Precalculus
Polynomial inequalities

Todor Milev

2019

Outline

Example

Solve the inequality.

$$2x^2 + 3x - 5 \geq 0$$

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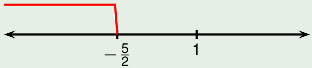

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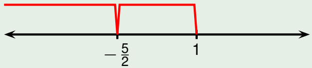

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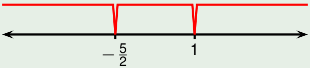

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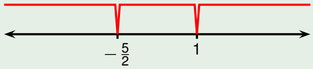

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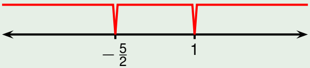

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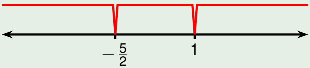

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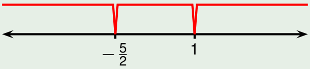

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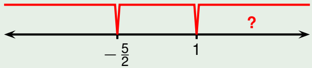

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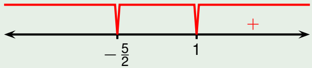

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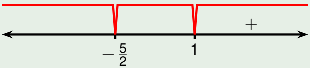

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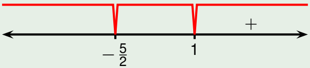

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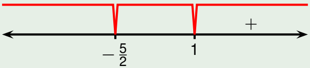

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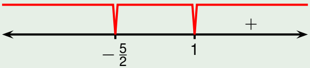

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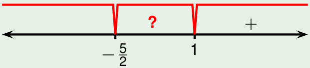

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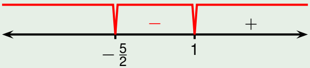

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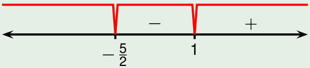

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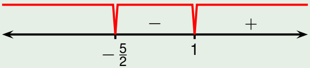

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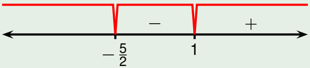

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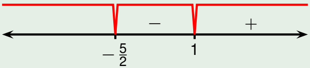

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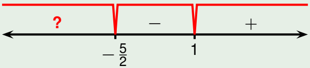

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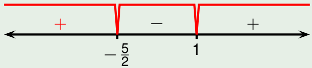

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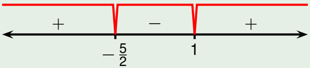

Interval	Factor signs	Final sign	Sample pt	Value at sample pt
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$\left(-\frac{5}{2}, 1\right)$	$(+)(-)$	$-$	0	$f(0) = -5 < 0$
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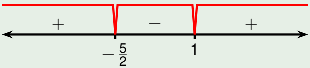

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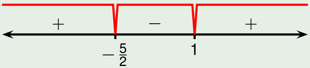

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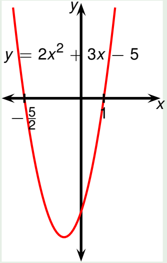

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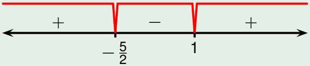

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Plot the function $2x^3 - 5x^2 + x + 2$. Solve the inequality.

$$2x^3 - 5x^2 + x + 2 \quad > \quad 0$$

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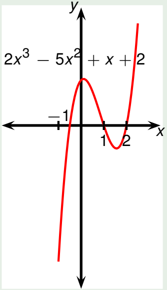

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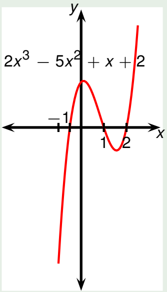

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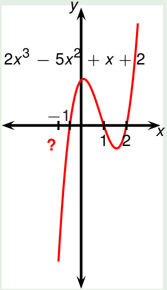
$$2x^3 - 5x^2 + x + 2 > 0$$
$$\textbf{?}\ (x - \qquad)(x - \quad)(x - \quad) > 0$$

Example



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$$
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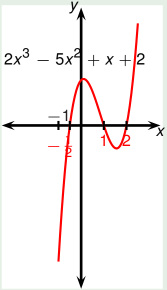
\mathbf{?}\left(x - \mathbf{?} \quad\right)(x - \mathbf{?})(x - \mathbf{?}) & > & 0
\end{array}
$$

Example

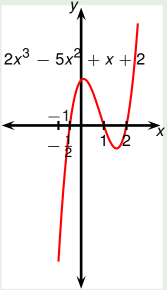


Plot the function $2x^3-5x^2+x+2$. Solve the inequality.

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

? $\left(x-\left(-\frac{1}{2}\right)\right)(x-1)(x-2) > 0$

Example



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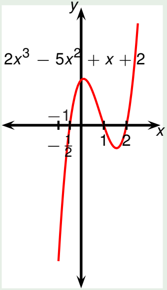
Example



Plot the function $2x^3 - 5x^2 + x + 2$. Solve the inequality.

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2x^3 - 5x^2 + x + 2 &> 0\\
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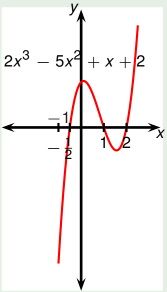
Example



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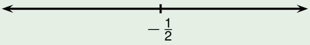
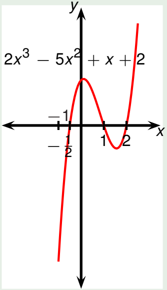


Example



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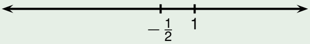
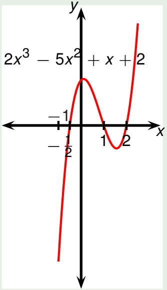


Example



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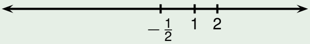
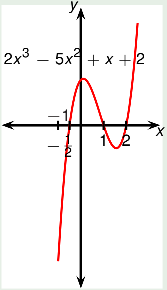


Example



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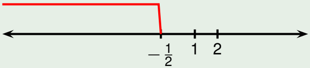
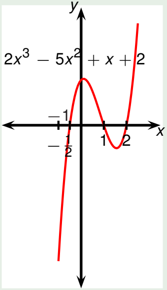


Interval	Factor signs	Final sign from plot
$\left(-\infty, -\frac{1}{2}\right)$		

Example



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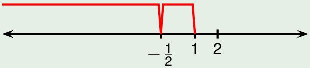

Interval	Factor signs	Final sign from plot
$\left(-\infty, -\frac{1}{2}\right)$		
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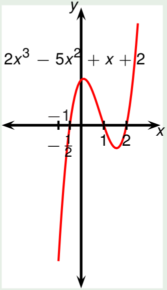
Example



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

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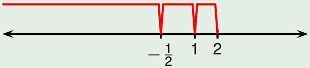

Interval	Factor signs	Final sign from plot
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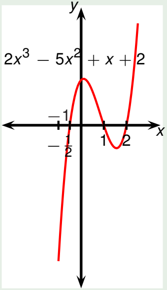
$\left(-\frac{1}{2},1\right)$		
$(1,2)$		

Example



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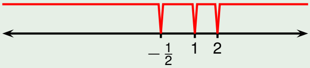

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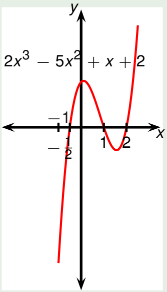
$(2, \infty)$		

Example



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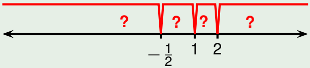
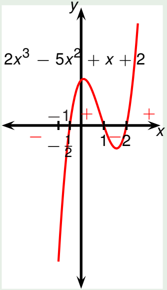


Interval	Factor signs	Final sign from plot
$\left(-\infty, -\frac{1}{2}\right)$	?	?
$\left(-\frac{1}{2}, 1\right)$	?	?
$(1, 2)$	?	?
$(2, \infty)$	?	?

Example



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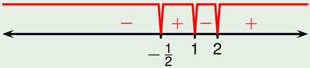
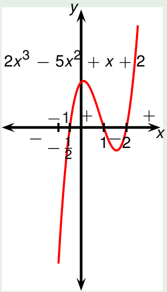


Interval	Factor signs	Final sign from plot
$\left(-\infty, -\frac{1}{2}\right)$	$(-)(-)(-)$	$-$
$\left(-\frac{1}{2}, 1\right)$	$(+)(-)(-)$	$+$
$(1, 2)$	$(+)(+)(-)$	$-$
$(2, \infty)$	$(+)(+)(+)$	$+$

Example



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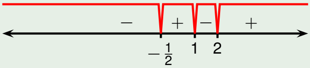
$x \in$ **?**

Left hand side vanishes when $x = -\frac{1}{2}$, when $x = 1$ and when $x = 2$. The two roots split the real line into four intervals: $\left(-\infty, -\frac{1}{2}\right), \left(-\frac{1}{2}, 1\right), (1, 2), (2, \infty)$.



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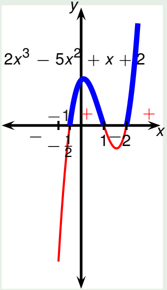
Example



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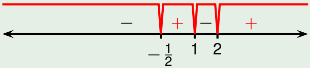
$$x \in \left(-\tfrac{1}{2}, 1\right) \cup (2, \infty)$$

Left hand side vanishes when $x = -\frac{1}{2}$, when $x = 1$ and when $x = 2$. The two roots split the real line into four intervals: $\left(-\infty, -\frac{1}{2}\right), \left(-\frac{1}{2}, 1\right), (1, 2), (2, \infty)$.



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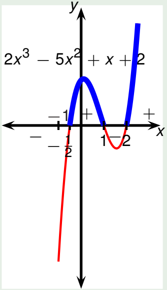
Example



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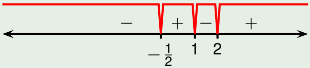

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