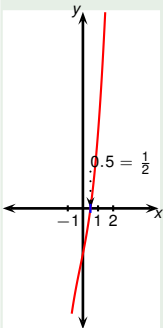# Precalculus
Factor cubic with one real root using its plot

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Example

Plot the left hand side of the equation with a graphing calculator. Find all real solutions of the equation.

$$2x^3 + x^2 + 5x - 3 = 0$$
$$\left(x - \tfrac{1}{2}\right)\left(2x^2 + 2x + 6\right) + 0 = 0$$

We see only one root, $x = 0.5 = \tfrac{1}{2}$. Is our guess correct? Is there another root (far away from 0)? Factor:

$$
\begin{array}{r}
\textbf{Quotient:} \quad 2x^2 + 2x + 6 \\
x - \tfrac{1}{2} \enclose{longdiv}{2x^3 + x^2 + 5x - 3} \\
\underline{2x^3 - x^2} \\
2x^2 + 5x - 3 \\
\underline{2x^2 - x} \\
6x - 3 \\
\underline{6x - 3} \\
\end{array}
$$

Remainder: 0

Example

Plot the left hand side of the equation with a graphing calculator. Find all real solutions of the equation.

$$2x^3 + x^2 + 5x - 3 = 0$$
$$\left(x - \tfrac{1}{2}\right)\left(2x^2 + 2x + 6\right) + 0 = 0$$

$$x - \tfrac{1}{2} = 0 \quad \textbf{or} \quad x = \frac{-2 \pm \sqrt{2^2 - 4 \cdot 2 \cdot 6}}{2 \cdot 2}$$

$$x = \tfrac{1}{2} \qquad x = \frac{-2 \pm \sqrt{-44}}{2 \cdot 2}$$

no real solution

We see only one root, $x = 0.5 = \tfrac{1}{2}$. Is our guess correct? Is there another root (far away from 0)?