

TEKS 2A.10.D, 2A.10.E



LESSON

8-5A

Technology Lab

Solving Rational Equations and Inequalities

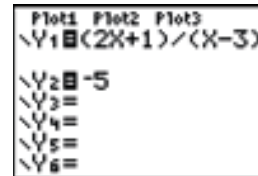
Use with Lesson 8-5

You can use a graphing calculator to solve rational equations and inequalities.

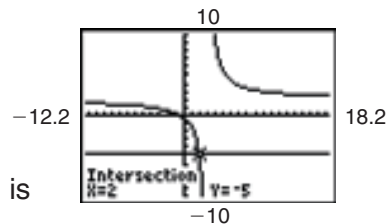
Activity 1

Solve $\frac{2x + 1}{x - 3} = -5$ by using a graph and a table.

Step 1 Enter $(2x + 1)/(x - 3)$ for **Y1** and -5 for **Y2**, as shown.



Step 2 Find the point or points where the graph of **Y1** intersects the graph of **Y2**. Press **GRAPH** to view the graphs of the functions. Find the intersection point or points by pressing **2nd TRACE** (CALC) and using the **intersect** feature.



The screen shows that **Y1** and **Y2** have the same value when $x = 2$. Therefore, the solution of the equation $\frac{2x + 1}{x - 3} = -5$ is $x = 2$.

Step 3 Check your answer by using a table to find values of x for which **Y1** equals **Y2**. Press **2nd GRAPH** (TABLE). The table confirms that **Y1** and **Y2** have the same value when $x = 2$. Notice that **Y1** is undefined when $x = 3$.

X	Y1	Y2
-1	-25	-5
0	-3333	-5
1	-15	-5
2	-5	-5
3	ERR	-5
4	15	-5
5	25	-5

X=2

Try This

Solve by using a graph and a table.

1. $\frac{x - 1}{x + 1} = 3$

2. $\frac{2}{x + 4} = 2$

3. $\frac{x - 3}{2x - 9} = -1$

4. $\frac{x}{x - 4} = 5$

5. $\frac{x + 2}{x - 1} = 2$

6. $\frac{4}{x} = x$



LESSON
8-5A

Technology Lab

Solving Rational Equations and Inequalities continued

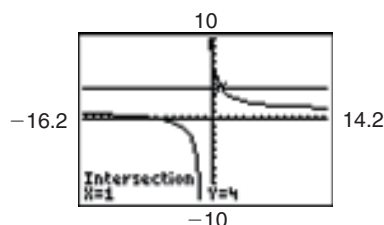
Activity 2

Solve $\frac{x+7}{x+1} \leq 4$ by using a graph and a table.

Step 1 Enter $(x+7)/(x+1)$ for **Y1** and **4** for **Y2**, as shown.



Step 2 Press **GRAPH** to view the graphs of the functions. The screen shows that the graph of **Y1** has a vertical asymptote at $x = -1$ and that **Y1** and **Y2** have the same value when $x = 1$.



The value of **Y1** is less than or equal to the value of **Y2** when $x < -1$ or when $x \geq 1$. Therefore, the solution of the inequality $\frac{x+7}{x+1} \leq 4$ is $x < -1$ or $x \geq 1$.

Step 3 Check your answer by using a table to find values of x for which **Y1** is less than or equal to **Y2**. Press **2nd** **GRAPH** (TABLE). The table supports the answer that **Y1** is less than or equal to **Y2** when $x < -1$ or when $x \geq 1$. Notice that **Y1** is undefined when $x = -1$.

X	Y1	Y2
-2	5	4
-2	5	4
-1	ERR	4
0	7	4
1	4	4
2	2.5	4

Try This

Solve by using a graph and a table.

1. $\frac{x+6}{x-4} < 6$

2. $\frac{4}{x-7} > 4$

3. $\frac{x-3}{2x+4} \geq -2$

4. $\frac{x}{x+3} \leq 4$

5. $\frac{x+8}{x-4} > 3$

6. $\frac{9}{x} < 3$

TEKS 2A.10.D, 2A.10.E



LESSON

8-5B

Technology Lab

Solving Problems with Rational Inequalities

Use with Lesson 8-5

You can use a graphing calculator to solve application problems involving rational inequalities.

Activity 1

If Rochelle and Jamie work together, it takes them at least 1.5 hours to mow a lawn. If Rochelle works by herself, it takes her at least 4 hours to mow the lawn. What is the least amount of time it would take Jamie to mow the lawn if she works by herself?

Step 1 Write an inequality. Let x represent the least number of hours Jamie needs to mow the lawn by herself.

Rochelle's rate \times time + Jamie's rate \times time \leq 1 complete job

$$\frac{1}{4}(1.5) + \frac{1}{x}(1.5) \leq 1$$

Step 2 Multiply both sides of the inequality by the LCD of the denominators, or $4x$. Because x represents time, you can assume that its value is positive. Therefore, you do not need to reverse the inequality symbol when you multiply both sides by $4x$.

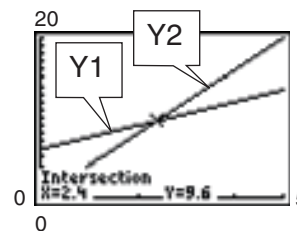
$$\frac{1}{4}(1.5)(4x) + \frac{1}{x}(1.5)(4x) \leq 1(4x)$$

$$1.5x + 6 \leq 4x$$

Step 3 Enter $1.5x + 6$ for **Y1** and $4x$ for **Y2** on a graphing calculator, as shown.



Step 3 Graph the functions in an appropriate window. Press **WINDOW**. Because x must be greater than 0, set the value of **Xmin** to 0. Then adjust the values of **Xmax**, **Ymin**, and **Ymax** so that you can see the intersection point of the functions. In this case, use 5 for **Xmax**, 0 for **Ymin**, and 20 for **Ymax**. Press **GRAPH**.



The graph shows that for positive values of x , **Y1** is less than or equal to **Y2** when $x \geq 2.4$. Therefore, it will take Jamie at least 2.4 hours to mow the lawn by herself.



LESSON
8-5B

Technology Lab

Solving Problems with Rational Inequalities continued

Try This

1. If Sasha and Annette work together, it takes them at least 2 days to paint a house. If Sasha works by herself, it takes her at least 3 days to paint a house. What is the least amount of time it would take Annette to paint a house if she works by herself? _____

Activity 2

It takes a riverboat at least 4 hours to travel 9 miles downstream and 9 miles upstream. If the average speed of the boat in still water is 6 mi/h, what is the minimum average speed of the current?

Step 1 Write an inequality. Let x represent the speed of the current.

Time downstream + Time upstream \leq Total maximum time

$$\frac{9}{6 + x} + \frac{9}{6 - x} \leq 4$$

Step 2 Multiply both sides of the inequality by the LCD of the denominators, or $(6 + x)(6 - x)$. Because the quantities $(6 + x)$ and $(6 - x)$ represent speeds, you can assume that their value is positive. Therefore, you do not need to reverse the inequality symbol when you multiply both sides by $(6 + x)(6 - x)$.

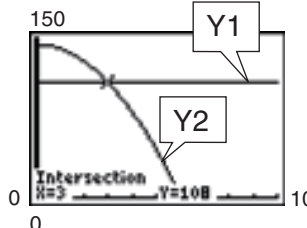
$$\begin{aligned} \frac{9}{6 + x}(6 + x)(6 - x) + \frac{9}{6 - x}(6 + x)(6 - x) &\leq 4(6 + x)(6 - x) \\ 9(6 - x) + 9(6 + x) &\leq 4(6 + x)(6 - x) \\ 108 &\leq 144 - 4x^2 \end{aligned}$$

Step 3 Enter **108** for **Y1** and **144 - 4X²** for **Y2** on a graphing calculator.



Step 4 Graph the functions in an appropriate window, as shown.

The graph shows that for positive values of x , **Y1** is less than or equal to **Y2** when $x \leq 3$. Therefore, the minimum average speed of the current is 3 mi/h.



Try This

1. It takes a tour boat at least 8 hours to travel 24 miles upstream and 24 miles downstream on a river. If the average speed of the boat in still water is 8 mi/h, what is the minimum average speed of the current?

Answer Key continued

TECH LAB 8-5A

Activity 1

Try This

1. $x = -2$
2. $x = -3$
3. $x = 4$
4. $x = 5$
5. $x = 4$
6. $x = \pm 2$

Activity 2

Try This

1. $x < 4$ or $x > 6$
2. $7 < x < 8$
3. $x < -2$ or $x \geq -1$
4. $x \leq -4$ or $x > -3$
5. $4 < x < 10$
6. $x < 0$ or $x > 3$

TECH LAB 8-5B

Activity 1

Try This

1. 6 days

Activity 2

Try This

1. 4 mi/h

TECH LAB 8-8

Activity 1

Try This

1. $x = -1$
2. $x = 9$
3. $x = 10$
4. $x = 7$
5. $x = -3$
6. $x = 7$

Activity 2

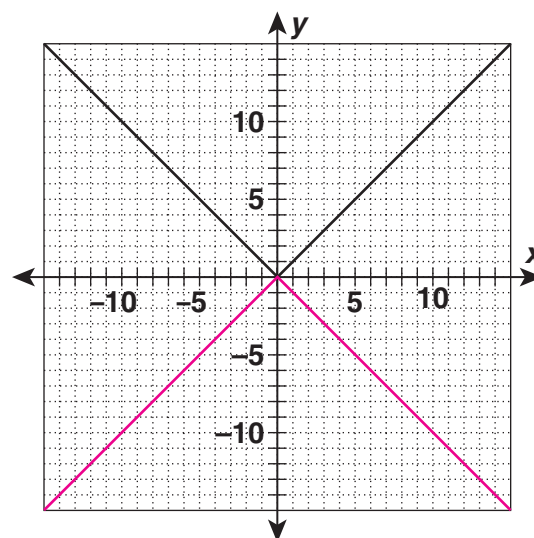
Try This

1. $-7 < x < -6$
2. $x > 10$
3. $x \geq 5$
4. $-4 < x < 0$
5. $x < -8$
6. $-2 < x < 7$

LAB 9-3

Try This

1.



2.

