

# Precalculus

## Polynomial inequalities

Todor Milev

2019

# Outline

## 1 Polynomial inequalities

## Example

Solve the inequality.

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

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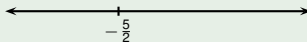
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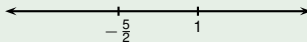


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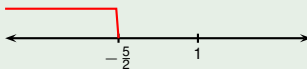


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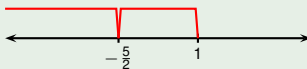


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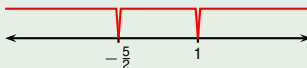
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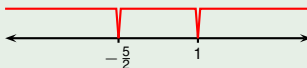
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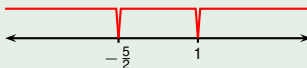
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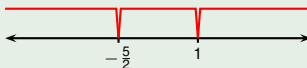
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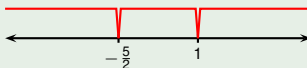
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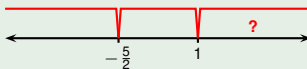
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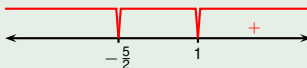
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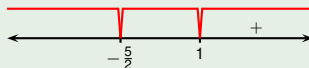
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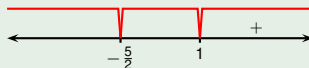
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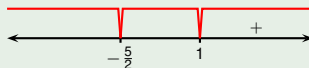
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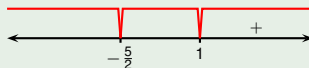
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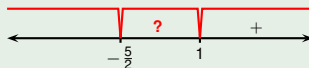
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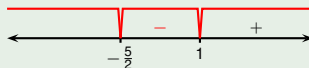
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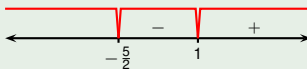
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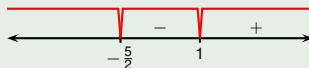
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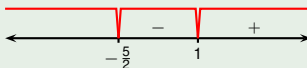


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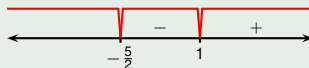
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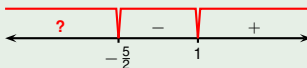
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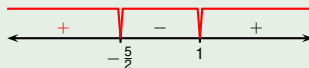
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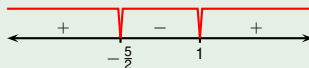
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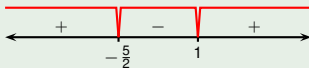
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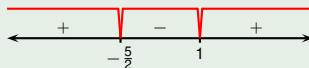
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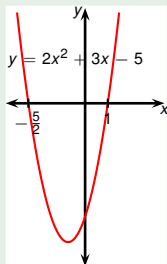
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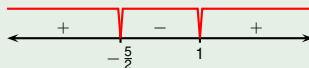


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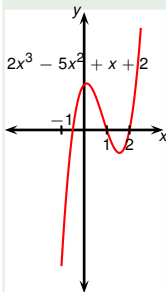


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Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

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

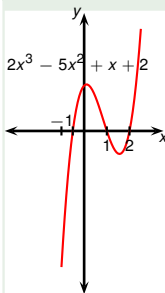
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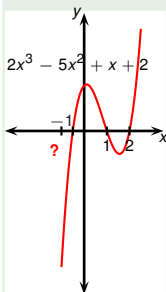


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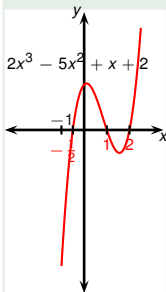


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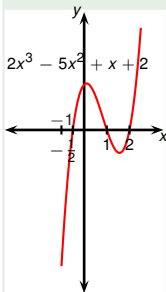


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$$? (x - (-\frac{1}{2})) (x - 1)(x - 2) > 0$$

## Example

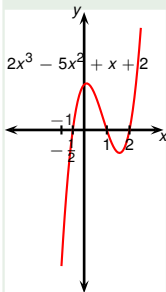


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## Example

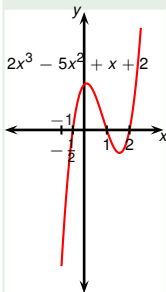


Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

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

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

## Example

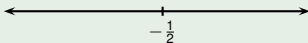


Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

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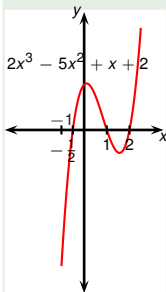
$$2(x - (-\frac{1}{2}))(x - 1)(x - 2) > 0$$

Left hand side vanishes when  $x = -\frac{1}{2}$ , when  $x = 1$  and when  $x = 2$ .





## Example

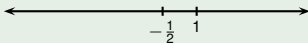


Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

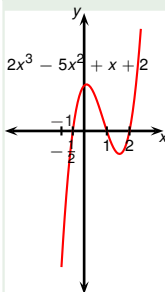
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## Example

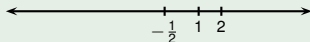


Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

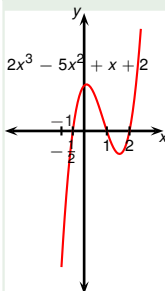
$$2x^3 - 5x^2 + x + 2 > 0$$

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# Example

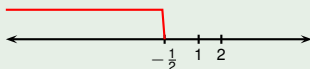


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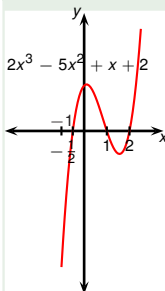
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Interval	Factor signs	Final sign from plot
$(-\infty, -\frac{1}{2})$		

# Example



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

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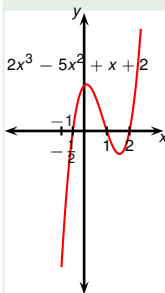
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Interval	Factor signs	Final sign from plot
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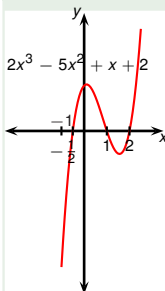
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Interval	Factor signs	Final sign from plot
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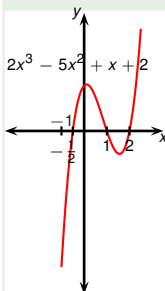
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$(-\frac{1}{2}, 1)$		
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$(2, \infty)$		

## Example

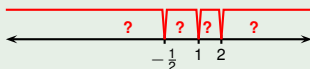


Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

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

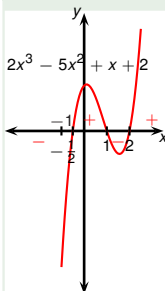
$$2\left(x - \left(-\frac{1}{2}\right)\right)(x - 1)(x - 2) > 0$$

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:  $(-\infty, -\frac{1}{2})$ ,  $(-\frac{1}{2}, 1)$ ,  $(1, 2)$ ,  $(2, \infty)$ .



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

# Example

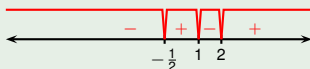


Plot the function  $2x^3 - 5x^2 + x + 2$ . Solve the inequality.

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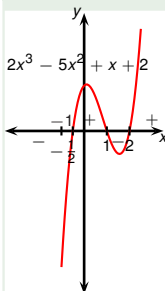
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Interval	Factor signs	Final sign from plot
$(-\infty, -\frac{1}{2})$	$(-)(-)(-)$	$-$
$(-\frac{1}{2}, 1)$	$(+)(-)(-)$	$+$
$(1, 2)$	$(+)(+)(-)$	$-$
$(2, \infty)$	$(+)(+)(+)$	$+$



# Example



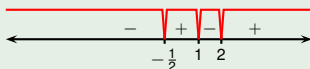
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$$2\left(x - \left(-\frac{1}{2}\right)\right)(x - 1)(x - 2) > 0$$

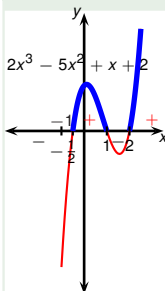
$$x \in ?$$

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:  $(-\infty, -\frac{1}{2})$ ,  $(-\frac{1}{2}, 1)$ ,  $(1, 2)$ ,  $(2, \infty)$ .



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# Example



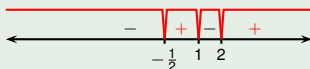
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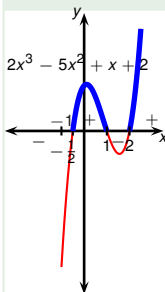
$$x \in (-\frac{1}{2}, 1) \cup (2, \infty)$$

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$(1, 2)$	$(+)(+)(-)$	-
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# Example



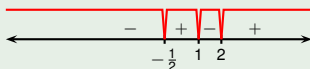
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