

Precalculus

**Use polynomial division with remainder 0 to
factor a polynomial**

Todor Milev

2019

Example

Demonstrate that $6x^3 - 19x^2 + 17x - 3$ is divisible by $2x - 3$ using polynomial long division. Use your work to factor the cubic. Solve the equation $6x^3 - 19x^2 + 17x - 3 = 0$.

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Divide $6x^3$ by $2x$.

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$3x^2$

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Multiply $3x^2$ by divisor.

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Subtract last two polynomials.

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Divide $-10x^2$ by $2x$.

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Divide $2x$ by $2x$.

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$$(\text{Dividend}) = (\text{Quotient}) \cdot (\text{Divisor}) + (\text{Remainder})$$

$$(6x^3 - 19x^2 + 17x - 3) = (3x^2 - 5x + 1) \cdot (2x - 3)$$

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$$= 3 \left(x - ? \right) \left(x - ? \right) (2x - 3)$$

No easy factorization of quadratic, so use formula:

$$x_1, x_2 = ?$$

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$$x_1, x_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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We are ready to solve the equation.

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$$\begin{aligned}6x^3 - 19x^2 + 17x - 3 &= 0 \\ 3 \left(x - \left(\frac{5+\sqrt{13}}{6} \right) \right) \left(x - \left(\frac{5-\sqrt{13}}{6} \right) \right) (2x - 3) &= 0 \\ 2x - 3 &= 0 \quad \text{or} \quad x = \left(\frac{5+\sqrt{13}}{6} \right) \quad \text{or} \quad x = \left(\frac{5-\sqrt{13}}{6} \right) \\ x &= \frac{3}{2}\end{aligned}$$

Example

Demonstrate that $6x^3 - 19x^2 + 17x - 3$ is divisible by $2x - 3$ using polynomial long division. Use your work to factor the cubic. Solve the equation $6x^3 - 19x^2 + 17x - 3 = 0$.

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No easy factorization of quadratic, so use formula:

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