Amplify Math TENNESSEE

Algebra 1

Student Edition

About Amplify

Amplify is dedicated to collaborating with educators to create learning experiences that are rigorous and riveting for all students. Amplify creates K–12 core and supplemental curriculum, assessment, and intervention programs for today's students.

A pioneer in K–12 education since 2000, Amplify is leading the way in next-generation curriculum and assessment. All of our programs provide teachers with powerful tools that help them understand and respond to the needs of every student.

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Volume 1

Unit 1 Linear Equations, Inequalities, and Systems

In this unit, you will encounter a range of situations, from high school to adulthood. Along the way, you will discover how constraints connect to equations and inequalities, and how they can be used to help with decision-making.

Unit Narrative:
Adulting (Making Life Decisions)

● = *Tennessee-specific lessons*

LAUNCH **1.01** Homecoming in Style 4

Sub-Unit 1 Writing and Modeling With Equations and Inequalities 11

1.02 Writing Equations to Model Relationships 12
1.03 Strategies for Determining Relationships 20
1.04 Equations and Their Solutions 27
1.05 Writing Inequalities to Model Relationships 34
1.06 Equations and Their Graphs 41

How did a tragic accident end a three-month strike?
Revisit how equations and inequalities can be used to model real-world situations, and how they can help you make decisions.

Sub-Unit 2 Manipulating Equations and Understanding Their Structure 49

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1.11 Connecting Equations in Standard Form to Their Graphs 78
1.12 Connecting Equations in Slope-Intercept Form to Their Graphs 85
1.12A Compound Linear Inequalities TN-1

How do first-gen Americans vault the hurdles of college?
"Solving" an equation doesn't always mean finding an unknown value — sometimes it can mean changing the equation's very structure.

Sub-Unit 3 Solving Inequalities and Graphing Their Solutions 93

1.12B Absolute Value Equations TN-8
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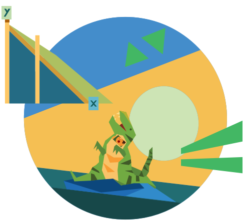
1.14 Solving Two-Variable Linear Inequalities 101
1.15 Graphing Two-Variable Linear Inequalities (Part 1) 109
1.16 Graphing Two-Variable Linear Inequalities (Part 2) 118

What's after high school?
Whether you work, intern, attend college, or do something else, inequalities can be used to model your time and money, helping you manage both of them.

● = *Tennessee-specific lessons*



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1.21 Solving Systems by Elimination: Multiplying 154

1.22 Systems of Linear Equations and Their Solutions 161

Are you a ‘Boomerang-er’?

For better or for worse, life is full of constraints. Discover new strategies for solving problems with multiple constraints, which you will see time and again.

Sub-Unit 5 Systems of Linear Inequalities in Two Variables 169

1.23 Graphing Systems of Linear Inequalities 170

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1.25 Modeling With Systems of Linear Inequalities 185

Is there such a thing as too much choice?

What happens when the decisions become more complicated? Look at the big picture and then fine-tune where the decision overlaps.

CAPSTONE **1.26** Linear Programming 192

Unit 2 Data Analysis and Statistics

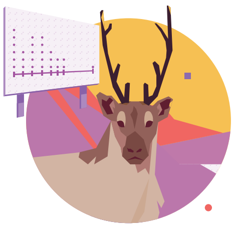
Unit Narrative:
Analyzing Climate Change

In this unit, you will explore data sets with one or two variables, often related to one of the most pressing threats we face as humanity: climate change. Along the way, you will encounter new statistical measures of center, spread, and association.

Note: *Lessons in gray are recommended to be omitted.*

LAUNCH

2.01 What Is a Statistical Question? 204



Sub-Unit 1 Data Distributions 211

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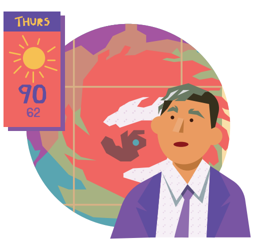
2.03 The Shape of Distributions 219
2.04 Deviation From the Center 225
2.05 Measuring Outliers 234
2.06 Data With Spreadsheets 242

How can we protect ourselves from a zombie virus?
Remember dot plots, histograms, and box plots? Revisit them through temperature data, while describing the data's center and variability.



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Is Sandy the new normal?
Meet the most commonly used measure of variability: standard deviation.

Sub-Unit 3 Bivariate Data 285

2.11 Representing Data With Two Variables 286
2.12 Linear Models 293
2.13 Residuals 300
2.14 Line of Best Fit 309

What is "Day Zero"?
You've seen linear models before, but now you will (finally!) see how to identify the "best" model, using what are called residuals.

Sub-Unit 4 Categorical Data 317

2.15 Two-Way Tables 318
2.16 Relative Frequency Tables 324
2.17 Associations in Categorical Data 331

What makes storms worse and has nothing to do with the weather?
Use two-way tables to see how the changing climate has affected marginalized people around the world.

Note: *Lessons in gray are recommended to be omitted.*

Sub-Unit 5 Correlation 337

2.18 "Strength" of Association 338

2.19 Correlation Coefficient (Part 1) 346

2.20 The Correlation Coefficient (Part 2) 353

2.21 Correlation vs. Causation 361

Who is the "water warrior"?

Finally, you can say just how strong or weak an association is using a new statistical measure: the correlation coefficient.

CAPSTONE **2.22** Cutting Through Misleading Statistical Claims 370

Unit 3 Functions and Their Graphs

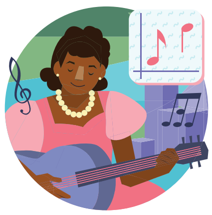
Unit Narrative:
Artscapes

You will expand your understanding of functions, their representations and graphs. Along the way, you will write, graph, and interpret a variety of functions and their inverses.

Note: *Lessons in gray are recommended to be omitted.*

LAUNCH

3.01 Music to Our Ears 380



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3.03 Function Notation 399
3.04 Interpreting and Using Function Notation 406
3.05 Using Function Notation to Describe Rules (Part 1) 413
3.06 Using Function Notation to Describe Rules (Part 2) 420

How did the blues find a home in Memphis?
Remember representing functions with description, tables, graphs, and equations? Take another look as you visit Memphis, and meet another common tool to represent and interpret functions: *function notation*.

Sub-Unit 2 Analyzing and Creating Graphs of Functions 427

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3.08 Understanding Scale 435
3.09 How Do Graphs Change? 441
3.10 Where Are Functions Changing? 447
3.11 Domain and Range 455
3.12 Interpreting Graphs 463
3.13 Creating Graphs of Functions 469

What's the function of a jazz solo?
The way you describe a graph helps you gain insight on the relationship it represents. *Average rate of change*, *domain*, and range help to construct and interpret graphs more precisely.

Sub-Unit 3 Piecewise Functions 477

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3.17 Absolute Value Functions 499

Where did the world meet soul?
Piecewise functions allow you to represent a relationship between two quantities as a set of rules. The absolute value function is a specific piecewise function that represents the distance from zero.

Sub-Unit 4 Inverses of Functions 507

3.18 Inverses of Functions 508
3.19 Finding and Interpreting Inverses of Functions 515
3.20 Writing Inverses of Functions to Solve Problems 522
3.21 Graphing Inverses of Functions 530

How do you get Sunday shoppers to hear your song?
What happens if you reverse the process used in a relationship between two quantities? What changes? What stays the same? You can explore these questions using inverses of functions.

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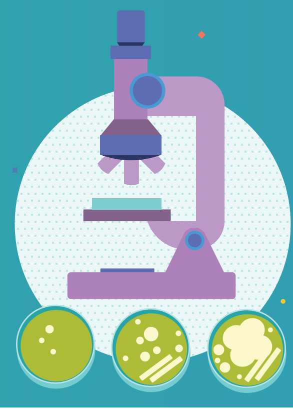
3.22 Freerunning Functions 537

Volume 2

Unit 4 Introducing Exponential Functions

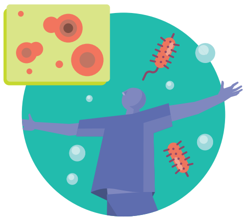
This is a unit of mathematical discovery, where relationships between quantities are unlike any function you have seen up to this point. You will encounter the explosiveness of exponential growth, as well as the lingering of exponential decay, through the lenses of infectious disease, vaccination, and prescription drug costs.

Unit Narrative: Infection Diseases, Vaccines, and Costs



LAUNCH

4.01 What Is an Epidemic? ... 546



Sub-Unit 1 Looking at Growth ... 553

4.02 Patterns of Growth ... 554

4.03 Growing and Growing ... 561

Where do baby bacteria come from?

Examine nonlinear functions using tables and graphs, before defining an exponential relationship. You'll represent exponential growth using an equation and explore it in context.

Sub-Unit 2 A New Kind of Relationship ... 569

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4.05 Understanding Decay ... 577

4.06 Representing Exponential Decay ... 585

4.07 Exploring Parameter Changes of Exponentials ... 591

How did an enslaved person save the city of Boston?

Examine growth factors between 0 and 1, as you develop an understanding of exponential decay.

Sub-Unit 3 Exponential Functions ... 599

4.08 Analyzing Graphs ... 600

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4.11 Interpreting Exponential Functions ... 624

4.12 Modeling Exponential Behavior ... 632

4.13 Reasoning About Exponential Graphs ... 640

4.14 Looking at Rates of Change ... 646

What does growing or shrinking look like on a graph?

Identify exponential relationships as exponential functions, and whether a graph is discrete.

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4.15 Recalling Percent Change 656

4.16 Functions Involving Percent Change 663

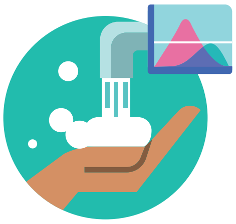
4.17 Compounding Interest 670

4.18 Expressing Exponentials in Different Ways 677

4.19 Different Compounding Intervals 684

Want to be CEO for a day?

Make sense of repeated percent increase and see how it relates to compound interest.



Sub-Unit 5 Comparing Linear and Exponential Functions 693

4.20 Which One Changes Faster? 694

4.21 Changes Over Equal Intervals 701

How does distance make the curve grow flatter?

Compare the growth of different kinds of functions and finish with an exploration of how social distancing can combat the dangers of an epidemic.

CAPSTONE **4.22** COVID-19 709

Unit 5 Introducing Quadratic Functions

Unit Narrative:
Squares in Motion

What goes up must come down. In this unit, you will study quadratic functions. By analyzing and comparing patterns, tables, graphs, and equations, you will gain an appreciation for the special features of quadratic functions and the situations they represent.

● = *Tennessee-specific lessons*

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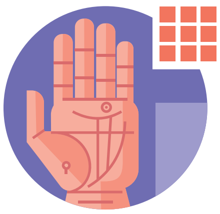
5.01 The Perfect Shot 720



Sub-Unit 1 A Different Kind of Change 727

5.02 A Different Kind of Change 728
5.03 How Does It Change? 736
5.04 Squares 745
5.05 Seeing Squares as Functions 752

What's the best shape for a crystal ball?
Dive into quadratic expressions by examining patterns of growth and change.

Sub-Unit 2 Quadratic Functions 761

5.06 Comparing Functions 762
5.07 Building Quadratic Functions to Describe Falling Objects 770
5.08 Building Quadratic Functions to Describe Projectile Motion 779
5.09 Building Quadratic Functions to Maximize Revenue 786

What would sports be like without quadratics?
Use quadratic functions to model objects flying through the air or revenues earned by companies.

Sub-Unit 3 Quadratic Expressions 795

5.10 Equivalent Quadratic Expressions (Part 1) 796
5.11 Equivalent Quadratic Expressions (Part 2) 803
5.11A Operations With Polynomials TN-28
5.12 Standard Form and Factored Form 811
5.13 Graphs of Functions in Standard and Factored Forms 818

How do you put the "quad-" in quadratics?
Use area diagrams and algebra tiles to factor quadratic expressions as you explore equivalent ways to write them.

Sub-Unit 4 Features of Graphs of Quadratic Functions 825

5.14 Graphing Quadratics Using Points of Symmetry 826
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5.19 Vertex Form 866
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5.21 Changing Parameters and Choosing a Form 880
5.22 Changing the Vertex 888

Mirror, mirror on the wall, what's the fairest function of them all?
Quadratics have their own beauty, and different forms help you identify features of their graphs.

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5.23 Monster Ball 895

Unit 6 Quadratic Equations

In this unit, you will explore how people have learned to solve quadratic equations throughout history. You will write, solve, and explore strategies for solving quadratic equations.

Unit Narrative:
The Evolution of Solving Quadratic Equations

Note: *Lessons in gray are recommended to be omitted.*
● = *Tennessee-specific lessons*

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6.01 Determining Unknown Inputs 906

Sub-Unit 1 Connecting Quadratic Functions to Their Equations 913

6.02 When and Why Do We Write Quadratic Equations? 914
6.03 Solving Quadratic Equations by Reasoning 920
6.04 The Zero Product Principle 927
6.05 How Many Solutions? 933

How did the Nile River spur on Egyptian mathematics?
Revisit projectile motion and maximizing revenue, as you discover new meanings for the zeros of a quadratic function.

Sub-Unit 2 Factoring Quadratic Expressions and Equations 941

6.06 Writing Quadratic Expressions in Factored Form (Part 1) 942
6.07 Writing Quadratic Expressions in Factored Form (Part 2) 948
6.08 Special Types of Factors 956
6.09 Solving Quadratic Equations by Factoring 963
6.10 Writing Non-Monic Quadratic Expressions in Factored Form 970

When is zero more than nothing?
Understand the importance of zero when solving quadratic equations. Then, efficiently factor quadratics using a variety of strategies.

Sub-Unit 3 Completing the Square 979

6.11 Square Expressions 980
6.12 Completing the Square 986
6.13 Solving Quadratic Equations by Completing the Square 994
6.14 Writing Quadratic Expressions in Vertex Form 1002
6.15 Solving Non-Monic Quadratic Equations by Completing the Square 1011
6.15A Solving Quadratic Inequalities TN-36

How many ways can you crack an egg?
Discover the ancient art of taking a quadratic expression and completing the square. It's all about that missing piece.

Sub-Unit 4 Roots and Irrationals 1019

6.16 Quadratic Equations With Irrational Solutions 1020
6.17 Rational and Irrational Numbers 1028
6.18 Rational and Irrational Solutions 1036

Where does a number call its home?
Subtraction and division took you from whole numbers to rationals. Now you must look beyond them as you operate with irrational numbers.

Note: *Lessons in gray are recommended to be omitted.*

Sub-Unit 5 The Quadratic Formula 1047

6.19 A Formula for Any Quadratic 1048

6.20 The Quadratic Formula 1056

6.21 Error Analysis: Quadratic Formula 1064

6.22 Applying the Quadratic Formula 1071

6.23 Systems of Linear and Quadratic Equations 1079

What was the House of Wisdom?

Discover strategies for solving any quadratic equation. You will also determine which strategies are more efficient.

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6.24 The Latest Way to Solve Quadratic Equations 1086

Name: ______________________ Date: __________ Period: __________

Unit 1 | Tennessee Lesson 12A

Compound Linear Inequalities

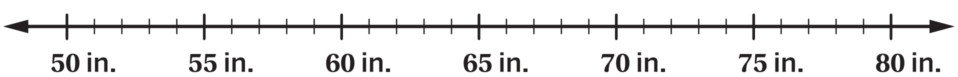
Let's explore the solutions of two inequalities joined together.

Warm-up How Tall Could Kiran Be?

Kiran does not know exactly how tall he is. What Kiran *does* know is that he is taller than his father but is shorter than his mother.

Kiran finds out his father is 5 ft, 8 in. tall and his mother is 6 ft tall.

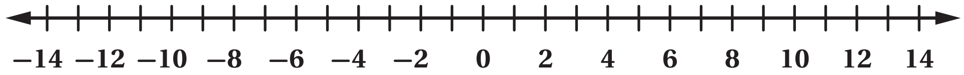
Plot three points on the number line that could represent Kiran's height.



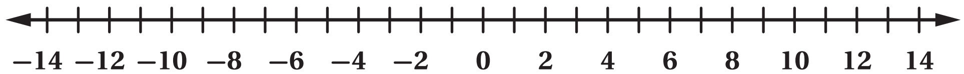
Activity 1 Graphing Solutions for Simple and Compound Inequalities

For each inequality, graph the solution on the number line provided.

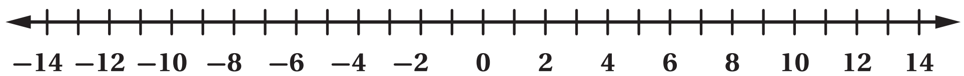
1. $5 \le x$



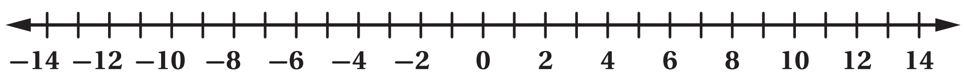
2. $x < -2.5$



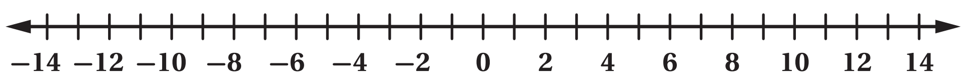
3. $x \ge 5$



4. $-7 < x \le 5$



5. $2.5 \le 4 + 0.5x < 6$



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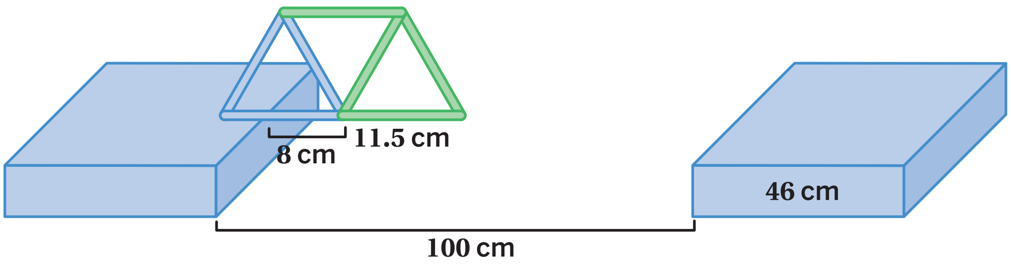
Activity 2 Building a Bridge

For his Introduction to Engineering class, Tyler is tasked with building a bridge to reach across a certain span.

The bridge must span at least 100 cm, but not be longer than 146 cm. There is one section already built that covers 8 cm of the span. Each section that Tyler adds to the bridge is 11.5 cm long.



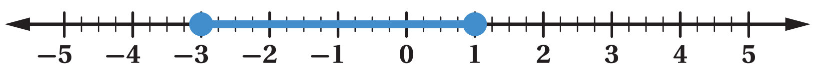
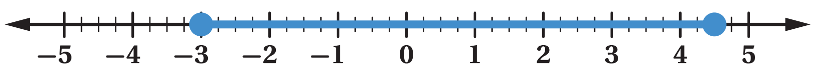
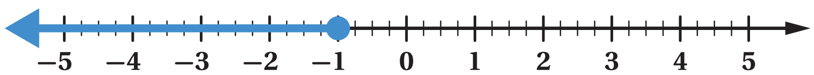
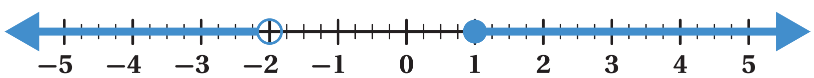
Write an inequality to represent how many sections s that Tyler can add to this bridge to cover the span.

1. Solve the inequality and graph the solution on a number line.

2. Interpret and explain the meaning of the solution in context.

Activity 3 Card Sort: Many Inequalities, Same Solution

You will be given a set of cards. Match each solution with the inequalities it represents. Not all inequalities will match with a solution.

Solutions	Inequalities
1. 	
2. 	
3. 	
4. 	

STOP

Name: ________________ Date: ________ Period: ________

Summary

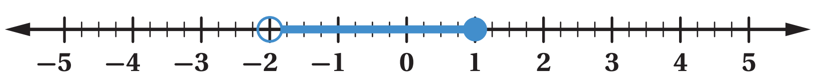
In today's lesson . . .

You explored a type of inequality where two inequalities are joined. These are called ***compound inequalities***.

Just as with a system of equations, the solution to a compound inequality is the set of values that satisfy both inequalities. You solve compound inequalities by separating them into individual statements and then solving each one independently. Then you consider how the solution set for each relates to the other solution set. For an *and* compound inequality, the solutions must satisfy both statements. For an *or* compound inequality, the solutions can satisfy either.

A solution to a compound inequality can be graphed on a number line. It is important to pay attention to the type of comparison symbols used in the compound inequality when graphing the solution. Strict inequalities, such as *greater than*, and *less than*, require an open circle at the boundary value. Non-strict inequalities, such *as greater than or equal to*, and *less than or equal to*, use a closed circle at the boundary value.

Consider the inequalities $-2 < x \leq 1$ and $-1 < x + 1 \leq 2$. Both of these compound inequalities share the same solution because they are *equivalent*.

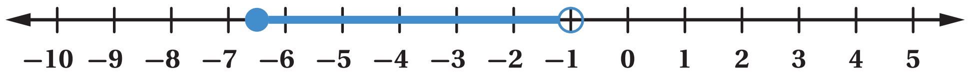


Reflect:

Name: ______ Date: ______ Period: ______

Practice

1. Select the graph that shows the solution to the compound inequality, $-6.5 < x \leq -1$.

A.


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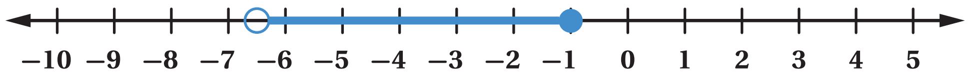

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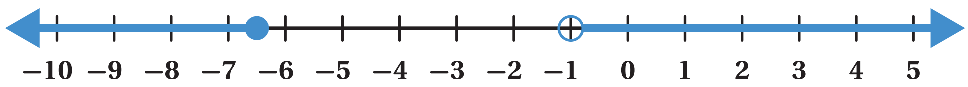

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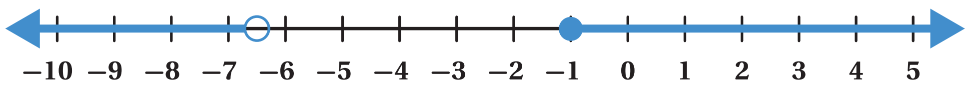
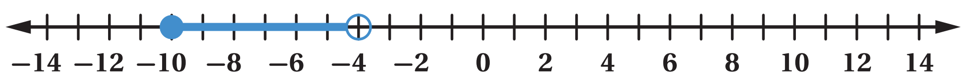


2. Select *all* of the compound inequalities that have the solution shown on the graph.



A. $-10 \leq x \leq -4$

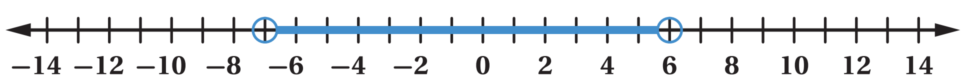
B. $-1 > 0.5x + 1 \geq -4$

C. $-8 \leq x + 2 \leq -2$

D. $-16 \leq 2x + 4 < -4$

E. $x \geq -10$ and $x < -4$

3. Write a number in each box to create a compound inequality with the solution shown on the graph.



$\boxed{} < 2x - 5 < \boxed{}$

Name: .... Date: .... Period: ....

Practice

4. Match each equation in Column 1 with an equivalent equation in Column 2. Not all equations in Column 2 will be used.

Column 1	Column 2
a $2x - 8 = x + 8$	.... $-6\,x = x + 8$
	.... $x = -16$
b $2(x - 8) = x + 8$	.... $2x - 16 = 8 + x$
c $x - 2x = 8 - (-8)$	.... $2x = x + 16$
	.... $2x - 8 = x + 8$

5. The equation $F = 1.8(K - 273) + 32$ can be used to convert the temperature from degrees Kelvin K to degrees Fahrenheit F. Write an equation that could be used to efficiently calculate the degrees in Kelvin.

6. Explain why $|10|$ and $|-10|$ have the same value.

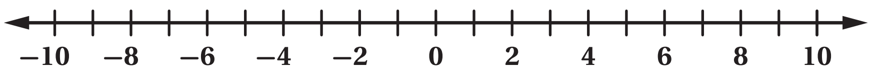
Absolute Value Equations

Let's solve equations involving absolute value.

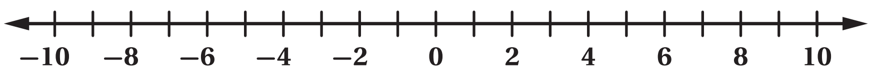
Warm-up Math Talk

Mark all points that are the following distances from 0 on each number line. Be prepared to explain your thinking.

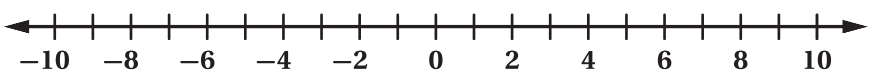
a 4



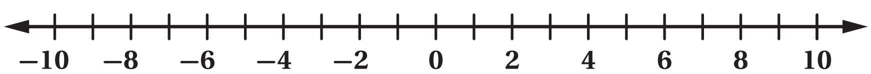
b 7



c 0



d −5



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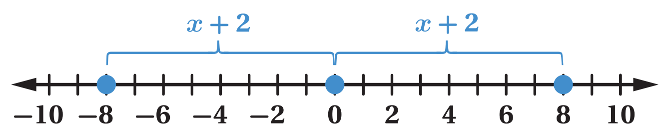
Name: ______________________ Date: __________ Period: __________

Activity 1 Two Ways to Solve Absolute Value Equations

Diego and Jada are trying to solve the equation $|x+2| = 8$. Their work is shown.

Diego's method	Jada's method
$|x+2| = \begin{cases} x+2, & \text{if } x+2 \geq 0 \\ -(x+2), & \text{if } x+2 < 0 \end{cases}$ So I need to consider two cases: • If $x+2 \geq 0$, then $x+2 = 8$. • If $x+2 < 0$, then $-(x+2) = 8$.	Since absolute value represents the distance a number is from 0, $|x+2| = 8$ must mean that the expression $x+2$ is 8 units away from 0. That means $x+2$ is equal to either 8 or -8.  $x+2=-8$ $x+2=8$

1. Do you agree with Diego or Jada? Explain or show your thinking.

2. Use any method to solve the equation $|x+4| = 10$.

Activity 2 Solving Absolute Value Equations

Solve each equation. Show your thinking.

1. $|x - 22| = 59$

2. $|x + 3.2| = 9.7$

3. $|-6x| = 5.4$

Name: ______ Date: ______ Period: ______

Activity 2 Solving Absolute Value Equations (continued)

4. $25 + |x| = 65$

5. $|2x + 6| - 17 = 43$

6. $\left|3 - \frac{1}{2}x\right| + 3 = 1$

STOP

Summary

In today's lesson . . .

You recalled what is meant by the absolute value of a number and used this knowledge to make sense of solving equations involving absolute value.

You saw that there are typically two solutions to an absolute value equation. Because it is possible for the expression inside the absolute value symbol to be equal to two different values, you can solve the absolute value equation by writing and solving two related equations.

You saw two different strategies for determining these equations.

Consider the equation $|x+3|=12$:

Here is one strategy.

Case 1:

For $x+3 \geq 0$, the equation is

$$x+3=12$$
$$x=9$$

Check:

$$|9+3|=12$$
$$|12|=12$$

Case 2:

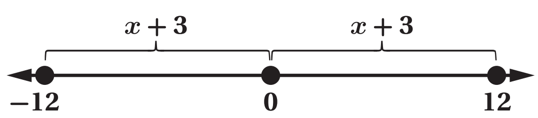
For $x+3<0$, the equation is

$$-(x+3)=12$$
$$x=-15$$

Check:

$$|-15+3|=12$$
$$|-12|=12$$

Here is another strategy.



$$x+3=-12$$
$$x=-15$$

Check:

$$|-15+3|=12$$
$$|-12|=12$$

$$x+3=12$$
$$x=9$$

Check:

$$|9+3|=12$$
$$|12|=12$$

When an absolute value equation includes operations outside of the absolute value symbol, you can use the properties of real numbers to isolate the absolute value expression.

Remember to check your solutions by substituting them into the original absolute value equation.

Reflect:

Name: ______ Date: ______ Period: ______

Practice

1. Which of the following statements is *not true* about the absolute value equation $|x+8|=24$?

   A. $x+8$ is 24 units from 0.

   B. The equation has two solutions.

   C. -32 is a solution.

   D. The distance between x and 24 is 8.

   E. The distance between $x+8$ and 0 is 24.

   F. The distance between $x-8$ and 0 is 24.

2. Solve each equation.

   a. $|x+14|=81$

   b. $|-x-5|=36$

   c. $2.1+|3x|=1.8$

Practice

Name: ______ Date: ______ Period: ______

3. Consider the equation: $|x - 5| = 0$.

a Explain why this equation has only one solution.

b Solve for x.

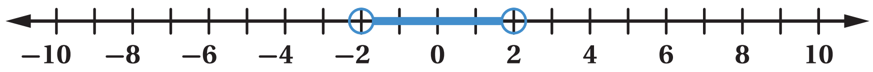
4. Consider the equation: $3x - 9y = 18$

Solve the equation for x:

Solve the equation for y:

5. Solve the inequality $-9 \leq -2x + 5 \leq 7$. Then graph the solution.

6. Write a compound inequality for the graph shown. Then explain why this is a solution to $|x| < 2$.



Name: ______ Date: ______ Period: ______

Unit 1 | Tennessee Lesson 12C

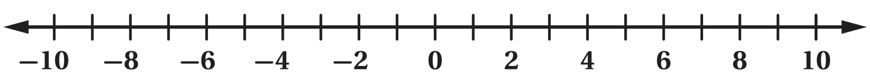
Absolute Value Inequalities

Let's solve inequalities involving absolute value.

Warm-up Compound Inequalities?

1. What values satisfy this inequality $|x| \le 6$?

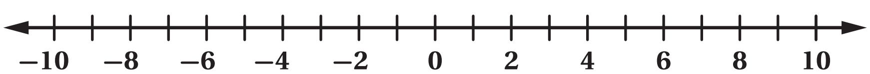
   a. Plot your answer on the number line.



   b. Write an inequality to represent the values you graphed in part a.

2. What values satisfy this inequality $|x| > 2$?

   a. Plot your answer on the number line.



   b. Write an inequality to represent the values you graphed in part a.

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Activity 1 Solving Absolute Value Inequalities

Solve each absolute value inequality. You may sketch a number line to help you.

1. $|x + 7| \leq 3$

2. $|1.25x| > 5$

3. $|-x| < 2.7$

Name: ______________ Date: ______________ Period: ______________

Activity 1 Solving Absolute Value Inequalities (continued)

4. $|3 - x| \geq \frac{15}{2}$

5. $|3x| + 3 \leq 7$

6. $12 + |x| < 9$

Activity 2 Card Sort: Absolute Value Inequalities

You will be given a set of cards containing absolute value inequalities and the graphs of their solutions. Match each inequality with the graph that represents its solution. Record your matches and be prepared to explain your thinking.

Graph of solution	Corresponding inequality

Are you ready for more?

Determine the solution for the card that has no match and plot your answer on the number line shown.

STOP

Name: ______________________ Date: __________ Period: __________

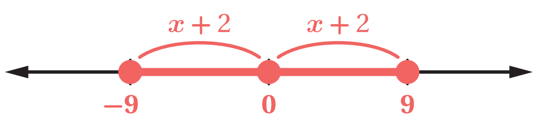
Summary

In today's lesson . . .

You determined the solutions to absolute value inequalities by interpreting their graphs and writing equivalent compound inequalities. Just as you wrote two equations to solve an absolute value equation, you can also write two inequalities to solve an absolute value inequality. Consider the following examples:

$|x+2| \le 9$

This absolute value inequality can be solved by solving the equivalent inequality $-9 \le x+2 \le 9$.



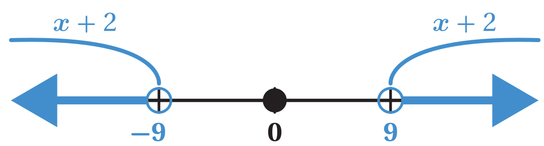
$-9 \le x+2$ $\quad$ $x+2 \le 9$

$-11 \le x$ $\quad$ $x \le 7$

The solution is $-11 \le x \le 7$.

$|x+2| > 9$

This absolute value inequality can be solved by solving the equivalent inequality $x+2 < -9$ or $x+2 > 9$.



$x+2 < -9$ $\quad$ $x+2 > 9$

$x < -11$ $\quad$ $x > 7$

The solution is $x < -11$ or $x > 7$.

An absolute value inequality typically results in the intersection or union of two solution sets. However, if an absolute value expression is less than (or less than or equal to) a negative value, there is no solution. For example, $|x+2| \le -9$ has no solution because the absolute value of a number represents distance, which is a nonnegative value.

Conversely, if an absolute value expression is greater than (or greater than or equal to) a negative value, the solution is all real numbers. For example, the solution to $|x+2| > -9$ is all real numbers because the absolute value of the expression is a nonnegative value, which will always be greater than a negative value.

Reflect:

Practice

Name: ______________________ Date: ____________ Period: ____________

1. Solve each of the following inequalities and graph the solutions:

a. $|x + 7| - 7 \geq 8$

b. $|-2x + 19| < 5$

c. $-|x - 14| + 2 \leq 4$

2. Explain why the inequality $|x^5 - 2x| + 19 \leq 15$ has no solutions.

Name: .... Date: .... Period: ....

Practice

3. Tyler makes a mistake when solving the inequality $|-3x| + 12 > 30$. His work is shown.
$|-3x| + 12 > 30$ can be rewritten as $|-3x| > 18$.

The equivalent inequality is $-18 < -3x < 18$.

$-18 < -3x$ $\quad\quad$ $-3x < 18$

$6 > x$ $\quad\quad$ $x > -6$

The solution is $-6 < x < 6$.

Find Tyler's error(s). Then determine the correct solution to the inequality.

4. Solve the equation $5|2x + 15| - 5 = 100$. Then check your solution(s).

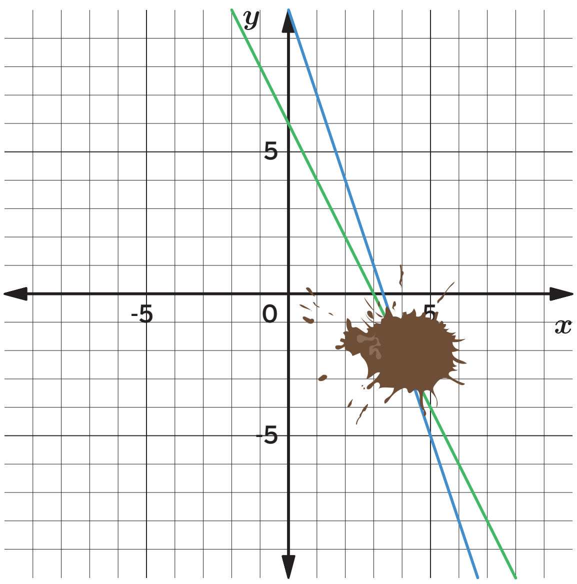
5. Write at least one solution for the inequality $x + 5 \leq 19$. Explain or show your thinking.

Solving Systems of Linear Equations

Let’s solve systems of linear equations.

Warm-up Clean up on Quadrant Four

While Priya was doing her homework, her mom accidently spilled coffee on it! Priya was graphing a system of equations to determine the solution but can no longer see where the lines intersect. Her work is shown.



Determine the ordered pair that makes both equations true.

$$\begin{cases} y = -3x + 10 \\ y = -2x + 6 \end{cases}$$

Show or explain another method Priya could use to determine the solution.

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Name: ________ Date: ________ Period: ________

Activity 1 What's the Solution?

Elena solved the system of equations from the Warm-up. Some of her work is shown.

$$\begin{cases} y = -3x + 10 \\ y = -2x + 6 \end{cases}$$

Elena's work:

$$\begin{aligned} -3x + 10 &= -2x + 6 \\ -x + 10 &= 6 \\ -x &= -4 \\ x &= 4 \end{aligned}$$

1. Describe Elena's method for calculating the value of x.

2. Describe a method that Elena could use to calculate the value of y. Then use this method to determine the value of y.

3. What is the ordered pair that is a solution to the system?

Activity 2 Partner Problems

With your partner, decide who will solve the systems of equations in Column A and who will solve the systems of equations in Column B. After each row, share your responses with your partner. Although the problems in each row are different, your responses should be the same. If they are not the same, work together to correct any errors or resolve any disagreements.

Column A	Column B
1. $\begin{cases} y = -3x + 9 \\ y = 2x + 4 \end{cases}$	$\begin{cases} y = -4x + 10 \\ y = 8x - 2 \end{cases}$
2. $\begin{cases} y = 5x + 7 \\ y = 6x + 4 \end{cases}$	$\begin{cases} y = -2x + 28 \\ y = -x + 25 \end{cases}$

STOP

Name: ________ Date: ________ Period: ________

Summary

In today's lesson . . .

You discovered that for an ordered pair to be a solution to a system of equations, the x- and y-values of the ordered pair must make the equations true.

For example, consider the following system of equations:

$$\begin{cases} y = 4x - 5 \\ y = -2x + 7 \end{cases}$$

To determine the solution to the system, you can write a single equation that sets the two expressions — for which y is equal to — equal to each other:

$$\begin{aligned} 4x - 5 &= -2x + 7 \\ 6x - 5 &= 7 \\ 6x &= 12 \\ x &= 2 \end{aligned}$$

Then you can use the solution for x and any of the original equations in the system to determine the value of y:

If $x = 2$, then $y = 4(2) - 5$, $y = 3$.

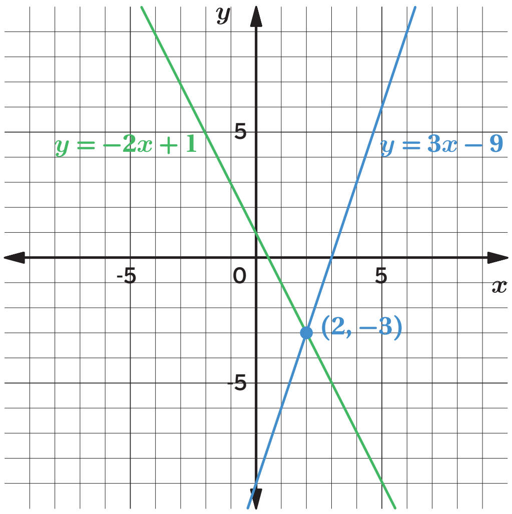
The ordered pair $(2, 3)$ is the solution to the system of equations.

Reflect:

Practice

Name: ________________ Date: ________ Period: ________

1. Use the lines shown to decide whether each statement is true or false.



a The solution to the equation $-2x + 1 = 3x - 9$ is $x = 2$.

b The point $(2, -3)$ is a solution to the following system of equations:

$$\begin{cases} y = -2x + 1 \\ y = 3x - 9 \end{cases}$$

c The point $(0, 1)$ is a solution to the equation $y = -2x + 1$.

d The point $(0, 1)$ is a solution to the equation $y = 3x + 9$

2. Solve each system of equations. Show or explain your thinking.

a $\begin{cases} y = 3x - 2 \\ y = -2x + 8 \end{cases}$

b $\begin{cases} y = -3x - 5 \\ y = 4x + 30 \end{cases}$

Name: .... Date: .... Period: ....

Practice

3. The solution to a system of equations is $(1, 5)$. Select two equations that might make up the system.

A. $y = -3x + 6$

B. $y = 2x + 3$

C. $y = -7x + 1$

D. $y = x + 4$

E. $y = -2x + 9$

4. Solve each equation. Show your thinking and check your solution.

a. $|x - 2| - 13 = 45$

b. $|2x| = 72$

5. Solve the system of equations without graphing. Show your thinking.

$$\begin{cases} y = 4x + 2 \\ y = x - 7 \end{cases}$$

Operations With Polynomials

Let's add, subtract, and multiply polynomials.

Warm-up Notice and Wonder

Study the two expressions. What do you notice? What do you wonder?

Expression 1	Expression 2
$2x^3 - 6x^4 - 1 + x^2$	$-6x^4 + 2x^3 + x^2 - 1$

1. I notice . . .

2. I wonder . . .

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Name: ________________ Date: ________ Period: ________

Activity 1 Adding and Subtracting Polynomials

1. Kiran and Elena evaluated the expression $(8x^3 + 7x^2 + 3x + 2) + (5x^2 + 2x^3 + 9)$. Each student's work and explanation are shown.

Kiran	Elena
$\begin{array}{r} (8x^3 + 7x^2 + 3x + 2) \\ + (5x^2 + 2x^3 + 9 \quad\quad) \\ \hline 13x^5 + 9x^5 + 12x + 2 \end{array}$ I lined up the terms in columns. Then I added the coefficients and exponents for each term in the same column.	$\begin{array}{r} (8x^3 + 7x^2 + 3x + 2) \\ + (2x^3 + 5x^2 \quad\quad + 9) \\ \hline 10x^3 + 12x^2 + 3x + 11 \end{array}$ I lined up the like terms in columns. Then I added the coefficients and kept the variable and exponents the same.

Which student is correct? Explain your thinking.

2. Bard and Clare each evaluated the expression $(10x^3 + 6x^2 + 5) - (8x^3 + 2x^2 + 1)$. Each student's work is shown.

Bard	Clare
$\begin{array}{r} (10x^3 + 6x^2 + 5) \\ - (8x^3 + 2x^2 + 1) \\ \hline 2x^3 + 4x^2 + 4 \end{array}$ I lined up the like terms in columns. Then I subtracted each term in the same column.	$\begin{array}{r} (10x^3 + 6x^2 + 5) \\ - (8x^3 + 2x^2 + 1) \\ \hline 2x^3 + 8x^2 + 6 \end{array}$ I lined up the like terms in columns. Then I subtracted.

Which student is correct? Explain your thinking.

Activity 1 Adding and Subtracting Polynomials (continued)

3. Match each expression in Column A with an equivalent expression from Column B.

Column A	Column B
a $(7x^2 + 5x^3 + 5) + (2x^3 - 3)$	.... $7x^3 + 7x^2 + 4$
b $(11x^3 + 5x^2 + 1) - (4x^3 + 3x^2)$	.... $7x^3 + 2x^2 + 1$
c $(10x^3 + 9x^2 + 3) - (3x^3 + 2x^2 - 1)$	.... $7x^3 + 8x^2 + 1$
d $(12x^3 + 7x^2 + 7) + (-5x^3 + x^2 - 6)$	.... $7x^3 + 7x^2 + 2$

Name: ______ Date: ______ Period: ______

Activity 2 Multiplying Polynomials

Area diagrams can be helpful when multiplying polynomials. For each problem:

- **Create an area diagram to determine the product and write it in standard form.**
- **Determine the degree, leading coefficient, and constant term.**

1. $(x - 5)(x^2 + 11)$

Degree:
Leading coefficient:
Constant term:

2. $(5x^4 - 12x^3 + x)(6x^2 - 3)$

Degree:
Leading coefficient:
Constant term:

3. $(4x - 1)(x^3 + 9x + 7)$

Degree:
Leading coefficient:
Constant term:

4. $(x - 2)(x + 4)(x + 3)$

Degree:
Leading coefficient:
Constant term:

Activity 3 Experimenting With Polynomials

Your teacher will assign you and your partner to work on a question about polynomials.

- **Try combining some polynomials to answer your question by making up your own polynomials. Keep a record of what polynomials you tried, and the results.**
- **When you think you have an answer to your question, explain your thinking using equations, visuals, calculations, words, or in any way that will help others understand your response.**

1. If you add or subtract two polynomials, will the result *always* be a polynomial?

2. If you multiply two polynomials, will the result *always* be a polynomial?

STOP

Name: ______ Date: ______ Period: ______

Summary

In today's lesson . . .

You simplified several examples of a ***polynomial***, which is a function or expression that is a sum of terms, each of which is a product of a constant and variable raised to a whole number power. Polynomials can be written in ***standard form***, a form where all the terms are ordered from greatest exponent to least exponent.

When adding or subtracting polynomials, you can combine terms with the same variable and exponent. For example,

Add like terms

$$\begin{array}{r} (9x^3+5x^2+2x) \\ +\ (8x^3-3x^2+x) \\ \hline 17x^3+2x^2+3x \end{array}$$

Subtract like terms

$$\begin{array}{r} (9x^3+5x^2+2x) \\ -\ (8x^3-3x^2+x) \\ \hline x^3+8x^2+x \end{array}$$

To determine the product of two polynomials, you can write each factor as the side lengths of the rectangle and determine its area.

$(2x^4-1)\,(3x^3-4x+5)$

$= 6x^7-8x^5+10x^4-3x^3+4x-5.$

	$3x^3$	$-4x$	5
$2x^4$	$6x^7$	$-8x^5$	$10x^4$
-1	$-3x^3$	$4x$	-5

After adding, subtracting, or multiplying polynomials, you can write the expression in standard form, if needed.

You found that when adding, subtracting, or multiplying polynomials, the result will always be a polynomial.

Reflect:

Practice

Name: .... Date: .... Period: ....

1. Match each expression in Column A with an equivalent expression from Column B.

Column A	Column B
a $(5x^3 + 3x + 1) - (7x - 5x^3 - 1)$	.... $8x^2 - 17x$
b $(2x^2 - 14x) - (6x^2 - 3x)$	.... $-3x^3 + 3x + 5$
c $(5x^3 + 3x + 1) + (7x - 5x^3 - 1)$	.... $10x^3 - 4x + 2$
d $(2x^2 - 14x) + (6x^2 - 3x)$	.... $10x$
e $(x^3 + 2x) - (4x^3 - x - 5)$	.... $-4x^2 - 11x$

2. Write each product in standard form. State the degree, leading coefficient, and constant term of each resulting polynomial.

a $(-5x^2 - 3)(6x^3 + 9x^2 - 8)$

Degree:
Leading coefficient:
Constant term:

b $(x^3 + 2x^2 - x)(9x^4 + 4)$

Degree:
Leading coefficient:
Constant term:

Name: .... Date: .... Period: ....

Practice

3. Does $(8x^3 + 6x + 9) - (8x^3 + 10x + 9)$ result in a polynomial? Explain your thinking.

4. Solve each inequality. Then sketch a graph to represent each solution.

a $\left|\frac{1}{2}x\right| > 5$

b $|3.5 - x| \leq 7.65$

5. Match each expression in Column A with an equivalent expression from Column B.

Column A	Column B
a $(x + 2)(x + 10)$	.... $2x^2 + 7x + 12$
b $(x + 4)(x + 5)$	.... $x^2 + 12x + 20$
c $(2x + 3)(x + 2)$	.... $2x^2 + 20x + 50$
d $(x + 5)(2x + 10)$	.... $x^2 + 9x + 20$

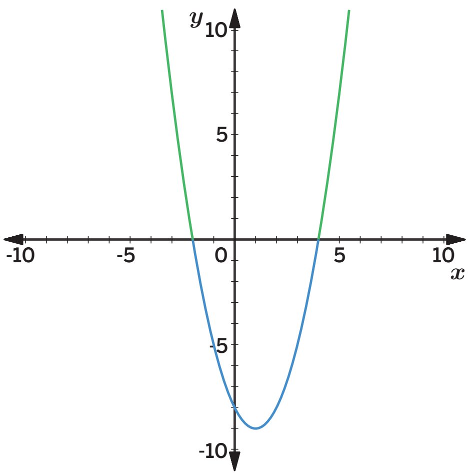
Solving Quadratic Inequalities

Let's solve quadratic inequalities using the graphs of the related quadratic equations.

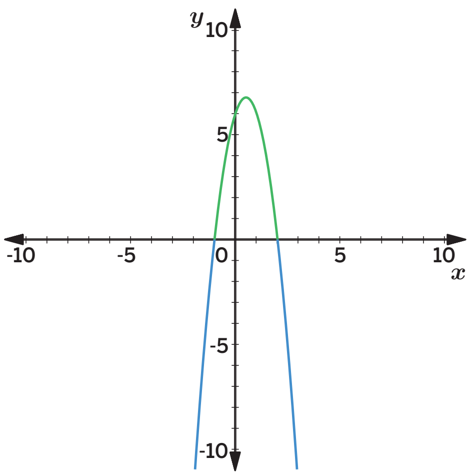
Warm-up Notice and Wonder

Study the two functions shown. What do you notice? What do you wonder?

Function $f(x)$



Function $g(x)$



1. I notice . . .

2. I wonder . . .

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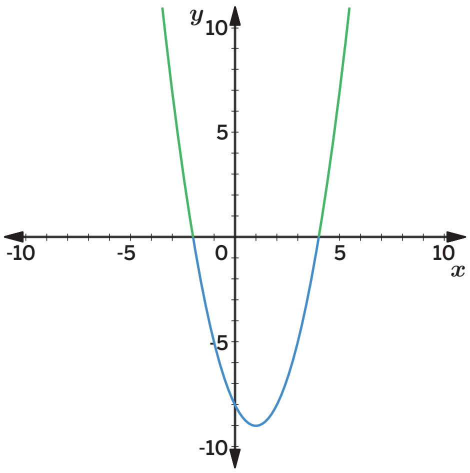
Name: ______ Date: ______ Period: ______

Activity 1 Quadratic Equations and Inequalities

The graphs and equations of the functions from the Warm-up are shown. Use the graph or the equation to solve each problem. Show or explain your thinking.

1. For what values is $(x+2)(x-4)=0$?

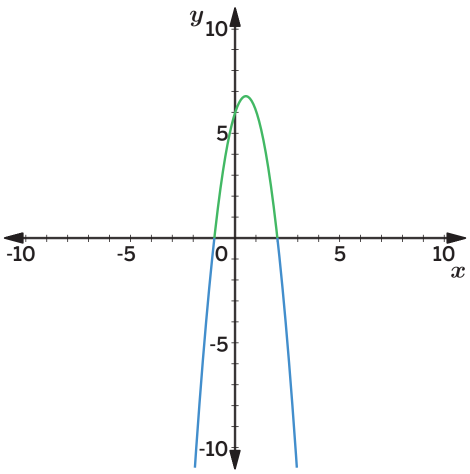
Function $f(x)=(x+2)(x-4)$



2. For what values is $(x+2)(x-4)<0$?

3. For what values is $(-3x+6)(x+1)=0$?

Function $g(x)=(-3x+6)(x+1)$

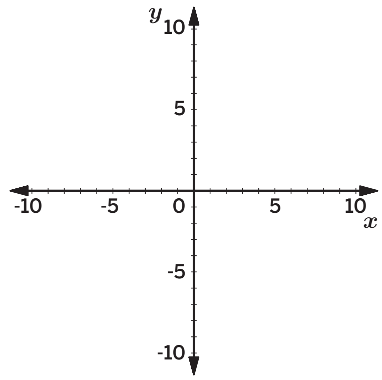


4. For what values is $(-3x+6)(x+1)<0$?

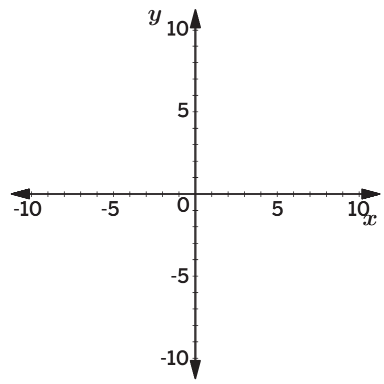
Activity 2 What is the Solution?

Determine the solution to each quadratic inequality. Use the graph to help your thinking.

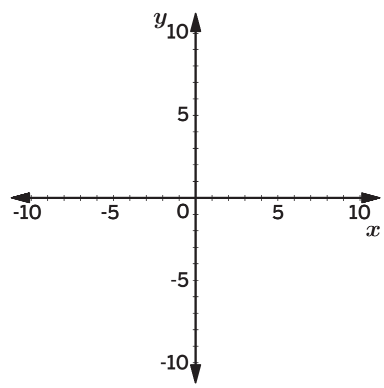
1. $(-2x+2)(x+3) \le 0$



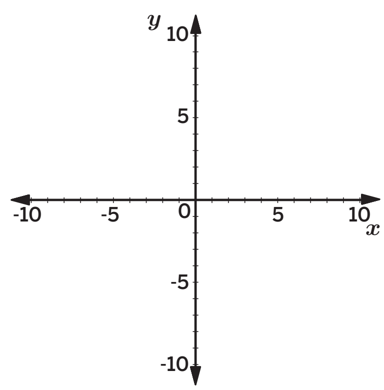
2. $3x^2 - 3x - 6 < 0$



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



4. $x^2 + 4 < 0$

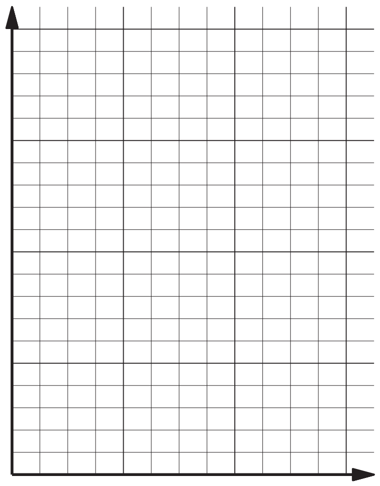


Name: ______ Date: ______ Period: ______

Activity 3 Selling Shirts

The equation $p = 25d - d^2$ gives the monthly profit p that Jada's aunt will earn selling custom shirts, if she charges d dollars for each shirt.

How much should Jada's aunt charge per shirt to earn a monthly profit of *at least* $\$100$? Show or explain your thinking. Use the graph to help your thinking.



STOP

Summary

In today's lesson . . .

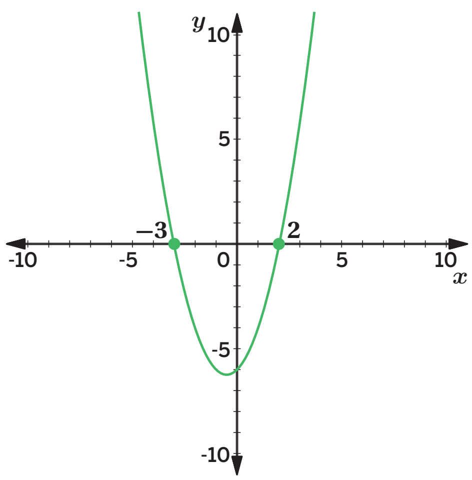
You solved quadratic inequalities using the related quadratic equation. To solve a quadratic inequality, you can solve the related quadratic equation. You can sketch the x-intercepts and use the coefficient of a in ax^2 to determine the direction in which the parabola opens.

For example, consider the inequality, $x^2 + x - 6 > 0$.

First, you can write a related quadratic equation to determine the zeros of the function.

$(x + 3)(x - 2) = 0$
$x = -3$ or $x = 2$

Next, to sketch the graph, you can plot the x-intercepts and determine whether the graph opens upward or downward.



The solution to $x^2 + x - 6 > 0$ is $x < -3$ or $x > 2$.

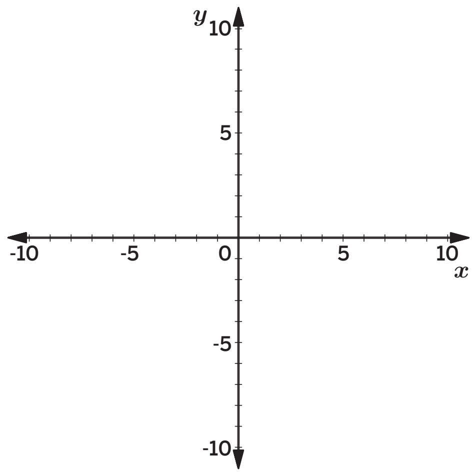
Reflect:

Practice

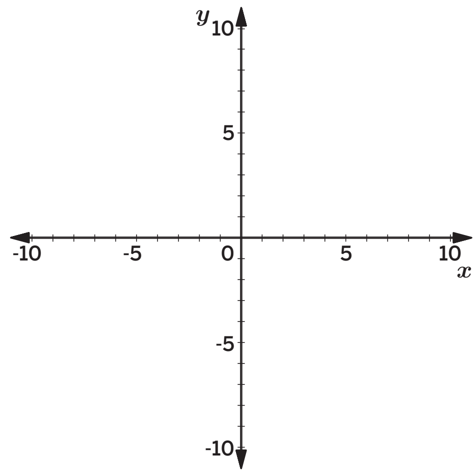
Name: ____________ Date: ____________ Period: ____________

1. Solve each quadratic inequality. Use the graph if it helps your thinking.

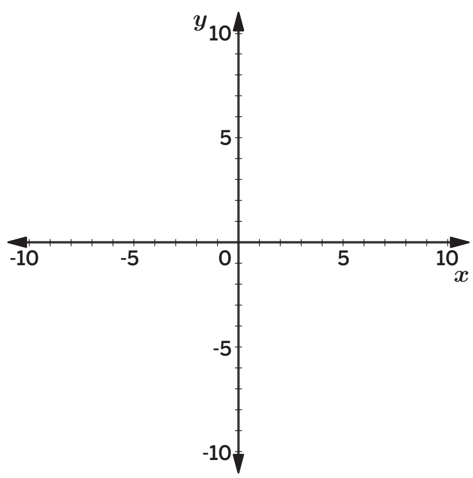
a $(2x + 6)(x + 5) < 0$



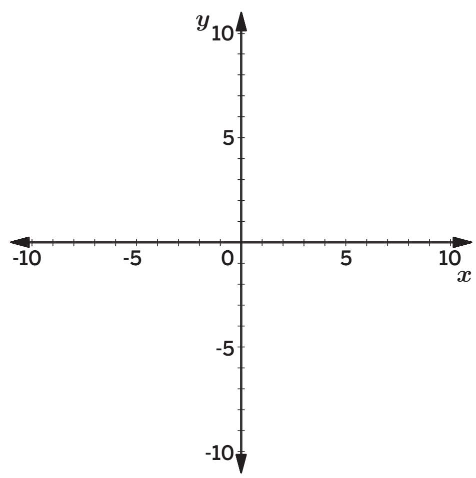
b $x^2 - 6x + 9 > 0$



c $-x^2 - 2 > 0$



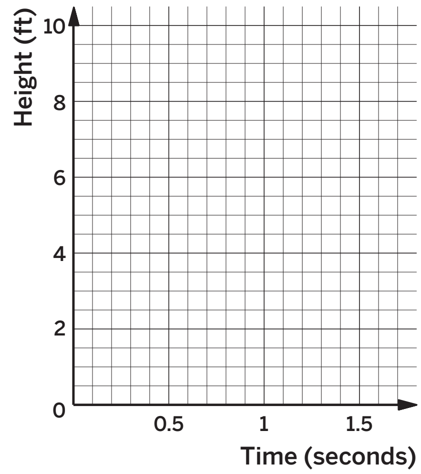
d $(-x - 2)(x - 4) \geq 0$



Practice

Name: ______ Date: ______ Period: ______

2. The function $h(t) = -16(t - 1)(t + 0.5)$ models the height of a ball from the ground, in feet, t seconds after it was thrown. Determine when the ball was higher than 8 ft from the ground. Use the graph to help your thinking.



3. Write each polynomial in standard form. State the degree, leading coefficient, and constant term of the polynomial.

a. $(6x^3 + 5x^2 - 2) + (4x^3 - 3x^2)$

b. $(7x^4 + x^2 + 1) - (8 - x^2)$

c. $(9x^3 + 3x^2 + 5) - (4x^2 + 1)$

4. Every irrational number lies between two consecutive whole numbers. For each of the following irrational numbers, write the two consecutive whole numbers between which it is located.

a. $\sqrt{3}$

b. $\sqrt{38}$

c. $\sqrt{17-1}$