4.5 Irrational & Complex Zeros

Wednesday, June 19, 2019 1:29 PM

$f(x) = 1x^3 - 7x^2 + 8x - 2$

$1, -1, 2, -2$

Possible Zeros: $1, -1, 2, -2$

1	1	-7	8	-2
		1	-6	2
	1	-6	2	0
	x^2	x	c	R

$f(x) = (x-1)(x^2-6x+2)$

$x = 1, 3+\sqrt{7}, 3-\sqrt{7}$

FACTOR → QUADRATIC FORMULA ax^2+bx+c $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

RRT $x^3, x^4, x^5 \ldots$

$x=1$

$(x-1)(x^2-6x+2)$

$a=1 \quad b=-6 \quad c=2$

$x = \frac{-(-6) \pm \sqrt{(-6)^2-4(1)(2)}}{2(1)}$

$= \frac{6 \pm \sqrt{28}}{2} \rightarrow \sqrt{4}\sqrt{7} \rightarrow 2\sqrt{7}$

$= \frac{6}{2} \pm \frac{2\sqrt{7}}{2}$

$= 3 \pm \sqrt{7}$

Rule:

① Irrational and complex zeros always occur in conjugate pairs

$3+\sqrt{7} \rightarrow 3-\sqrt{7}$

$1+3i \rightarrow 1-3i$

ex $f(x) = x^4 - 3x^3 + 6x^2 + 2x - 60$ Hint: $x = 1+3i$ is a zero ✓

possible zeros: $1, -1, 2, -2, 3, -3, 4, -4, 5, -5, 6, -6, 10, -10, 12, -12, 15, -15, 20, -20, 30, -30, 60, -60$

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

$x = \underbrace{1+3i, 1-3i}_{\text{(hint)}}, \underbrace{3, -2}_{\text{(rule)}}$

① Form factors from the complex zeros: $1+3i$ and $1-3i$

$(x-(1+3i))(x-(1-3i))$

② FOIL: $x^2 - x(1-3i) - x(1+3i) + (1+3i)(1-3i)$

FOIL

$x^2 - x + 3ix - x - 3ix + 1 - 9i^2 \rightarrow -9(-1) \rightarrow +9$

$x^2 - 2x + 10$ ← no complex i's

③ Long Divide:

$x^2-2x+10 \overline{)\, x^4 - 3x^3 + 6x^2 + 2x - 60}$

$x^2 - x - 6$

$-x^4 + 2x^3 \mp 10x^2 \downarrow$

$-1x^3 - 4x^2 + 2x$

$+x^3 \mp 2x^2 + 10x$

$-6x^2 + 12x - 60$

$+6x^2 \mp 12x + 60$

0 ← Must get zero as Remainder

$f(x) = x^4 - 3x^3 + 6x^2 + 2x - 60$

$(x^2-2x+10)(x^2-x-6)$

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