The Remainder and Factor Theorems

Warm-up intro ... Divide using synthetic division.

a. $(x^3-2x^2-2x+8)\div(x-1)$

$$\begin{array}{c|cccc} 1 & 1 & -2 & -2 & 8 \\ & \downarrow & 1 & -1 & -3 \\ \hline & 1 & -1 & -3 & 5 \end{array}$$

$x^2-x-3+\frac{5}{x-1}$

b. $(x^3-x^2-2x+8)\div(x+2)$

$$\begin{array}{c|cccc} -2 & 1 & -1 & -2 & 8 \\ & \downarrow & -2 & 6 & -8 \\ \hline & 1 & -3 & 4 & 0 \end{array}$$

x^2-3x+4

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The Remainder Theorem

The Factor Theorem

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Example 1:

Factor $f(x)=3x^3+13x^2+2x-8$ given that $f(-4)=0$.

$$\begin{array}{c|cccc} -4 & 3 & 13 & 2 & -8 \\ & \downarrow & -12 & -4 & 8 \\ \hline & 3 & 1 & -2 & 0 \end{array}$$

get down to quadratic & either... 1) Factor or 2) quadratic formula

$3x^2+x-2=0$ → use quadratic formula or factoring to solve

$x=\frac{-1\pm\sqrt{(1)^2-4(3)(-2)}}{2(3)}$

$x=\frac{-1\pm\sqrt{1+12}}{6}$

$x=\frac{-1\pm\sqrt{13}}{6}$ ← 2 answers

total of 3 answers

$x=-4$

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Example 2:

One zero of $f(x)=x^3+6x^2+3x-10$ is $x=-5$.

Find the other zeros of the function.

$$\begin{array}{c|cccc} -5 & 1 & 6 & 3 & -10 \\ & \downarrow & -5 & -5 & 10 \\ \hline & 1 & 1 & -2 & 0 \end{array}$$

get down to quadratic 1) Factor or 2) quadratic formula →

$x^2+x-2=0$ (Factor & solve)

$(x+2)(x-1)=0$

$x=-2 \quad x=1$

$x=-5$

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Example 3:

One zero of $f(x)=5x^3-27x^2-17x-6$ is $x=6$.

Find the other zeros of the function.

$$\begin{array}{c|cccc} 6 & 5 & -27 & -17 & -6 \\ & \downarrow & 30 & 18 & 6 \\ \hline & 5 & 3 & 1 & 0 \end{array}$$

$5x^2-3x+1=0$

$$x=\frac{3\pm\sqrt{9-4(5)(1)}}{2(5)}$$

$$x=\frac{3\pm\sqrt{9+20}}{10}$$

$$x=\frac{3\pm\sqrt{29}}{10}$$

3 total solutions

$x=6$

2 answers (solutions)

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