2.5 Complex Zeros

Objectives: 1) I can find complex zeros of a polynomial.

2) Given the complex factors or zeros, I can write a polynomial is standard form.

3) I can determine how many complex, real, and total zeros of a polynomial.

Oct 28-11:05 AM

Complex Numbers $a \pm bi$

$a + bi$ $a - bi$

Solve.

$x^2 + 8 = -1$

$\sqrt{x^2}\sqrt{-9}$

$x = 3i, -3i$

$a + bi$

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

$-1 + 2i$

$-1 - 2i$

$x^2 + 2x + 4 = 0$

$x^2 + 2x = -4$

$x^2 + 2x + 1 = -4 + 1$

$\sqrt{(x+1)^2}\sqrt{-3}$

$x + 1 = \pm\sqrt{3}\, i$

$x = -1 \pm \sqrt{3}\, i$

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Write the polynomials in standard form.

$f(x) = (x - 2i)(x + 2i)$

$= x^2 + \cancel{2ix} - \cancel{2ix} - 4i^2$

$\boxed{f(x) = x^2 + 4}$

$f(x) = (x - 5)(x - i\sqrt{2})(x + i\sqrt{2})$

$x^2 + \cancel{i\sqrt{2}x} - \cancel{i\sqrt{2}x} - 2i^2$

$(x - 5)(x^2 + 2)$

$x^3 + 2x - 5x^2 - 10$

$f(x) = x^3 - 5x^2 + 2x - 10$

$f(x) = (x - 3)(x - 3)(x - i)(x + i)$

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Write the polynomials of minimum degree from the given zeros. $x = 1, x = 1, \boxed{x = 1 + 2i}, x = 1 - 2i$

$x = 1$

$x - 1 = 0$

$f(x) = (x-1)^2(x - 1 - 2i)(x - 1 + 2i)$

$x = 1 + 2i$

$(x - 1 - 2i)$

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Write the polynomial of minimum degree from the zeros and multiplicities given:

$x=-1$
$x+1=0$

-1 (with multiplicity 3) and 3 (with multiplicity 1)

$f(x)=(x+1)^3(x-3)$

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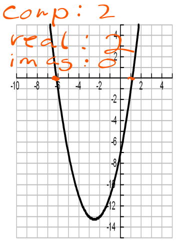
How many real zeros and how many imaginary ~~complex~~ zeros are there in each function?

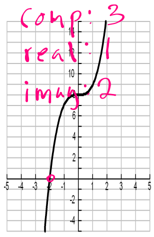
x^2+5x-7

comp: 2
real: 2
imag: 0



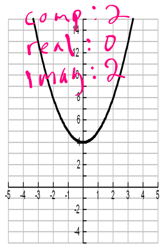
x^3+8

comp: 3
real: 1
imag: 2



x^2+4

comp: 2
real: 0
imag: 2



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Finding complex zeros

$f(x)=x^5-3x^4-5x^3+5x^2-6x+8$

$x=-2,1,4,i,-i$

1st) Rational Roots Theorem or Calculator

$x=\pm\frac{1,2,4,8}{1}=\pm 1,2,4,8$

$$\begin{array}{r|rrrrrr} 1 & 1 & -3 & -5 & 5 & -6 & 8 \\ & & 1 & -2 & -7 & -2 & -8 \\ \hline & 1 & -2 & -7 & -2 & -8 & \boxed{0} \end{array}$$

$x^4-2x^3-7x^2-2x-8$

$$\begin{array}{r|rrrrr} -2 & 1 & -2 & -7 & -2 & -8 \\ & & -2 & 8 & -2 & 8 \\ \hline & 1 & -4 & 1 & -4 & \boxed{0} \end{array}$$

x^3-4x^2+x-4

$$\begin{array}{r|rrrr} 4 & 1 & -4 & 1 & -4 \\ & & 4 & 0 & 4 \\ \hline & 1 & 0 & 1 & \boxed{0} \end{array}$$

$x^2+1=0$

$x^2=-1$

$x=i,-i$

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Given the complex zero $1-2i$, $1+2i$

of the function $f(x)=4x^4+17x^2+14x+65$.

Find the remaining zeros.

$x=1-2i \qquad x=1+2i$

$(x-1+2i)(x-1-2i)$

$x^2-x-\cancel{2ix}-x+1+\cancel{2i}+\cancel{2ix}-\cancel{2i}-4i^2$

x^2-2x+5

$$\begin{array}{r|l} & 4x^2+8x+13 \\ x^2-2x+5 & 4x^4+0x^3+17x^2+14x+65 \\ - & 4x^4-8x^3+20x^2 \\ \hline & 8x^3-3x^2+14x+65 \\ - & 8x^3-16x^2+40x \\ \hline & 13x^2-26x+65 \\ & 13x^2-26x+65 \\ \hline \end{array}$$

a b c
$4x^2+8x+13$

$x=\frac{-8\pm\sqrt{8^2-4(4)(13)}}{2(4)}$

64 -208

$=\frac{-8\pm 12i}{8}$

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

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Linear Factorization

$$f(x) = 2x^3 - 6x^2 + 4x$$

$$2x(x-1)(x-2)$$

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