Precalculus
Factor cubic with one real root using its plot

Todor Milev

2019

Example

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

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

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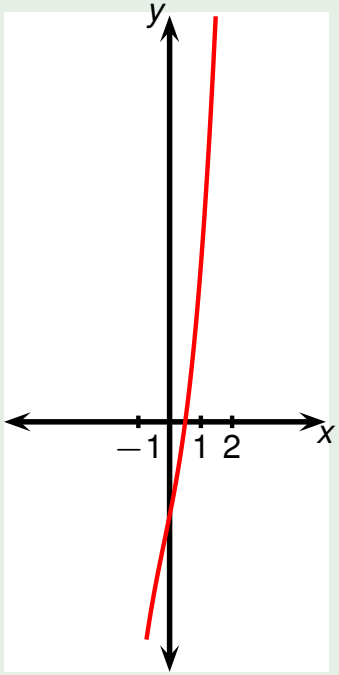

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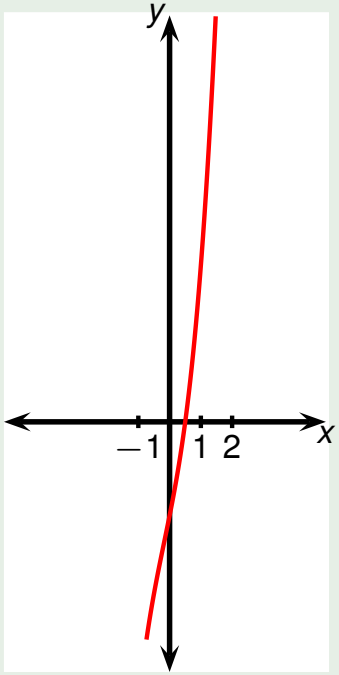

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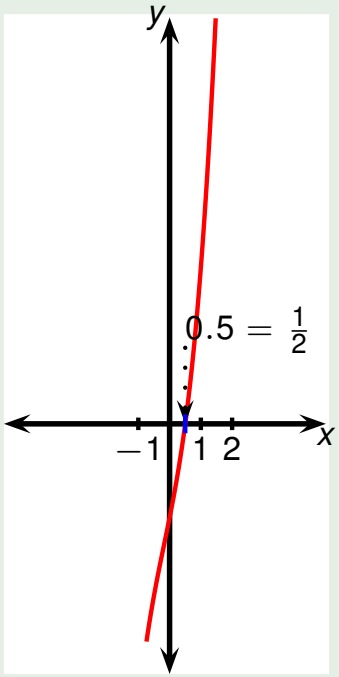

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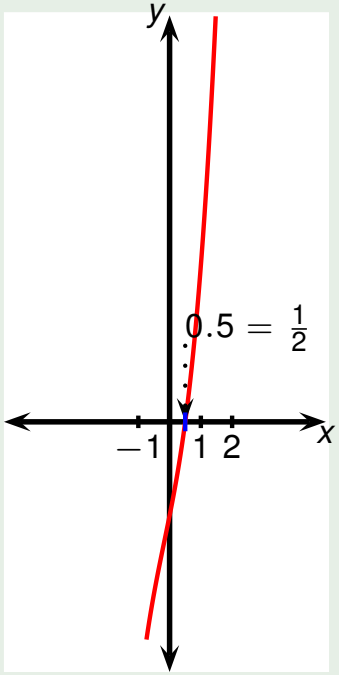

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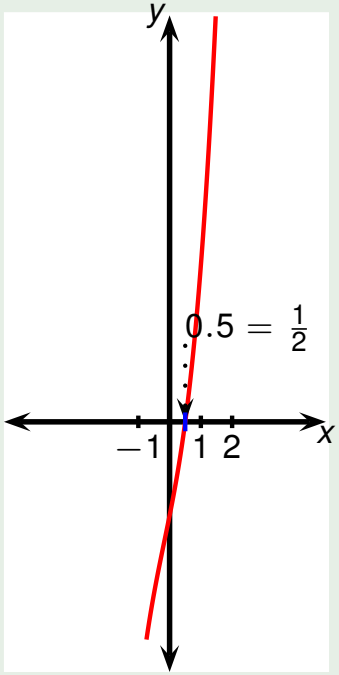

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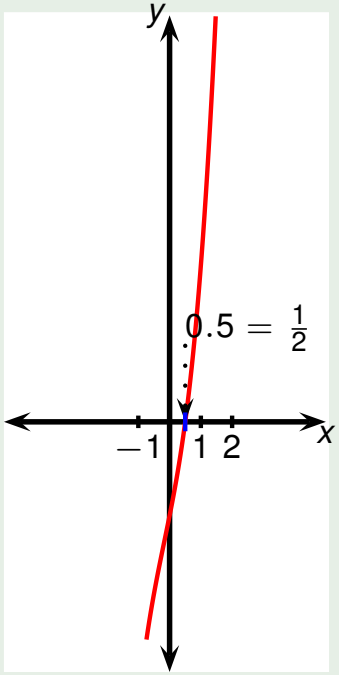

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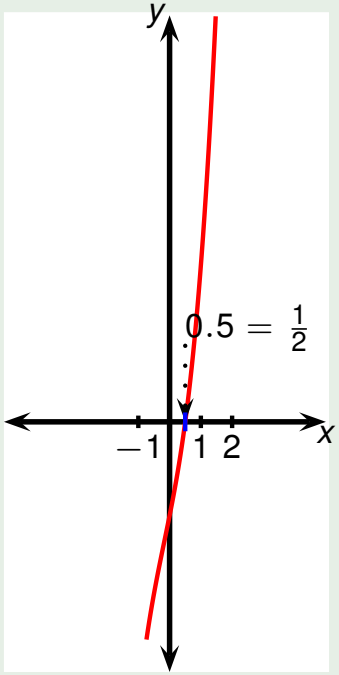

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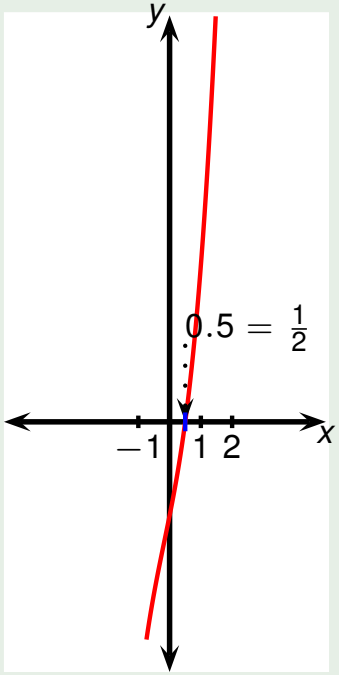

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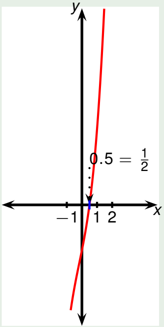

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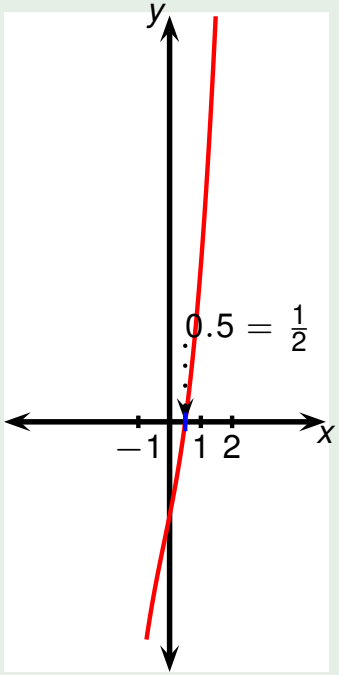

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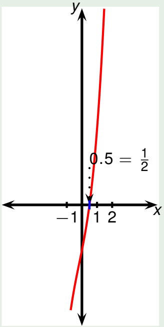

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Multiply $2x^2$ by divisor.

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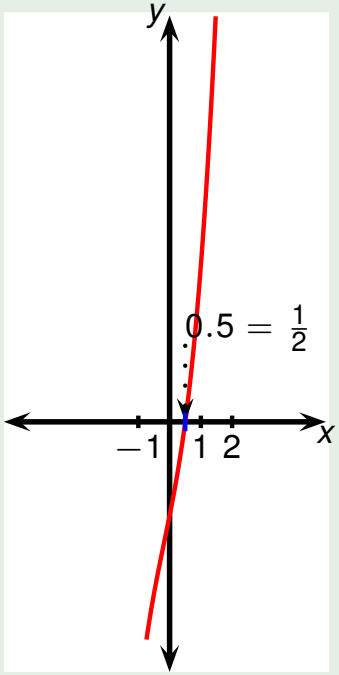

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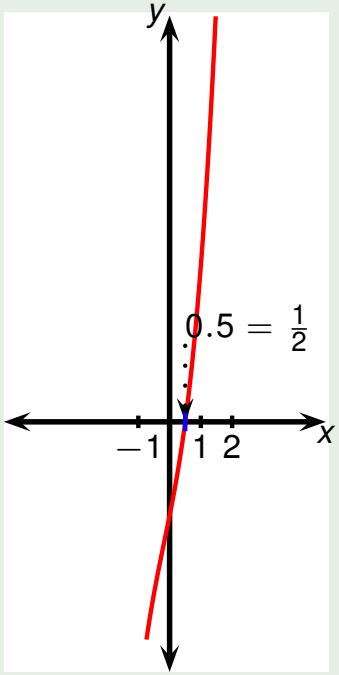

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Subtract last two polynomials.

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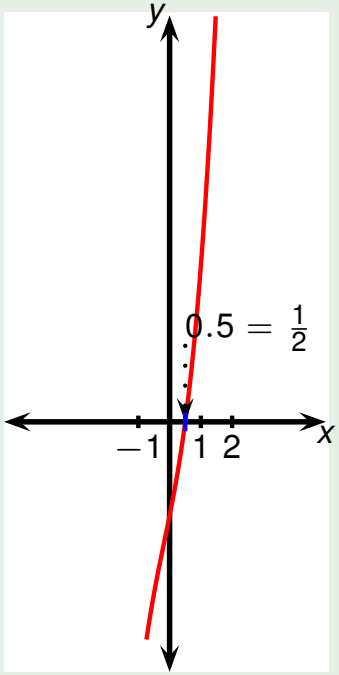

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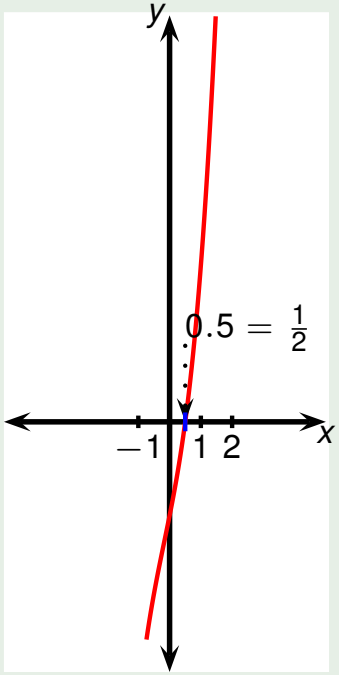

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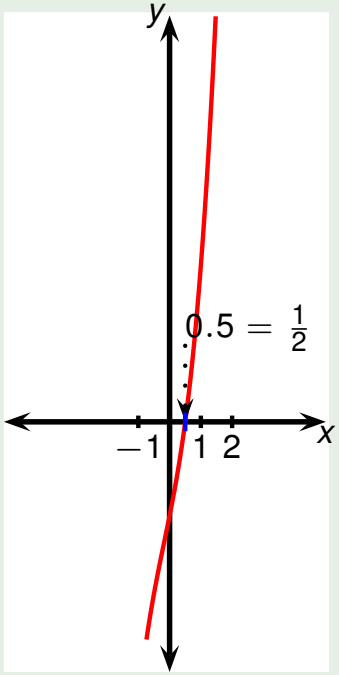

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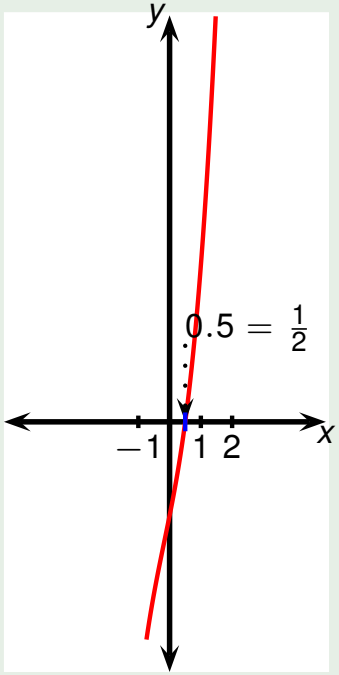

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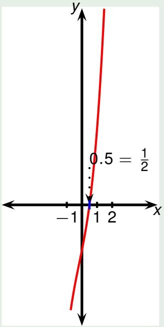

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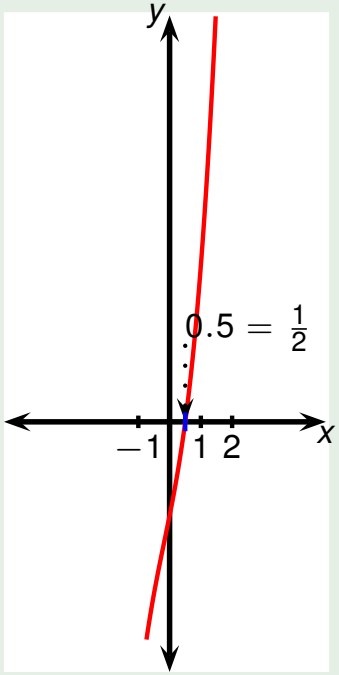

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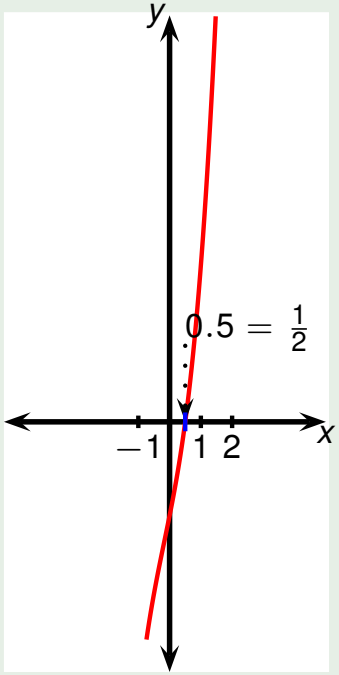

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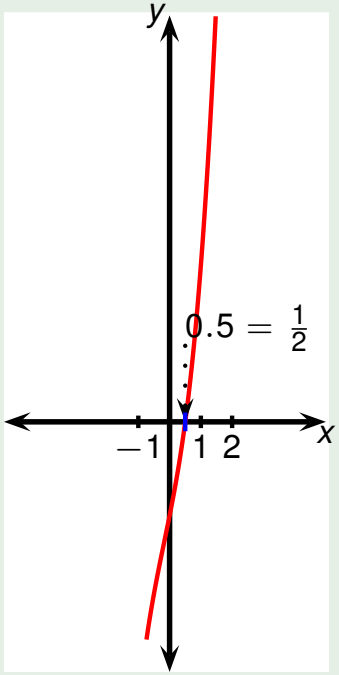

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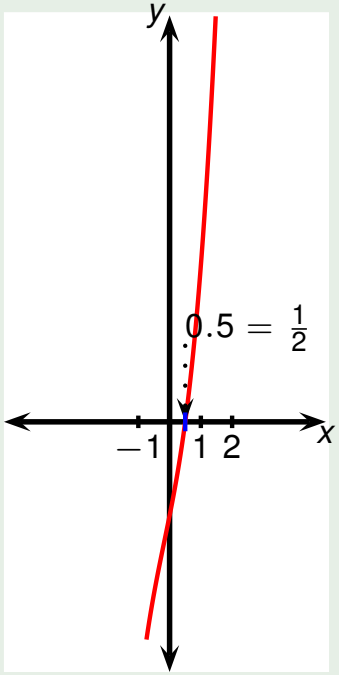

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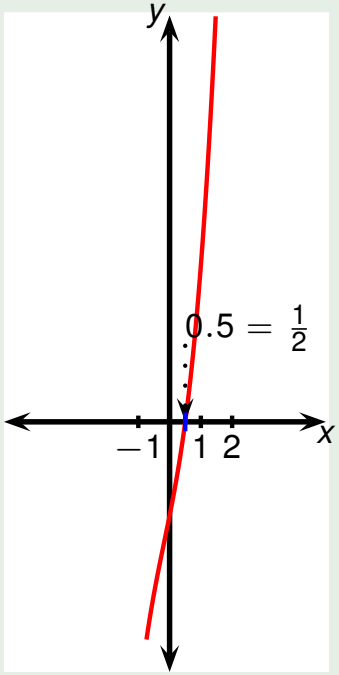

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Multiply 6 by divisor.

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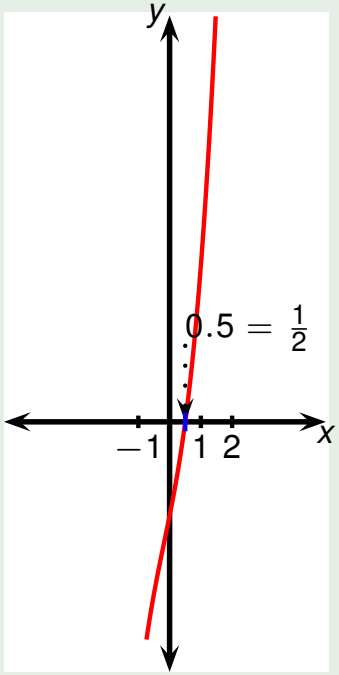

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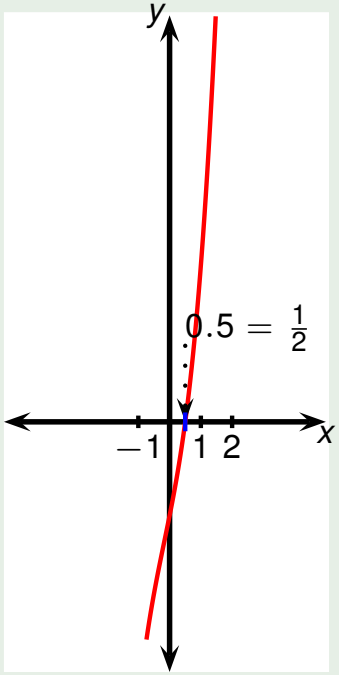

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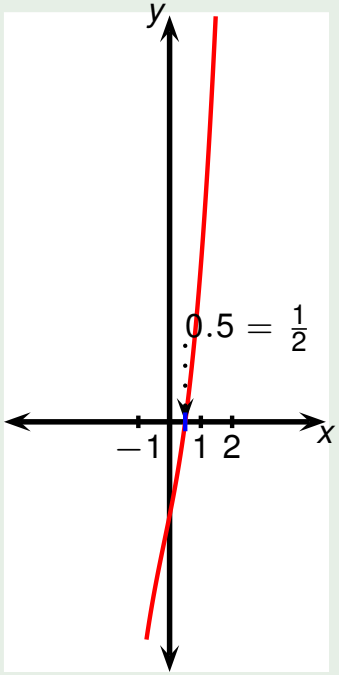

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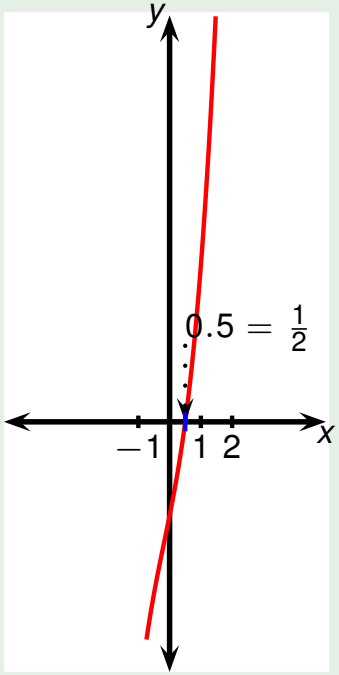

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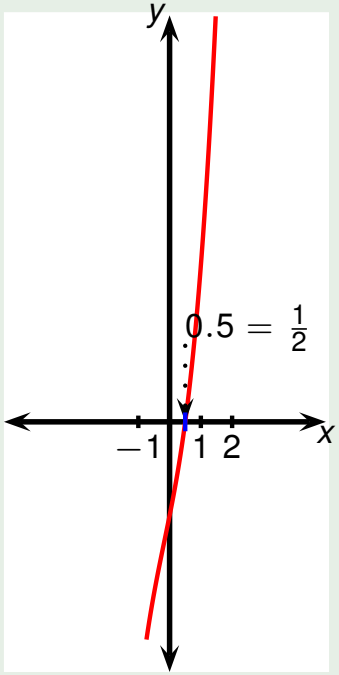

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$$\begin{aligned} 2x^3 + x^2 + 5x - 3 &= 0 \\ \left(x - \tfrac{1}{2}\right)\left(2x^2 + 2x + 6\right) + 0 &= 0 \end{aligned}$$

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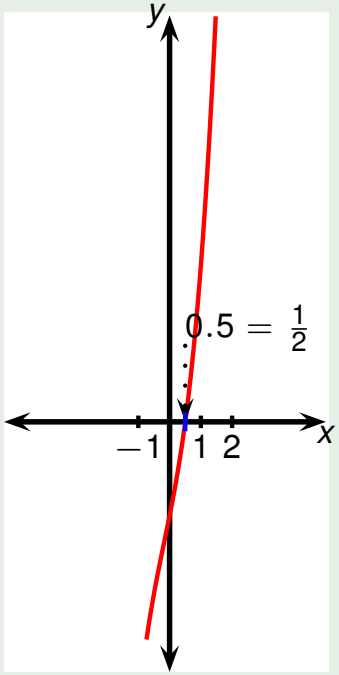

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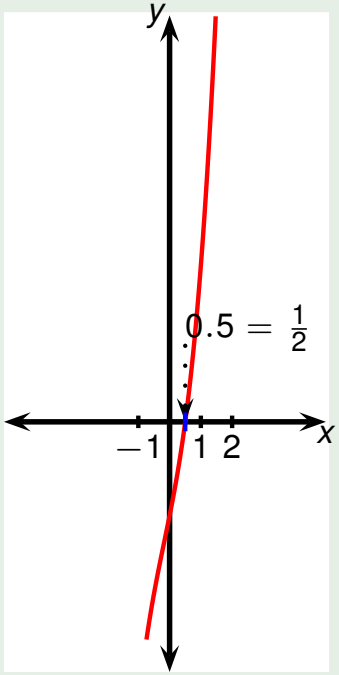
$$\begin{array}{rl|l} & & 2x^3 + x^2 + 5x - 3 \\ x - \frac{1}{2} & & \\ - & & 2x^3 - x^2 \\ \hline & & 2x^2 + 5x - 3 \\ - & & 2x^2 - x \\ \hline & & 6x - 3 \\ - & & 6x - 3 \\ \hline & & 0 \end{array}$$

Remainder: 0

Example



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

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

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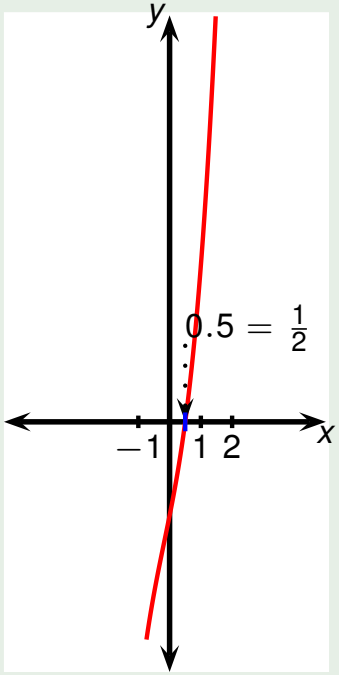

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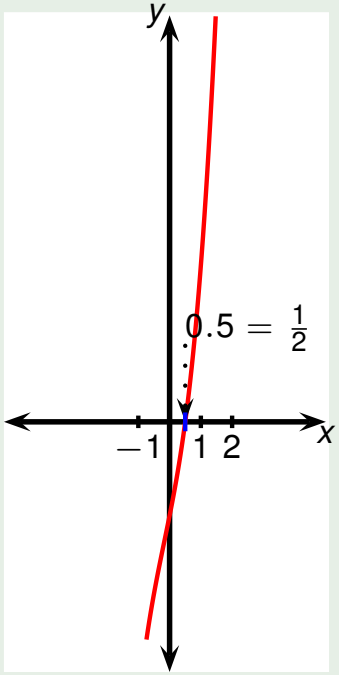

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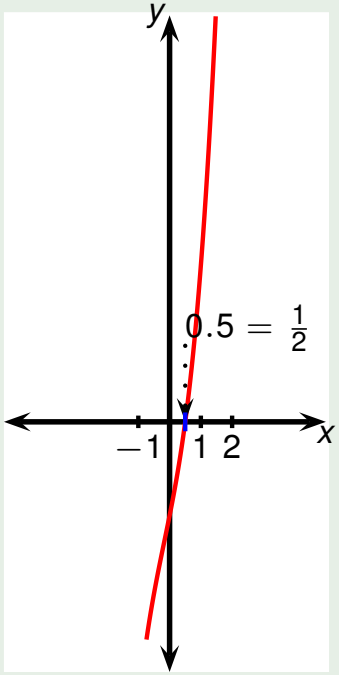

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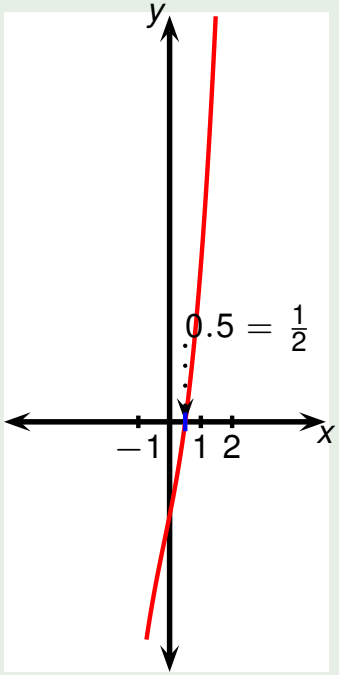

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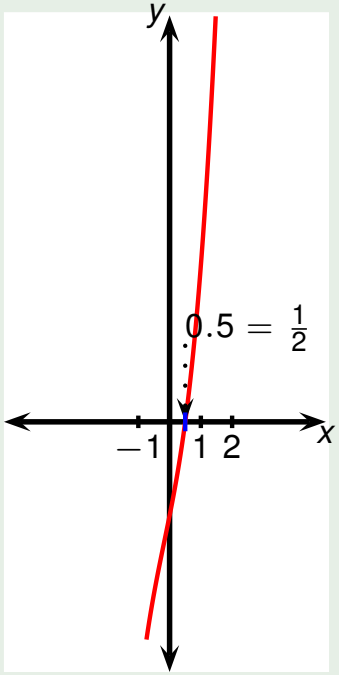

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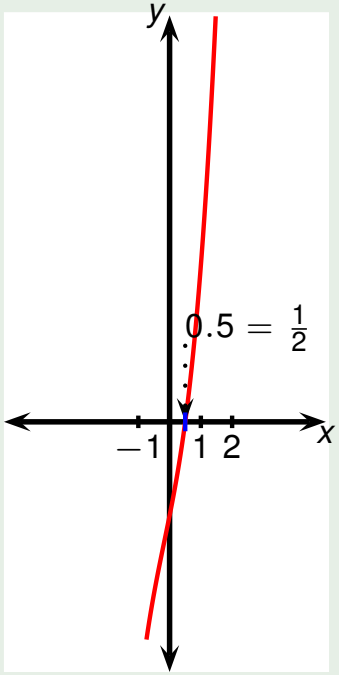

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$$x = \tfrac{1}{2} \qquad x = \frac{-2 \pm \sqrt{-44}}{2 \cdot 2}$$

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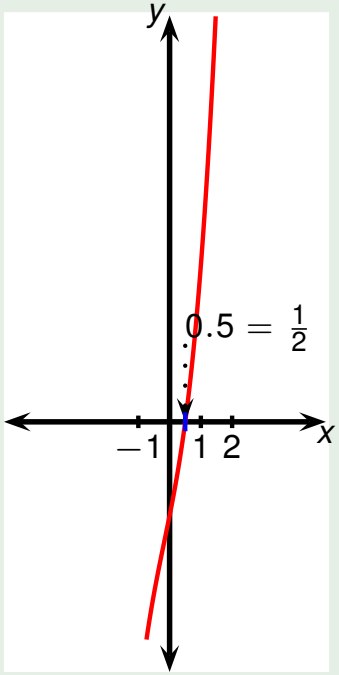
Example



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no real solution

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