}{x^2-1}$$

$$= x + \frac{x+3}{x^2-1}$$

$$\lim_{x \rightarrow \pm\infty} \left(\frac{x+3}{x^2-1} \right) = 0$$

Complex Number

Step by step examples of calculating complex numbers.

Complex Number

Calculation

$$(2+3i)(3-i)$$

$$= 6-2i+9i-3i^2$$

$$= 6-2i+9i+3$$

$$= 9+7i$$

 When $z=2+3i$,

$$z^2 = (2+3i)^2$$

$$= -5+12i$$

Conjugate \bar{z}
 When $z=a+bi$, $\bar{z}=a-bi$.

$$(2+3i)(3-i) = 9+7i$$

$$(2+3i)^2 = -5+12i$$

Conjugate \bar{z}
 When $z=a+bi$, $\bar{z}=a-bi$.

Standard Form $a+bi$
 When $z = \frac{2}{1-i}$,

$$z = \frac{2}{1-i}$$

$$= \frac{2}{1-i} \times \frac{1+i}{1+i}$$

$$= \frac{2+2i}{1+1}$$

$$= 1+i$$
 Then $\bar{z}=1-i$

Function in Complex

Factor and graph complex functions.

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Function in Complex

<Example>
 $f(x) = x^2 + 1$
 $= (x+i) \cdot (x-i)$

Graph

Calculator

$f(x) = x^3 - x^2 + 2 \cdot x - 2$
 $= (x + \sqrt{2} \cdot i) \cdot (x - \sqrt{2} \cdot i) \cdot (x - 1)$

Graph

Calculator

Alg Standard Cplx Rad

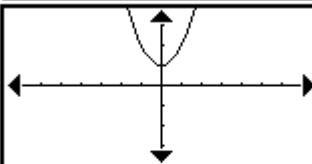
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Function in Complex

<Example>
 $f(x) = x^2 + 1$
 $= (x+i) \cdot (x-i)$

Graph

Calculator



Rad Cplx

File Edit Insert Action

Calculator

$f(x) = x^3 - x^2 + 2 \cdot x - 2$
 $= (x + \sqrt{2} \cdot i) \cdot (x - \sqrt{2} \cdot i) \cdot (x - 1)$

Graph

Calculator

factor($x^3 - x^2 + 2 \cdot x - 2$)
 $(x^2 + 2) \cdot (x - 1)$
rFactor($x^3 - x^2 + 2 \cdot x - 2$)
 $(x + \sqrt{2} \cdot i) \cdot (x - \sqrt{2} \cdot i) \cdot (x - 1)$

Alg Standard Cplx Rad

Quadratic Formula in Complex

Solve the equation with imaginary results.

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Quadratic Formula in Complex

<Example>
Solve $x^2 + x + 1 = 0$

Quadratic Formula

$$= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-1 \pm \sqrt{1^2 - 4 \times 1 \times 1}}{2 \times 1}$$

$$= \frac{-1 \pm \sqrt{-3}}{2}$$

$$= \frac{-1 \pm \sqrt{3} \cdot i}{2}$$

Alg Standard Cplx Rad

File Edit Insert Action

Quadratic Formula

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Calculator

Try your own!

Calculator

Alg Standard Cplx Rad

Edit Action Interactive

$$\frac{-1 + \sqrt{1^2 - 4 \times 1 \times 1}}{2 \times 1}$$

$$\frac{-(1 - \sqrt{3} \cdot i)}{2}$$

$$\frac{-1 - \sqrt{1^2 - 4 \times 1 \times 1}}{2 \times 1}$$

$$\frac{-(1 + \sqrt{3} \cdot i)}{2}$$

Alg Standard Cplx Rad