

What's Going On?

Checking In

Minds on

Warm-Up Question

Action!

Polynomial Inequalities

Consolidation

Expressing Answers

Learning Goal - I will be able to solve polynomial inequalities by pencil and paper, and on the TI-83 graphing calculator.

Minds on

Secret Message

Rearrange the inequality below for i .

$$9 - 7i > -3(7u - 3)$$

$$\cancel{9} - 7i > -21u + \cancel{9}$$

$$\frac{-7i}{-7} > \frac{-21u}{-7}$$

$$i < 3u$$

Minds on

Parabolic Inequalities

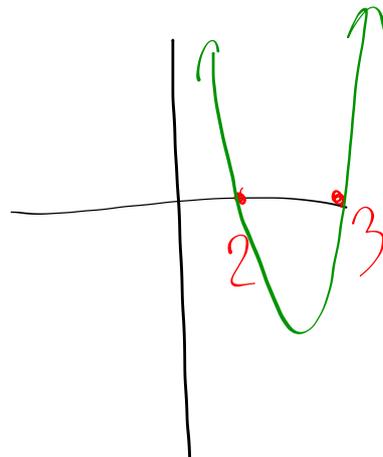
Determine when the parabola $f(x) = x^2 - 5x + 6$ is greater than 0.

$$\underbrace{x^2 - 5x + 6}_{\text{factor}} > 0$$

$$(x-2)(x-3) > 0$$

We can't use factors alone to determine our answer.

Consider the graph



$$\therefore x^2 - 5x + 6 > 0$$

when $x < 2$, $x > 3$

Action!

Solving Polynomial Inequalities

Determine when zeros: +2, +4, -2

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

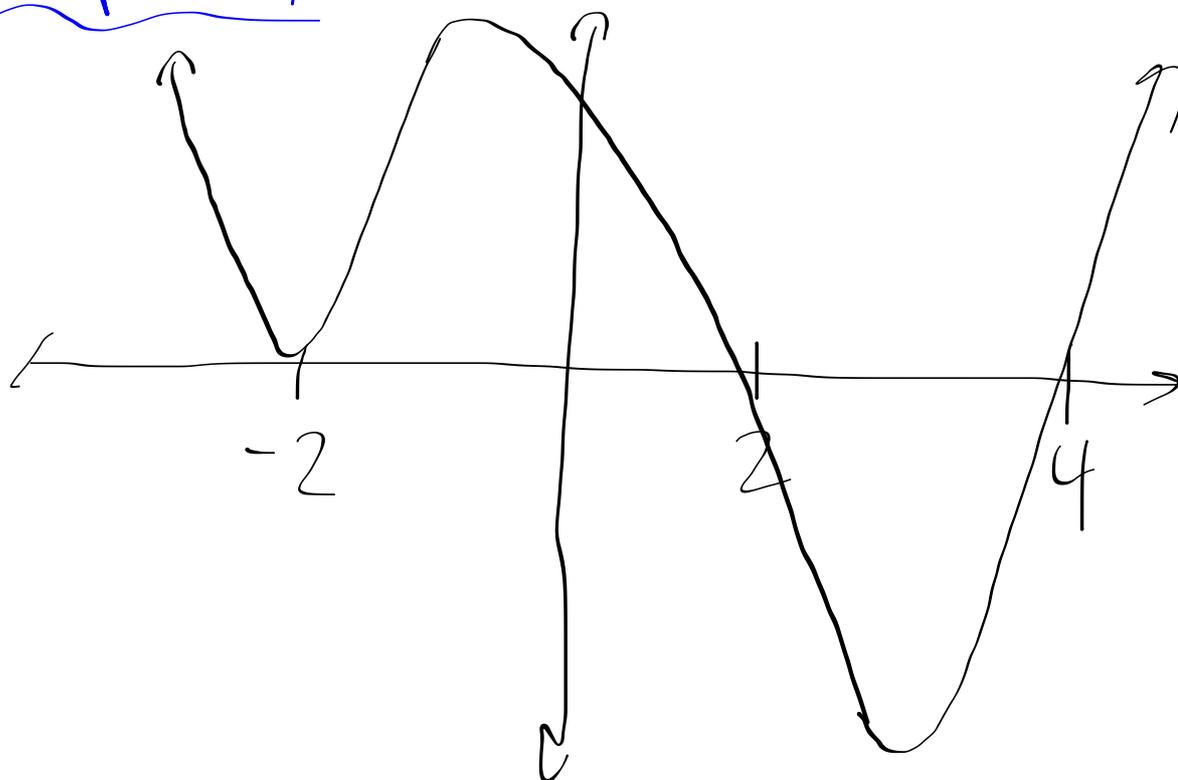
Solve using a factor table.

	$x < -2$	$-2 < x < 2$	$2 < x < 4$	$x > 4$
$(x-2)$	-	-	+	+
$(x-4)$	-	-	-	+
$(x+2)^2$	+	+	+	+
$f(x)$	+ ✓	+ ✓	- ✗	+ ✓

$$\therefore (x-2)(x-4)(x+2)^2 > 0$$

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

Graphically



Action!

Solving Polynomial Inequalities

Determine when

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

First, find a factor. (Guess & Check)

$$f(1) = 0$$

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

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

factor

$$f(x) = (x-1)(2x^2 + 8x - 3x - 12)$$

$$= (x-1)(2x(x+4) - 3(x+4))$$

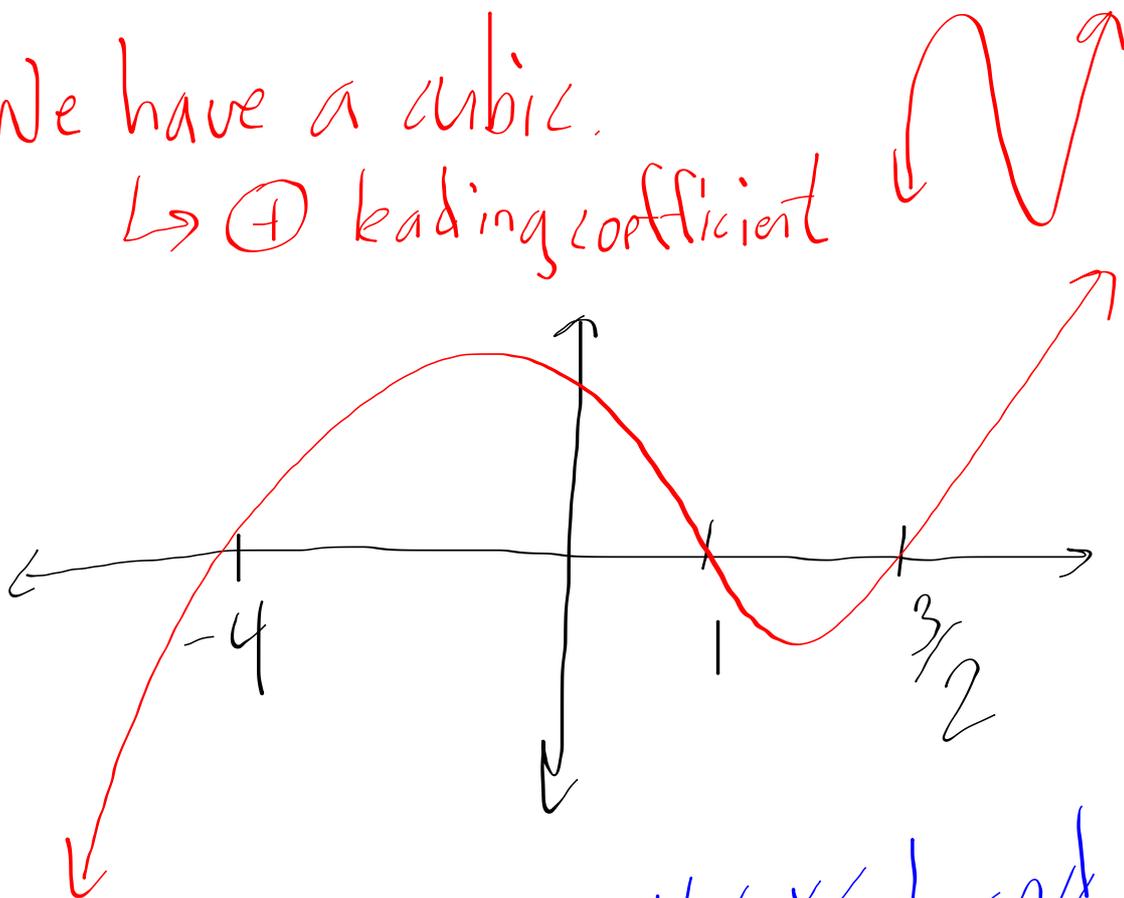
$$= (x-1)(x+4)(2x-3)$$

$f(x) = 0$ when

$$x = 1, -4, \frac{3}{2}$$

We have a cubic.

↳ \oplus leading coefficient



$\therefore f(x) > 0$ when $-4 < x < 1$ and
when $x > \frac{3}{2}$.

Action!

Solving Polynomial Inequalities

Solve the inequality

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

(A red arrow points to the right-hand side of the inequality.)

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

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

Try factoring by grouping.

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

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

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

Our zeroes are 4, -3, +3

We could sketch a rough graph,
but we'll use a factor table.

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

$\therefore f(x) \geq 0$ when

$-3 \leq x \leq 3$ and

when $x \geq 4$.

Action!

Solving Polynomial Inequalities

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

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

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?

We will solve graphically!
On a TI-83, graph $h(x)$
and $y=9$.
Curve meets $y=9$ when
 $x=4.7, 21.7, 40, 48.1,$
 54.6

$\therefore h(x) > 0$ when

$$4.7 < x < 21.7$$

$$40 < x < 48.1$$

$$x > 58.6$$

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.

$$-2 \leq x < 4$$

3. Using interval notation.

$$[-2, 4)$$

Consolidation

Practice Questions

Pg. 225

3, 6, 7, 10