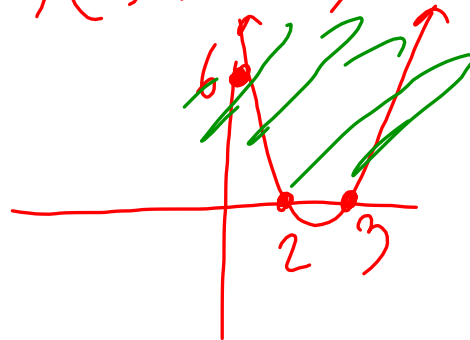


Minds on

Parabolic Inequalities

Determine when the parabola $f(x) = x^2 - 5x + 6$ is greater than 0.

$$f(x) = (x-2)(x-3)$$



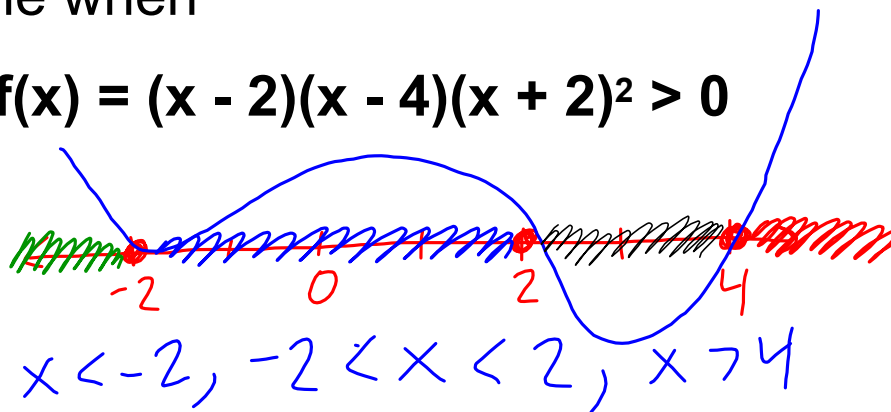
$f(x) > 0$ when $x < 2$ and
when $x > 3$

Action!

Solving Polynomial Inequalities

Determine when

$$f(x) = (x - 2)(x - 4)(x + 2)^2 > 0$$



$$x < -2, -2 < x < 2, x > 4$$

Using a Factor Table

	^{x = -3} x < -2	^{x = 0} -2 < x < 2	^{x = 3} 2 < x < 4	⁵ x > 4
(x - 2)	-	-	+	+
(x - 4)	-	-	-	+
(x + 2) ²	+	+	+	+
product	+	+	-	+

$$f(x) > 0 \text{ when } x < -2, -2 < x < 2, x > 4$$

Action!

Solving Polynomial Inequalities

Determine when

$$f(x) = 2x^3 + 3x^2 - 17x + 12 > 0$$

4 terms, factor by grouping?

Use factor theorem to find values when $f(x) = 0$.

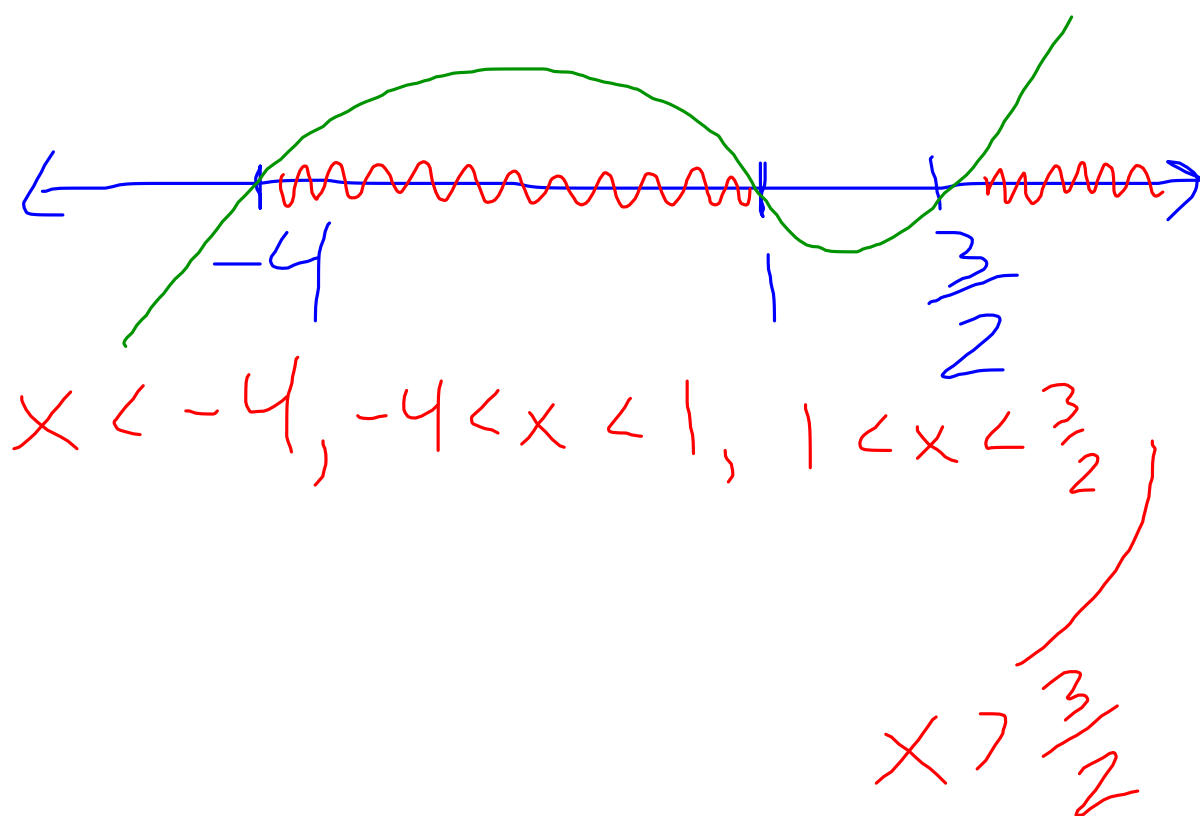
$$f(x) = 0 \text{ when } x = 1$$

$$\begin{array}{r|rrrr} 1 & 2 & 3 & -17 & 12 \\ & & 2 & 5 & -12 \\ \hline & 2 & 5 & -12 & 0 \end{array}$$

$$f(x) = (x-1)(2x^2 + 5x - 12)$$

$$\begin{aligned} f(x) &= (x-1)(2x^2 + 8x - 3x - 12) \\ &= (x-1)(2x(x+4) - 3(x+4)) \\ &= (x-1)(x+4)(2x-3) \end{aligned}$$

$$f(x) = 0 \text{ when } x = 1, -4, \frac{3}{2}$$



$h(x) > 0$ when
 $-4 < x < 1, x > \frac{3}{2}$

Action!

Solving Polynomial Inequalities

Solve the inequality

$$x^3 - 2x^2 + 5x + 20 \geq 2x^2 + 14x - 16$$

$$-2x^2 - 14x + 16 \quad -2x^2 - 14x + 16$$

$$x^3 - 4x^2 - 9x + 36 \geq 0$$

$$x^2(x-4) - 9(x-4) \geq 0$$

$$(x-4)(x^2-9) \geq 0$$

$$(x-4)(x+3)(x-3) \geq 0$$

The roots are 4, -3 and 3. These divide the numbers into 4 intervals.

	$x = -4$ $x < -3$	$x = 0$ $-3 < x < 3$	$x = 3.5$ $3 < x < 4$	$x = 5$ $x > 4$
$(x-4)$	-	-	-	+
$(x+3)$	-	+	+	+
$(x-3)$	-	-	+	+
Product	-	+	-	+

$$x^3 - 2x^2 + 5x + 20 \geq 2x^2 + 14x - 16 \text{ when}$$

$$-3 \leq x \leq 3, x \geq 4$$

Action!

Solving Polynomial Inequalities

One section of a roller coaster can be described by the function

$$h(x) = \frac{1}{4\,000\,000} x^2 (x - 30)^2 (x - 55)^2 > 9$$

where h is the height in metres and x is the distance from the start.

When will the roller coaster be more than 9 m above the ground?

$$x = 4.7, 21.7, 40, 44.1$$

The roller coaster is above 9m when

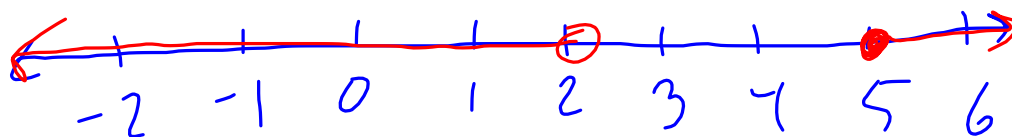
$$4.7 < x < 21.7, 40 < x < 44.1$$

Consolidation

Expressing Answers to Inequalities

If your solution was "x is less than 2 and x is greater than or equal to 5"

1. On a number line.



2. Using set notation.

$$x < 2, x \geq 5$$

3. Using interval notation.

$$(-\infty, 2), [5, +\infty)$$

Consolidation

Expressing Answers to Inequalities

If your solution was "x is greater than or equal to -2 and less than 4"

1. On a number line.
2. Using set notation.
3. Using interval notation.