Lesson 36 Objective: SWBAT write the polynomial function given the roots.

Kickoff

Find the zeros of the polynomial function and list the linear factors.

f(x) = $x^5 - 7x^3 + 12x$

$x(x^4 - 7x^2 + 12)$

$x^4 - 3x^2 - 4x^2 + 12$

$x^2(x^2 - 3) - 4(x^2 - 3)$

$x^2 - 3 = 0 \quad x^2 - 4 = 0$

$+3 \quad +3 \quad +4 \quad +4$

$\sqrt{x^2} = \pm\sqrt{3} \quad x = \pm 2$

Linear factors $(x)(x-\sqrt{3})(x+\sqrt{3})(x-2)(x+2)$

Zeros $\{+\sqrt{3}, -\sqrt{3}, -2, 2, 0\}$

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(19) $\{-3, 3, -3i, 3i\}$

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

(23) $\{-5, 4+3i, 4-3i\}$

$(x+5)(x-4-3i)(x-4+3i)$

(27) $\{i, -i, 3i, -3i\}$

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

(40) $\{4, 4, i, -i\}$

$(x-4)(x-4)(x+i)(x-i)$

(23) $f(t) = t^3 - 3t^2 - 15t + 125$

PZ $\pm 125, \pm 5, \pm 25, \pm 1$

$f(-5) = 0$

$-5 \mid 1 \quad -3 \quad -15 \quad 125$

$t^2 - 8t + 16 = -25$

$(t-4)^2 = -9$

$t - 4 = \pm 3i$

$t = 4 \pm 3i$

27) $x^4 + 10x^2 + 9 = 0$

$(x^2+1)(x^2+9) = 0$

$x^2 = -1$

(40) $f(x) = x^4 - 8x^3 + 17x^2 - 8x + 16$

$f(4) = 0$

$4 \mid 1 \quad -8 \quad 17 \quad -8 \quad 16$

$1 \quad -4 \quad 1 \quad -4 \quad 0$

Writing a Polynomial Function Given Mixed Roots

Try This: Write the equation of the function whose roots are:

1) 0, 3, $\pm$

$x = 0 \quad x = 3 \quad x = -\frac{4}{5}$ or 5

$-3 \quad -3$

$x - 3 = 0 \quad 5x = -4$

$+4 \quad +4$

$x(x-3)(5x+4)$

$(x^2 - 3x)(5x+4)$

$5x^3 + 4x^2 - 15x^2 - 12x$

$f(x) = 5x^3 - 11x^2 - 12x$

2) 0, $3 + \sqrt{6}$, $3 - \sqrt{6}$

$x = 0 \quad x - 3 = \pm\sqrt{6}$

$-3 \quad -3$

$(x-3)^2 = (\pm\sqrt{6})^2$

$x^2 - 6x + 9 = 6$

$-6 \quad -6$

$x(x^2 - 6x + 3)$

$x^2 - 6x + 3$

	x	-3	$-\sqrt{6}$
x	x^2	$-3x$	$-\sqrt{6}x$
-3	$-3x$	$+9$	$+3\sqrt{6}$
$+\sqrt{6}$	$\sqrt{6}x$	$-3\sqrt{6}$	-6

$x^2 - 3x - 3x + 9 - 6$

$x^2 - 6x + 3$

Solve by completing the square

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

$x^2 + 2x + 1 = -5 + 1$

$\sqrt{(x+1)^2} = \sqrt{-4}$

$x + 1 = \pm 2i$

$-1 \quad -1$

$x = -1 \pm 2i$

Given the zeros, find the polynomial function

Given irrational/imaginary zeros, use completing the square backwards!!

1) $\{2, 3i, -3i\}$

$x = 2 \quad (x-2)$

$(x)^2 = (\pm 3i)^2$

$x^2 = i^2 9$

$x^2 = (-1)(9)$

$x^2 = -9$

$+9 \quad +9$

$x^2 + 9 = 0$

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

$f(x) = x^3 - 2x^2 + 9x - 18$

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2) Given the zeros, find the polynomial function. $\{0, 5 + i\sqrt{3}\}$

$5 + i\sqrt{3}$ and $5 - i\sqrt{3}$

$x = 0 \quad x = 5 \pm i\sqrt{3}$

$-5 \quad -5$

$(x-5)^2 = (\pm i\sqrt{3})^2$

$x^2 - 10x + 25 = -3$

$+3 \quad +3$

$x^2 - 10x + 28 = 0$

$x(x^2 - 10x + 28)$

$f(x) = x^3 - 10x^2 + 28x$

Given the roots, find the polynomial function for each of the following.

3) $\{0, -2, \pm 4i\}$

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evens

4) $\{3, 3, 5i\}$

5) $\{-6, 2 \pm 2i\sqrt{2}\}$

6) $\{0, 2, 2, 3 + i\sqrt{6}\}$