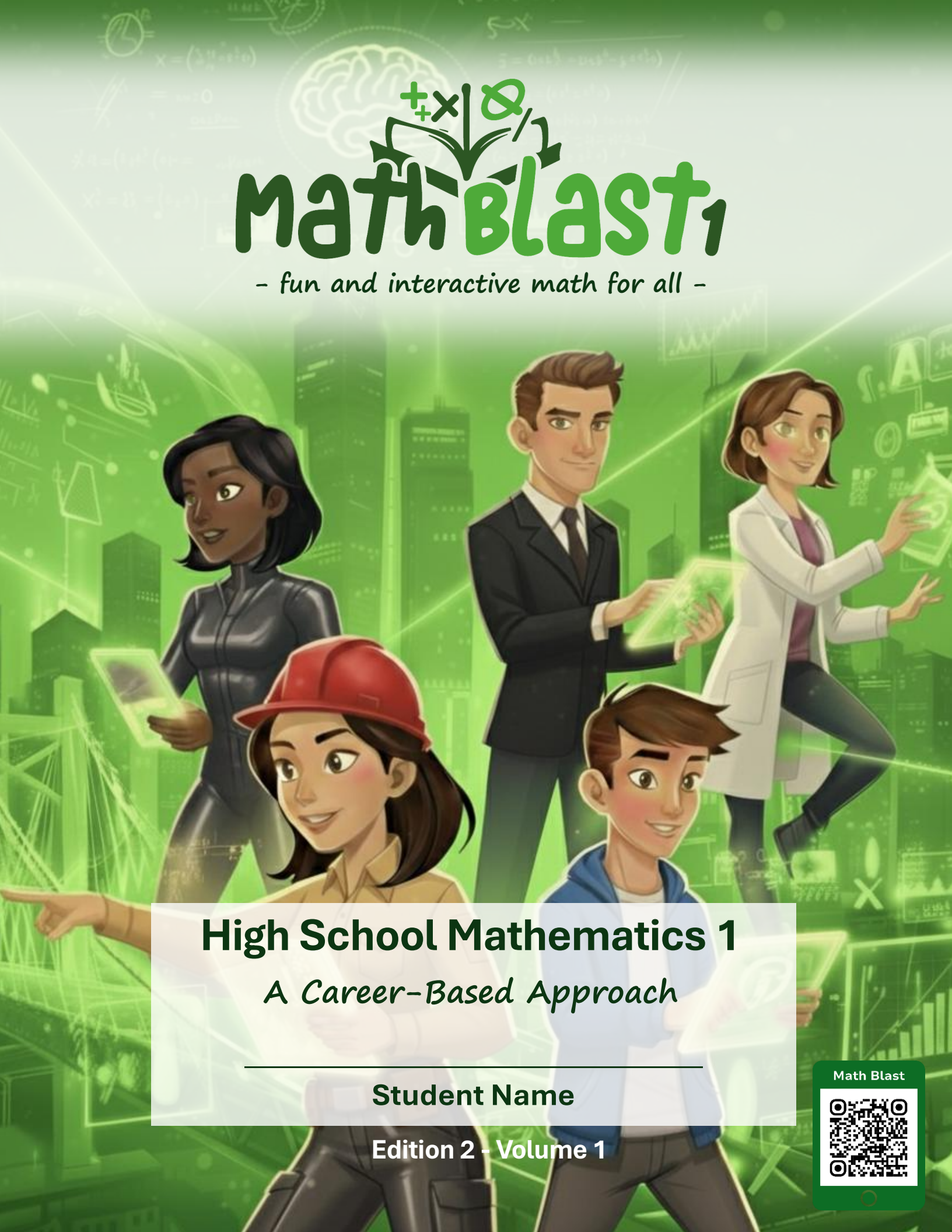




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High School Mathematics 1

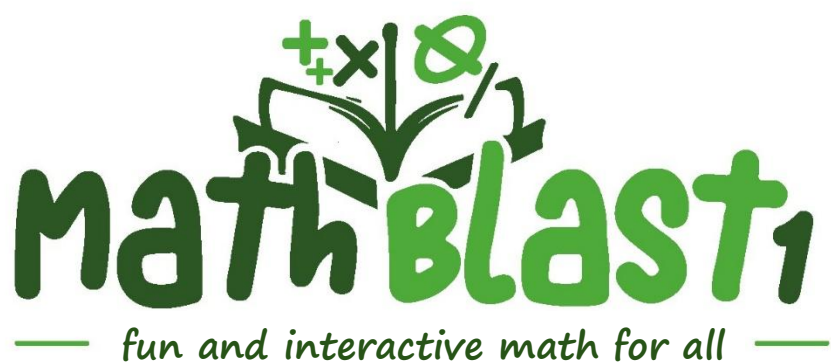
A Career-Based Approach

Student Name

Edition 2 - Volume 1

Math Blast





High School Mathematics 1

A Career-Based Approach

Edition 2
Volume 1

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Unit 1 | Equations and Inequalities

Supply Chain Management

High School Mathematics 1

North Carolina Math 1 Standards

Unit 1

Creating Equations

Create equations that describe numbers or relationships.

NC.M1.A-CED.1	Create equations and inequalities in one variable that represent linear, exponential, and quadratic relationships and use them to solve problems.
NC.M1.A-CED.4	Solve for a quantity of interest in formulas used in science and mathematics using the same reasoning as in solving equations.

Reasoning with Equations and Inequalities

Solve equations and inequalities in one variable.

NC.M1.A-REI.10	Understand that the graph of a two variable equation represents the set of all solutions to the equation.
----------------	---

1.1 Algebraic Expressions

Warm-Up

A company sells blue jeans for \$10 per pair and shorts for \$5 per pair.

A sales analyst needs to calculate the total revenue generated from a specific shipment.

Write an algebraic expression that represents the total revenue from the sale of the apparel if the shipment contains: j pairs of blue jeans and s pairs of shorts

Main Topic Combining Like Terms

Shoe Blast is a popular shoe company preparing for the upcoming basketball season, their busiest time of the year. The company's supply chain manager, Marco, is responsible for making sure they have enough supplies in stock. If they have too few shoes, they'll lose sales. If they have too many, they'll be stuck with excess inventory that costs them money to store.



TASK

1

Write an algebraic expression that represents the total number of shoes that were sold in the listed towns in North Carolina last season.

Historical Data

Town	Blue Shoes	Red Shoes	Green Shoes
Greensboro	13	17	13
Jamestown	26	14	32
Stony Point	35	35	25
Whitsett	21	27	29

Market Analysis: Due to the team colors of the basketball teams that qualified for the finals, the demand for blue shoes is expected to increase by 10% and the demand for green shoes is expected to increase by 15%. The demand for red shoes will decrease by 20%.

Sales Forecast: Write an algebraic expression that represents the sales forecast for this basketball season.

Combine like terms.

$5x + 7 + 4x$	$5x + 7 - 4x$	$-5x - 7 + 4x$
$8x + 3y - x + 2y$	$8a - 2b + c + 10b - 6c$	$-13m - 6n + 25n + 18m$
$82 - 11k - 25 + 9k$	$19p + 5q - 77p - 81q$	$-s + 3v - 15 + 54v$

Solve each problem and show all steps.

A shoe company's marketing budget for Q1 is represented by $2m + 500$, and for Q2, it's $3m - 200$. What is the total budget for the first half of the year?	The number of blue shoes sold in two different regions is given by $4x + 10$ and $2x - 5$. What is the total number of blue shoes sold?
The cost to produce a new sneaker is $25p + 500$, where p is the number of pairs. The shipping cost is $10p + 150$. Write an expression for the total cost of production and shipping.	A company's projected profits for the first two quarters are $7y + 1000$ and $5y - 500$. Find the combined profit for the first six months.
The sales revenue from the Greensboro store is $15r + 3000$, and the sales from the Jamestown store are $12r - 500$. What is the total revenue from both stores?	The number of hours worked by the design team is $6h + 25$, and the hours worked by the production team are $8h - 10$. Write an expression for the total hours worked by both teams.

Main Topic Evaluating Algebraic Expressions

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K

2

Shoe Blast



**Shoe Blast is launching
a new online store.**

All online orders are subject to a \$12 flat-rate shipping fee.



blue shoes for \$25



red shoes for \$18



green shoes for \$30

Shoe Color	Expression of the total cost	Total cost of 5 pairs of shoes
Blue		
Red		
Green		

Evaluate the following expressions such that **a=5**, **b=-3**, and **c=16**.

$7a + 10b$	$12 - 5b + 9c$	$6a - 10b - 5c$
$4(3b - 5)$	$9a - 5(3b - 4c)$	$24a - b + 7(10 - c)$

Solve each problem and show all steps.

A landscaping company's profit is represented by the expression $150h - 250$, where h is the number of hours worked. If they work for 12 hours on a project, what is their profit?	The cost to print promotional t-shirts is given by the expression $8t + 15$, where t is the number of t-shirts. What is the cost to print 50 t-shirts?
A salesperson's monthly salary is calculated using the formula $2500 + 0.05s$, where s is their total sales in dollars. What is their salary if they have \$15,000 in sales?	The number of customers a coffee shop serves is estimated by the expression $100 + 5x$, where x is the number of degrees the temperature is below 70°F. If the temperature is 55°F, how many customers can they expect?
A company's online advertising cost is represented by $0.25c + 100$, where c is the number of clicks on an ad. What is the total cost if the ad receives 200 clicks?	The amount of ingredients needed for a bakery is given by $1.5f + 0.75c$, where f is the number of cakes and c is the number of cookies. How many pounds of ingredients are needed to make 10 cakes and 50 cookies?
A car rental agency's fee is calculated using the expression $50d + 0.20m$, where d is the number of days and m is the number of miles driven. What is the total cost to rent a car for 3 days and drive 150 miles?	The revenue from a mobile app is given by the expression $500 + 2.5a$, where a is the number of active users. If the app has 1,000 active users, what is the total revenue?
A factory's daily production output is represented by the expression $1000 - 5w$, where w is the number of defective products found. If 15 defective products are found in a day, what is the factory's output?	The cost to ship a package is given by the expression $0.50p + 8$, where p is the package's weight in pounds. What is the shipping cost for a 25-pound package?

Honors Level

Explain the concept of a variable in an algebraic expression. What does it fundamentally represent?

Why is it only possible to combine like terms when simplifying an expression?

Why does the order of operations (PEMDAS/BODMAS) need to be strictly followed when evaluating an algebraic expression?

What is the significance of writing a polynomial expression in standard form?

Explain the difference between evaluating an expression and simplifying an expression.

End-of-Course Prep

1.2 Algebraic Equations

Warm-Up

Express in algebraic phrase.

5 more than a number

Twice an integer increased by 5

5 less than a number

5 less than three times a number

Main Topic Algebraic Equations – Sourcing and Procurement

Sourcing and Procurement

The Shoe Blast Sourcing and Procurement Department is working on a new deal to purchase a large quantity of high-quality fabric from a new supplier. The supplier's pricing model is a bit complex: they charge a flat fee for the contract and then a variable cost for each roll of fabric.



TASK

1

The department's director, Mr. Sanchez, has been told that the total cost of the order will be \$1,300. He knows the fixed contract fee is \$250, and he needs to figure out the variable cost per roll. This information is crucial for his negotiation strategy.

Problem:

Write and solve an equation to find the variable cost per roll of fabric if the total cost of the order is \$1,300, the fixed fee is \$250, and the order is for 50 rolls.



Need Help?

Business Proposal Form

Company Name		Company Owner(s)	
--------------	--	------------------	--

Business Description

List products or services.	Plan to sell products/Plan to provide the service.
Target customers.	Marketing plans.

Finances

Source of funds.	Equipment needed and their costs.
Product/service charges to customers.	Monthly expenses.
Total Monthly Revenue:	Total Monthly Expense:

Additional information.

Accounting Equation

Accounting equation states that the company's asset is the sum of its liability and equity.

Asset

How much the company owns.

=

Liability

How much the company owes.

+

Equity

How much the investor's contribution

One-Step Equations

Solve for x.

<table><tr><th>Asset</th><th>Liability</th><th>Equity</th></tr><tr><td>x</td><td>\$1,000</td><td>\$500</td></tr></table>	Asset	Liability	Equity	x	\$1,000	\$500	<table><tr><th>Asset</th><th>Liability</th><th>Equity</th></tr><tr><td>\$2, 000</td><td>x</td><td>\$200</td></tr></table>	Asset	Liability	Equity	\$2, 000	x	\$200
Asset	Liability	Equity											
x	\$1,000	\$500											
Asset	Liability	Equity											
\$2, 000	x	\$200											
<table><tr><th>Asset</th><th>Liability</th><th>Equity</th></tr><tr><td>\$5, 000</td><td>\$3,500</td><td>x</td></tr></table>	Asset	Liability	Equity	\$5, 000	\$3,500	x	<table><tr><th>Asset</th><th>Liability</th><th>Equity</th></tr><tr><td>\$8, 000</td><td>x</td><td>0</td></tr></table>	Asset	Liability	Equity	\$8, 000	x	0
Asset	Liability	Equity											
\$5, 000	\$3,500	x											
Asset	Liability	Equity											
\$8, 000	x	0											

Algebra Tiles

Use algebra tiles to demonstrate solving for x.

$$x + 5 = 2$$

$$x - 5 = 2$$

$$5 = 2 - x$$

$$5 - x = 2$$



Need Help?

Two-Step Equations

Use algebra tiles to demonstrate solving for x .

$2x - 1 = 5$	$2x - 2 = 5$
$3x + 2 = 7$	$3x + 1 = 13$

Solve for x algebraically.

$2x - 1 = 5$	$2x - 2 = 5$
$3x + 2 = 7$	$3x + 1 = 13$

Speed Math

Answer as many questions as you can in 2 minutes.

$2x - 1 = 9$

$2x + 1 = 9$

$2x - 1 = -9$

$-2x - 1 = 9$

$2x - x = 9$

$2x + x = 9$

$-2x + x = 9$

$-2x - x = 9$

$\frac{x}{2} = 9$

$\frac{x}{3} = 9$

$\frac{x}{2} = -9$

$-\frac{x}{2} = 9$



Need Help?

Multi-Step Equations

Solve for x.

$$5x - 1 = 4x + 9$$

$$7x + 3 + x = 10 - 2x - 12$$

$$2(x - 5) = x + 6$$

$$4 - 3(2x - 7) = 8 - 5x$$

$$\frac{3x}{2} - 5 = 17$$

$$5 - \frac{x}{2} = 17$$

$$\frac{3x - 5}{2} = 17$$

$$\frac{3(x + 5)}{2} = 17$$

$$\frac{3x - 5}{2} = \frac{x + 4}{7}$$

$$\frac{3x - 5}{x + 4} = \frac{2}{7}$$



Need Help?

Honors Level

What is the underlying reason for reversing the inequality sign when multiplying or dividing both sides by a negative number?

What is the fundamental concept of an equation, and why must you perform the same operation on both sides?

How does the concept of an equation differ conceptually from an expression?

How does the process of checking your solution reinforce the concept of equality?

Describe the concept of "Distributing" in terms of equality and why it is valid.

End-of-Course Prep

1.3 Consecutive Numbers Problems

Warm-Up

Solve for n .

$$n + n + 1 + n + 2 = 78$$

$$n + n + 1 + n + 2 = -102$$

Main Topic Consecutive Numbers Problems

Sales Forecasting and Production Planning

The Shoe Blast company needs to plan its production for the next three quarters. The operations manager has determined that for the plan to be successful, the number of shoes produced each quarter must be a **consecutive number** to maintain a smooth production flow and efficient resource allocation.

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1

Quarter Number	Consecutive Numbers (No. of Shoes Produced)	Consecutive Number Expressions
1 st	863	
2 nd	864	
3 rd	865	



I have three consecutive numbers.
If the 3rd number is 18, what are the 1st and 2nd numbers?

I listed five consecutive **odd** numbers.
If the 2nd number is 23, what is the 5th number?



The number on the screen is the 2nd number of the consecutive **even** numbers.
What is the 4th number?



Consecutive Integers	Consecutive Odd Integers	Consecutive Even Integers																																				
Write down four 2-digit consecutive integers. How do you get the next integer? <table><tr><td></td><td>Formula</td></tr><tr><td>1st Integer</td><td></td></tr><tr><td>2nd Integer</td><td></td></tr><tr><td>3rd Integer</td><td></td></tr><tr><td>4th Integer</td><td></td></tr><tr><td>5th Integer</td><td></td></tr></table>		Formula	1 st Integer		2 nd Integer		3 rd Integer		4 th Integer		5 th Integer		Write down four 3-digit consecutive odd integers. How do you get the next integer? <table><tr><td></td><td>Formula</td></tr><tr><td>1st Integer</td><td></td></tr><tr><td>2nd Integer</td><td></td></tr><tr><td>3rd Integer</td><td></td></tr><tr><td>4th Integer</td><td></td></tr><tr><td>5th Integer</td><td></td></tr></table>		Formula	1 st Integer		2 nd Integer		3 rd Integer		4 th Integer		5 th Integer		Write down four 1-digit consecutive even integers. How do you get the next integer? <table><tr><td></td><td>Formula</td></tr><tr><td>1st Integer</td><td></td></tr><tr><td>2nd Integer</td><td></td></tr><tr><td>3rd Integer</td><td></td></tr><tr><td>4th Integer</td><td></td></tr><tr><td>5th Integer</td><td></td></tr></table>		Formula	1 st Integer		2 nd Integer		3 rd Integer		4 th Integer		5 th Integer	
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Need Help?

Find the integers.

If the sum of three consecutive integers is 111, what are the integers?	If the sum of three consecutive odd integers is 81, what are the integers?
If the sum of five consecutive integers is 120, what is the largest integer?	If the sum of four consecutive integers is -42, what is the smallest integer?

Solve each problem and show all steps.

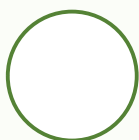
A company's sales forecast for three consecutive weeks totals 210 units. How many units are forecast to be sold each week?	Shoe Blast is planning to produce a total of 99 pairs of shoes over three consecutive days. How many pairs should they produce each day to meet this goal?
The sales revenue for three consecutive months is projected to be \$45,000 . If the revenue increases by a consecutive amount each month, what is the revenue for each of the three months?	A factory manager needs to schedule production to run for three consecutive hours. The total number of items produced during this time is 69. How many items are produced each hour?



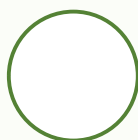
Need Help?

Solve the questions and write the answers in the circles.

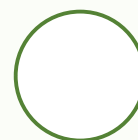
The sum of the 1st two consecutive even integers is 14 less than the 3rd number. What is the number closest to zero?



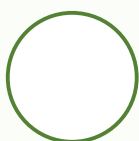
The sum of the 1st and 3rd integers of consecutive integers is 246 minus the 2nd number. What is the 3rd number?



Twice the 3rd number of consecutive odd numbers is 33 more than the 4th number. What is the smallest number?



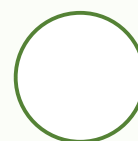
The sum of the 1st two consecutive numbers is 5 more than the 4th number. What is the 3rd number?



The sum of the 1st and 4th consecutive even numbers is 26 more than the 3rd number. What is the 4th number?



Twice the 3rd number of consecutive odd numbers is 71 minus the 4th number. What is the number closest to zero?



EOC Question

The sum of three consecutive integers is -102. What integer is closest to zero?



Need Help?

Honors Level

How does the representation of consecutive even integers differ from consecutive odd integers, and why?

Explain why using only n and $n+1$ to represent two consecutive numbers is often more efficient than using n and $n+2$?

How would you represent two consecutive integers such that the first number is n and the second number is $3n$ times the first?

If the problem involves consecutive odd integers and the sum is a multiple of 4 (e.g., 20), what simplifying assumption can you make about the total number of terms?

Explain the difference between "consecutive integers" and "consecutive numbers" in the context of setting up equations.

End-of-Course Prep

1.4 Age Problems

Warm-Up

Express the statements in algebraic expressions.

28 more than twice a number

28 more than the square of a number

28 less than twice a number

28 less than the square of a number

Main Topic Age Problems



Good morning, Mrs. Garcia! It's been a long time since your children completed math 1 class. How old are they now?

Marvin is 5 years older than Jen.

What is the algebraic expression of Marvin's age?

Richard is 2 years younger than twice the age of Roz. The sum of their ages is 34. How old are they?

Richard's Age:

Roz's Age:

Gerry is 10 years older than two-thirds the age of Jonathan. The sum of their ages is 25. How old are they?

Gerry's Age:

Jonathan's Age:



Need Help?

Past, Present, and Future Age

What was Pritha's age 5 years ago?

What is Pritha's age 5 years from now?



What was Janiyah's age 5 years ago?

What is Janiyah's age 5 years from now?

Chris is 6 years older than Michelle. In 4 years, the sum of their ages is 34. How old are they now?

	Present Age	Future Age
Chris		
Michelle		

Geneva is 2 years older than 5 times the age of Ryan. Last year, the sum of their ages is 18. How old are they next year?

	Present Age	Past Age
Geneva		
Ryan		



Need Help?

Ready-Set-Go**Ready**

Work with groupmates.

Nicole is 3 years younger than Mark.
The sum of their ages is 87. What is the product of their ages?

Set

Work with a partner.

Amy's age added by three times Ted's age is 105.
Amy is 5 years older than twice the age of Ted.
What is the sum of their ages?

Go

Work on your own.

Fred is 4 years older than Barney.
Five years ago, the sum of their ages was 48.
What are their present ages?

Honors Level

Explain the common mistake of confusing "times as old as" with "years older than" in setting up an age equation.

What does it signify if, upon solving an age problem, you find the value of the variable to be negative?

If the problem asks for the age of the oldest person after you have solved for (the youngest person's age), what crucial final step must you remember?

Conceptually, what does the equal sign represent in the context of an age word problem?

Why must you be careful when solving an age problem that involves multiplicative relationships (like "times as old")?

End-of-Course Prep

1.5 Perimeter Problems

Warm-Up

Solve for x .

$$x + 7 + x + 7 + x + x = 54$$

$$2(x + 7) + 2(x) = 54$$

Main Topic Perimeter Problems

CEO's Expansion Plan

The CEO of Shoe Blast, Mr. Jackson, has just approved the expansion plan for the new Online Order Department. The growing demand for online sales has made it necessary to build a new, dedicated office space.

Mr. Jackson has a specific design in mind for the new office building. He wants it to be rectangular with a total **perimeter of 440 feet**. To ensure the layout is practical for the team, he has specified that the **length of the office must be 20 feet longer than its width**.

The construction team must now use this information to determine the exact dimensions of the new office. They need to find the specific length and width to begin the architectural design.



Illustrate the shape of the office and show all steps to find the dimensions.

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Making Connections

Connect the shapes that correspond to each other by drawing a line.

$L = x + 5$
 $W = x$

The length of a rectangle is 5 ft longer than the width.

$L = x$
 $W = x + 5$

The height of a triangle is 7 in longer than twice the base.

$H = x$
 $B = 2x - 7$

$H = 2x + 7$
 $B = x$

The width of a rectangle is 5 ft longer than the length.

The base of a triangle is 7 in shorter than twice the height.

Illustrate each problem, solve, and show complete work.

Rectangle

The operations manager at Shoe Blast is reorganizing a warehouse section. The original rectangular section has a length that is 10 feet longer than its width. To accommodate more inventory, they expand the section by adding 5 feet to each side. The new, larger section has a perimeter of 190 feet. What were the original dimensions of the warehouse section?

Square

The company has designed a new, square box for packaging shoes. The side length of the new box is 9 inches shorter than the old, square box's side length. The perimeter of the new square box is 284 inches. What were the dimensions of the old box?

Regular Hexagon

The shipping department at Shoe Blast is using a new hexagonal sticker for their premium shoe boxes. To make the boxes stand out, they've increased the length of each side of the sticker by 3 inches. The new, larger sticker has a perimeter of 90 inches. What was the length of each side of the original sticker?

Rectangle

The shipping room's new design has a perimeter of 156 inches. The length is 18 inches longer than twice the width. What are the dimensions of the new room?

Switch It Up

Show complete work on the left side of the shape then switch with a partner.
Have your partner show complete work of the same problem on the right side of the shape.

The length of a rectangular garden is 3 ft longer than the width. Shannon decided to put a fence that is 5 ft away from the garden. Find the dimensions of the fence if the perimeter is 126 ft.

A square parking lot is being renovated. An engineer wanted to add 20 ft to each side of the parking lot. Find the dimensions of the new parking lot if the perimeter is 440 ft.

The second base of a regular trapezoid is 10 inches longer than the first base. Each diagonal side is 1 inch less than twice the length of the first base. If the sum of all sides of a trapezoid is 32 inches , how long is the second base?

Honors Level

Define perimeter conceptually, and explain how it fundamentally relates to setting up a one-variable equation.

If the perimeter of an equilateral triangle is represented by the equation $3x = 18$, what does the variable represent?

Why is it impossible for a perimeter problem involving a polygon with positive side lengths to yield $x = 0$ as a solution?

Consider a perimeter equation that simplifies to $-2x + 10 = 4$. Explain the conceptual error a student might make if they don't solve this correctly.

If the solution to a perimeter equation yields $x = -5$, what does this result mean, and what must be true about the problem setup?

End-of-Course Prep

1.6 Literal Equations

Warm-Up

Simplify.

$19 - 4 =$

$6 - 10 =$

$-1 - 4 =$

$5 + 4 =$

$19 + 4 =$

$-6 - 10 =$

$1 - 4 =$

$-5 + 4 =$

Main Topic Literal Equations

The Shoe Blast Sourcing and Procurement Department is in charge of acquiring the high-quality materials needed to produce their shoes, such as premium leather, durable rubber, and strong fabric. The department's director, Mr. Sanchez, wants to ensure the company is getting the best value while maintaining excellent supplier relationships.



Mr. Sanchez is working on a new pricing agreement with a supplier.

The current contract is based on the total cost of an order, which includes a variable cost per unit and a fixed negotiation fee.

T = Total Cost of the order

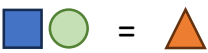
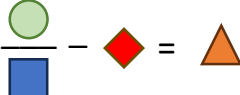
V = Variable cost per unit

U = Number of units (or pairs of shoes)

F = Fixed negotiation fee

$$T = (V * U) + F$$

He has tasked his team with a few problems to practice this skill, emphasizing that a strong understanding of literal equations is key to securing favorable terms and ensuring supplier accountability.

Solve for x. $x + 5 = 7$	Isolate the circle. 
Solve for x. $5x = 10$	Isolate the circle. 
Solve for x. $\frac{x}{4} = 3$	Isolate the circle. 
Solve for x. $\frac{x}{4} - 2 = 3$	Isolate the circle. 

Solve for x	Solve for y
$x + y = z$	$x + y = z$
$xy = z$	$xy = z$
$\frac{x}{y} = z$	$\frac{x}{y} = z$
$\frac{x}{y} - 2 = z$	$\frac{x}{y} - 2 = z$



Need Help?

Take One

Cutouts containing literal equations are posted across the classroom. Locate cutouts that are equivalent to the equations in the shapes. Take one then paste it in the box of its equivalent equation.

Solve for b.

$$ab = c$$

Solve for a.

$$ab = c$$

Solve for a.

$$\frac{a}{b} = c$$

Solve for b.

$$ab + d = c$$

Solve for b.

$$ab - d = c$$

Solve for b.

$$\frac{ab}{d} + e = c$$

Solve for b.

$$\frac{a + b}{d} = c$$

Solve for a.

$$\frac{a - b}{d} + e = c$$

Solve for a.

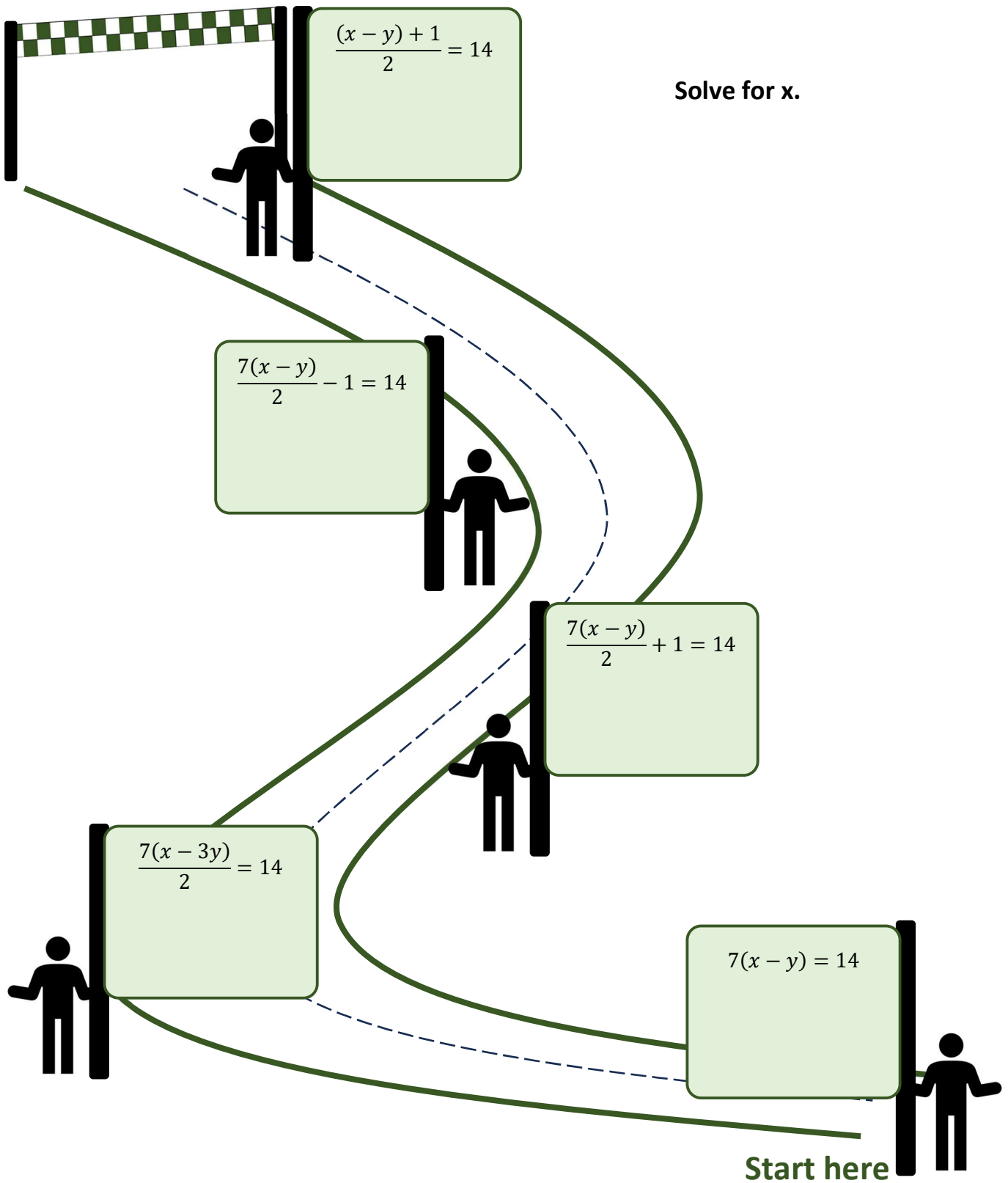
$$\frac{a}{bd} - e = c$$

Solve for x. $5x + y = z$	Solve for y. $x - 5y = z$
Solve for x. $5xy = z$	Solve for y. $5xy = z - 6$
Solve for x. $\frac{x + 5}{y} = z$	Solve for y. $\frac{x}{y + 5} = z$
Solve for x. $\frac{x + 5}{y} - 2 = z$	Solve for y. $\frac{x}{y + 5} - 2 = z$



Need Help?

Reaching the Finish Line



Honors Level

What does it mean conceptually to "solve a literal equation for a specific variable"?

Why can the order of operations (PEMDAS) be thought of as being reversed when solving a literal equation for an interior variable?

Consider the equation $F = \frac{9}{5}C + 32$ (Fahrenheit to Celsius).
Conceptually, what does solving this equation for allow you to calculate?

In the equation $y = mx + t$, if you solve for the slope m , what mathematical process is used to group the b term before dividing by x ?

Is it possible for a literal equation to have no solution when solving for a specific variable?
If so, give an example.

End-of-Course Prep

1.7 Graphing Inequalities

Warm-Up

Draw the inequality symbol between the integers.

$-8 \quad \square \quad -7$

$-5 \quad \square \quad -24$

$-100 \quad \square \quad 0$

$12 \quad \square \quad 15$

$-9 \quad \square \quad 9$

$10 \quad \square \quad -10$

Main Topic Graphing Inequalities

Production Planning for Shoe Blast

The Production Planning team at Shoe Blast is gearing up for the busiest season of the year. Their goal is to efficiently schedule manufacturing to meet the high demand for their popular "Speedster" running shoes and "Urban Stride" casual sneakers.

The factory has limited resources and time, which means the production manager needs to use inequalities to represent the constraints and targets for production.

Graph the following scenarios.

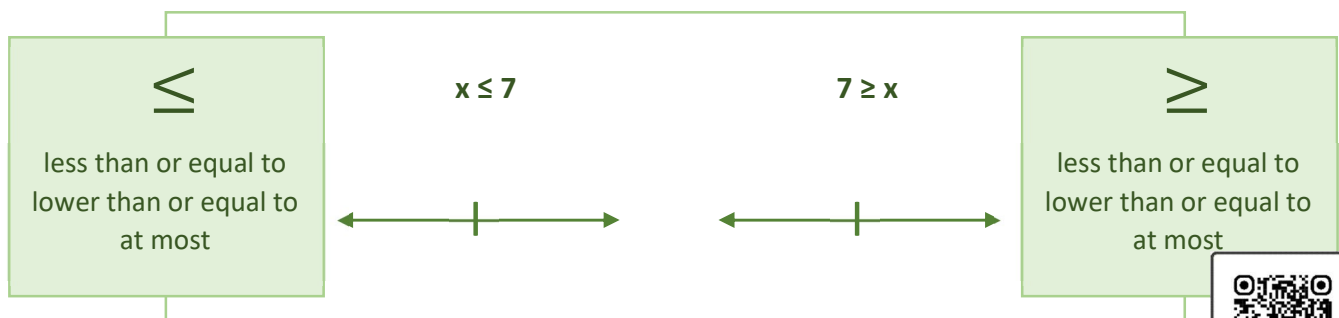
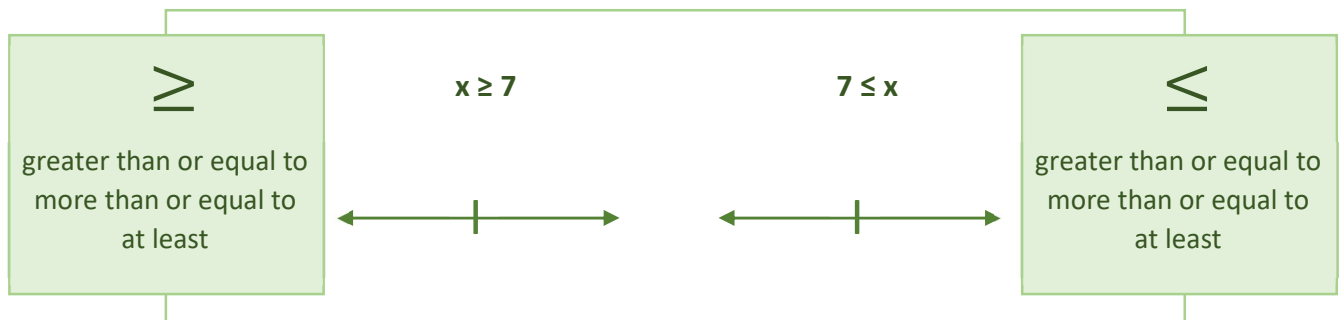
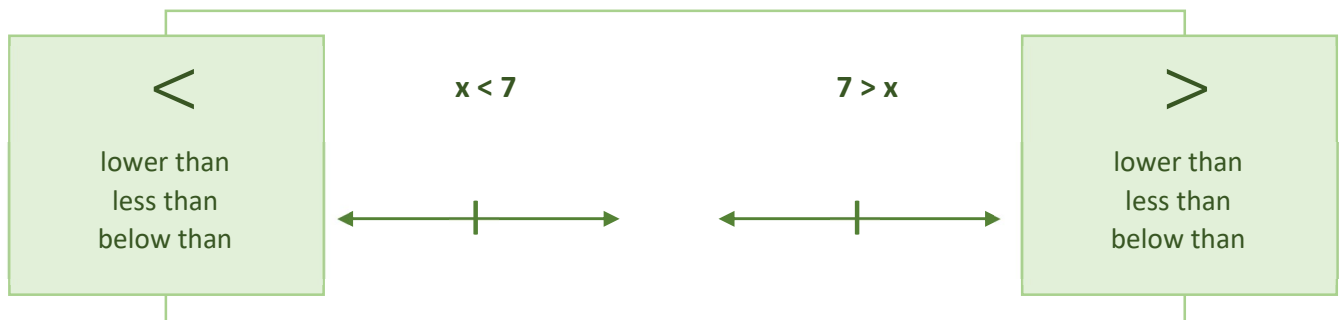
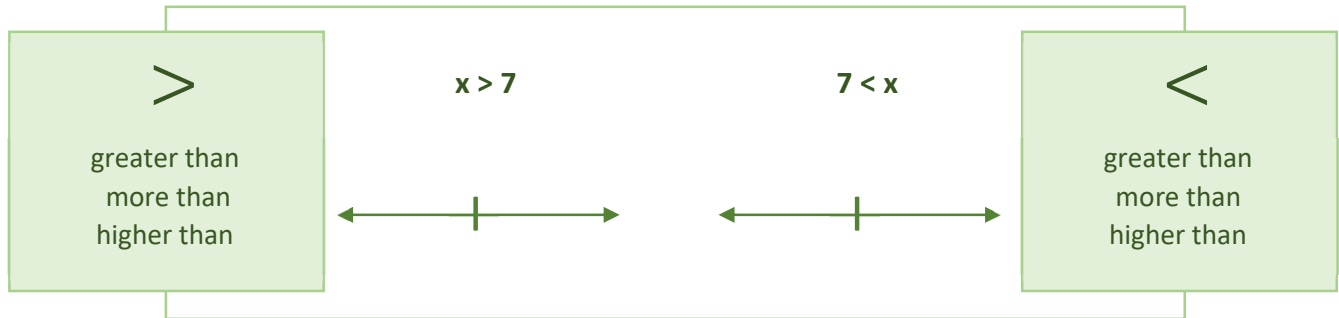
TASK

1

Minimum Daily Output for Speedsters To keep up with demand, the factory must produce more than 150 pairs of Speedster running shoes each day.	Total Combined Production Target To meet overall sales goals, the combined production of Speedsters and Urban Strides must be at least 200 pairs per day.
Maximum Daily Output for Urban Strides Due to material availability, the factory can produce less than 100 pairs of Urban Stride casual sneakers per day.	Labor Hour Constraint The number of labor hours available for Speedsters (each requiring 0.5 hours) and Urban Strides (each requiring 0.75 hours) must be less than or equal to 120 hours per day to avoid overtime.

Graphing Inequalities

Note: Read starting from x.



Need Help?

Foldable

Inequality Expressions and Graphs

A Quality Control manager at Shoe Blast is tasked with ensuring that a batch of shoes meets certain standards. For a given production run, the total number of pairs produced must be **at least 200** to meet sales goals.

Inequality Expression

Graph

Inequality Expression

Graph

The Quality Control team also monitors the use of materials and labor for each batch of shoes to ensure efficiency. To pass a quality audit, the number of fabric swatches used (f) must be **at most 1,200**.

Inequality Expression

Graph

To reduce material waste, the Shoe Blast factory has set a new goal. For a production run of a new sneaker for efficiency, the number of shoes produced must be **greater than 300**.

Inequality Expression

Graph

To reduce material waste, the Shoe Blast factory has set a new goal. For a production run of a new sneaker, the number of discarded scraps of fabric (s) must be **less than 10% of the total shoes produced (1540)**.

Inequality Expression

Graph

The total number of shoes produced must be **more than 200 pairs per day**.

Honors Level

Define perimeter conceptually, and explain how it fundamentally relates to setting up a one-variable equation.

What does it mean if the graph of an inequality covers the entire number line? Give an example of an inequality that results in this graph.

If the final step in solving an inequality is $-x < 2$, how must the inequality be rewritten before graphing, and why?

Describe the graph of the solution set for an inequality that has no solution.

If you are unsure which direction to shade (left or right), what is a quick conceptual way to use a test point to confirm the correct direction?

End-of-Course Prep

1.8 Solving Inequalities

Warm-Up

Connect the shapes that correspond to the inequality expressions.



Main Topic Solving Inequalities – Inventory Control

Inventory Control

To ensure we can meet customer demand while also managing costs, the Shoe Blast Inventory Control team must carefully manage stock levels. They need to find a balance between having enough shoes to prevent shortages during busy sales periods and avoiding overstocking, which can lead to unnecessary storage costs and wasted resources.



TASK

1

To avoid a stock-out of red shoes, the inventory must be more than 250 pairs. If there are currently 200 pairs in stock, what is the minimum number of pairs that must be added to meet this requirement?

The maximum storage capacity for green shoes is 1,000 pairs. If the current inventory is 850 pairs, what is the maximum number of additional pairs that can be stored?



List the 1st 3 whole numbers that are **greater than** 5.

List the 1st 3 whole numbers that are **less than** 5.



List the 1st 4 whole numbers that are **greater than or equal to** 5.

List the 1st 4 whole numbers that are **less than or equal to** 5.



List the next 5 numbers based on the given condition.

Less than or equal to 8	Greater than -4
Greater than or equal to 10	Less than 156

List the next 5 numbers based on the given condition.

The number of pairs in an order must be less than 100.	The weight of a package must be greater than or equal to 2 pounds.
An order for express shipping must have a processing time of less than 24 hours.	The number of boxes on a pallet must be at least 50.
The total value of a single shipment must be more than \$500.	The number of items to be picked for an order must be less than or equal to 15.



Need Help?

Write two inequality expressions of the statement. One expression on each side then graph.

	A number at least 2	
		

	A number not more than -3	
		

	A number higher than 4	
		

	A number at most 0	
		

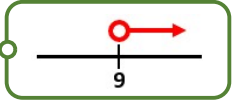
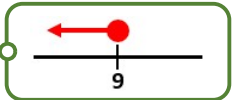
	A number more than -3	
		

	A number lower than 5	
		



Complete It

Fill out the necessary information in each row.

Inequality Expressions	Statements	Graphs
	A number is less than 9.	
$x \geq 9$		
		
	A number that is not greater than 9.	
$-9 > x$		
		
$-9 < x$		

Quick Math

Circle the solutions of $-6 \leq x$.

-4 -6 12 5 100 -100 -5 -7 0

One-Step Inequalities

Solve for x . Round to the nearest tenth.

$x - 5 < 17$	$-2x > -14$
$\frac{x}{2} \geq 3$	$\frac{x}{2} \leq -7$

Inequalities Domino

Circle a pair that does not match.
Otherwise, let your teacher know that you agree with the sequence of the domino.

						Start
						$x > 5$
$-x > 4$	$x < -2$	$-3x > 6$	$x - 3 \geq 5$	$x \geq 8$	$-x < -5$	
$x < -4$						
$x - 4 \leq 3$						
$7 \geq x$	$x + 3 > 7$	$4 < x$	$\frac{x}{2} \geq 5$	$10 \leq x$	Finish	



Need Help?

Two-Step Inequalities

Solve for x. Round to the nearest tenth.

$2x - 5 > 17$	$5 - 2x \geq -17$
$\frac{x}{2} - 5 < 17$	$\frac{x}{2} + 5 < 17$
$\frac{x - 5}{2} \leq 17$	$\frac{x + 5}{2} > 17$

Agree or Disagree

Circle "Agree" if the steps are correct. Otherwise, circle "Disagree".

$$3 - x \geq -9$$

- Subtract 3 on both sides.
- Multiply both sides by -1.
- Flip the inequality sign.

Agree Disagree

$$\frac{x}{3} - 1 \geq -5$$

- Add 1 on both sides.
- Divide both sides by 3.

Agree Disagree

$$\frac{x + 1}{3} \geq -5$$

- Multiply both sides by 3.
- Subtract both sides by 1.

Agree Disagree



Need Help?

Multi-Step Inequalities

Solve for x. Round to the nearest tenth.

$$2(x - 5) > 17$$

$$5 - \frac{2x}{3} \geq -17$$

$$\frac{x - 5}{2} - 1 < 17$$

$$\frac{x}{2} + 5 < 8(2 - x)$$

$$\frac{x - 5}{2} \leq \frac{4x + 2}{3}$$

$$\frac{x - 3}{5} \leq \frac{2 - 8x}{7}$$



Need Help?

Honors Level

Why is it necessary to reverse the inequality sign when multiplying or dividing by a negative number?

When solving an inequality, if the variables cancel out and the resulting statement is $5 < 2$, what is the solution set?

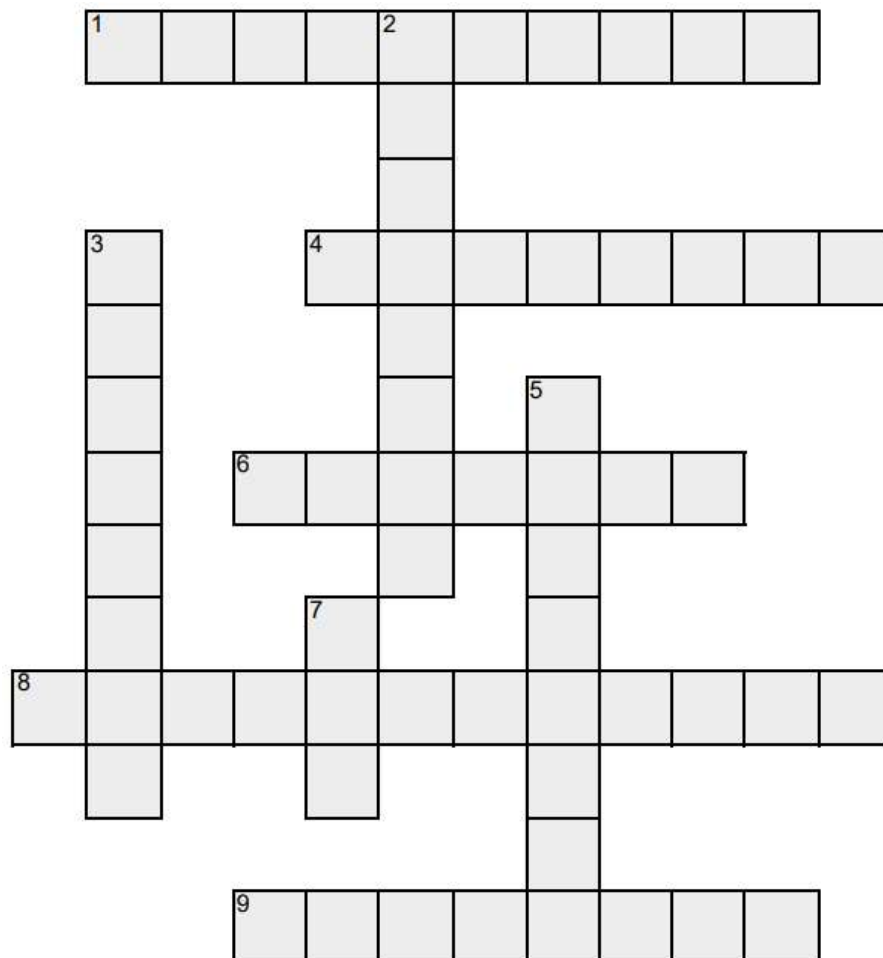
Explain why a solid circle on a number line corresponds to the use of a square bracket in interval notation.

A student incorrectly solves $3 - 2x \geq 5$ as $-2x \geq 2$, leading to $x \geq -1$.
What conceptual error did they make?

How does the method for checking solutions differ between an equation and an inequality?

End-of-Course Prep

Equations and Inequalities



Across	Down
1. A mathematical phrase that consists of numbers, variables, and operations.	2. A mathematical statement of two equal expressions.
4. A letter or symbol in mathematical expression representing an unknown value.	3. A fixed value in an expression that does not change.
6. The result when multiplying numbers or expressions.	5. The result when dividing numbers or expressions.
8. Statements that compare two expressions.	7. The result when adding numbers or expressions.
9. A set of values that satisfies a statement.	



Unit 2 | Sequences

Financial Planning

High School Mathematics 1

North Carolina Math 1 Standards

Unit 2

Creating Equations <i>Create equations that describe numbers or relationships.</i>	
NC.M1.A-CED.1	Create equations and inequalities in one variable that represent linear, exponential, and quadratic relationships and use them to solve problems.
NC.M1.A-CED.2	Create and graph equations in two variables to represent linear, exponential, and quadratic relationships between quantities.
NC.M1.A-CED.4	Solve for a quantity of interest in formulas used in science and mathematics using the same reasoning as in solving equations.

Interpreting Functions <i>Understand the concept of a function and use function notation.</i>	
NC.M1.F-IF.1	Build an understanding that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range by recognizing that: • if f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. • the graph of f is the graph of the equation $y = f(x)$.
NC.M1.F-IF.3	Recognize that recursively and explicitly defined sequences are functions whose domain is a subset of the integers, the terms of an arithmetic sequence are a subset of the range of a linear function, and the terms of a geometric sequence are a subset of the range of an exponential function.

Building Functions <i>Build a function that models a relationship between two quantities.</i>	
NC.M1.F-BF.1 NC.M1.F-BF.1a	Write a function that describes a relationship between two quantities. a. Build linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two ordered pairs (include reading these from a table).
NC.M1.F-BF.1b	b. Build a function that models a relationship between two quantities by combining linear, exponential, or quadratic functions with addition and subtraction or two linear functions with multiplication.
NC.M1.F-BF.2	Translate between explicit and recursive forms of arithmetic and geometric sequences and use both to model situations.

2.1 Arithmetic Sequence

Warm-Up

Evaluate each algebraic expression.

$$a = 5, \quad b = -2, \quad c = 1$$

$$3a + 8$$

$$12 - 5b$$

$$9 - 2(a + c)$$

Main Topic Arithmetic Sequence

A group of investors is seeking to fund promising startup businesses in your area. Do you have a business idea with strong growth potential? We want to hear from you.



TASK

1

- Find a business partner.
- List several business ideas.
- Pick the business idea that will be profitable.
- When ready, fill out the form on the next page.

Business Ideas

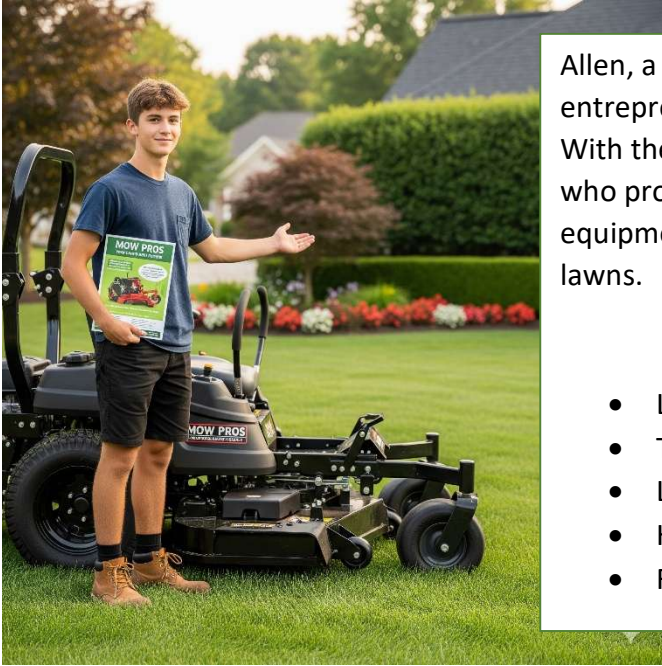
Business Proposal Form

Company Name		Company Owner(s)	
--------------	--	------------------	--

Business Description	
Products or services	Plan to sell products/Plan to provide the service
Target customers	Marketing plans

Finances	
Source of funds	Required equipment and costs
Product/Service pricing	Monthly expenses
Total Monthly Revenue:	Total Monthly Expense:

Additional information.



Allen, a determined high school student, transformed his entrepreneurial spirit into a thriving venture: "**Mow Pros.**" With the full support and financial backing of his parents, who provided the initial capital (debt) for top-of-the-line equipment, Allen was ready to conquer the neighborhood lawns.

Equipment Costs

- Lawn Mower - \$300
- Trimmer/Weed Eater - \$150
- Leaf Blower - \$200
- Hand Tools - \$100
- Fuel Cans - \$35

**Allen plans to increase his client base by two new clients each month.
He starts the year with 5 clients in January.**

	January	February	March	April	May	June
No. of Clients						

How many clients will he have in December?

T
A
S
K

2

Allen charges a flat fee of \$15 to mow a yard, plus an additional \$7 for every hour he works on the lawn.

No. of Hours	1	2	3	4	5	6
Total Amount						

How much will he charge the client if he spends 8 hours mowing a yard?

Main Topic **Arithmetic Sequence – Explicit Formula**

Allen charges \$20 for the first hour of mowing a yard, and then \$9 for every additional hour.

No. of Hours (n)	Pattern	Amount
1		
2		
3		
4		
5		
6		
n		

T
A
S
K

3

- Identify the pattern.
- Write a formula.
- Use the formula to calculate how much he will make in 8 hours, 10 hours, and 12 hours.

Arithmetic Sequence

A sequence where each term is obtained by adding a constant value from the previous term.

Put a check mark in the circle next to the set of numbers that is an arithmetic sequence.



14, 23, 32, 41, 50....



85, 74, 63, 51, 40....



5, 6.5, 8, 9.5, 11....



1, 4, 9, 16, 25....

TASK

4

Allen plans to pay back the \$300 his parents lent him for a lawn mower. He'll begin making monthly payments of \$25 starting in the second month and will continue these payments until the debt is paid in full.

No. of Months (m)	Pattern	Amount
1		
2		
3		
4		
5		
6		
n		

- Identify the pattern.
- Write a formula.
- Use the formula to calculate how much he owes in the 4th month.

Explicit Formula

A formula that directly expresses the n th term of a sequence.

$$a_n = a_1 + (n - 1)d$$

Fill out the tables below.

-12, -4, 4, 12...		
	Notations	Value
First Term	a_1	
Difference	d	
Explicit Formula		

82, 75, 68, 61...		
	Notations	Value
First Term	a_1	
Difference	d	
Explicit Formula		

Cut-and-Paste

Cut out the information that will be provided by your teacher and place it in the correct boxes below.

Sequence	Pattern
Formula	Next Three Terms

Arithmetic Sequence

Sequence	Pattern
Formula	Next Three Terms

Arithmetic Sequence

Main Topic **Arithmetic Sequence - Recursive Formula**
**Recursive
Formula**

A formula that defines a sequence by expressing each term in terms of the previous term(s).

$$a_n = a_{n-1} + d$$

2, 5, 8, 11...

Terms	Next Term = Previous Term + Difference
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	

38, 33, 28, 23...

Terms	Next Term = Previous Term + Difference
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	

-98, -86, -74, -62...

Terms	Next Term = Previous Term + Difference
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	

-25, -38, -51, -63...

Terms	Next Term = Previous Term + Difference
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	



Need Help?

Tic-Tac-Toe

Choose three questions horizontally, vertically, or diagonally to answer.
Show complete work to receive full credit.

If $a_1 = 5$ and
 $a_n = 5 + 3(n - 1)$,
what is the sum of the first
3 terms?

If $a_1 = 85$ and
 $a_n = a_{n-1} + (n - 10)$,
what is the difference
between the 2nd and 4th
terms?

If $a_1 = 12$ and
 $a_n = 12 + 3(n - 1)$,
what is the product
between the first two
terms?

If $a_1 = 9$ and
 $a_n = a_{n-1} + (n - 4)$,
what is the product
between the 2nd and 3rd
terms?

If $a_1 = 12$ and
 $a_n = 12 - 2(n - 1)$,
what are the first 3 terms?

If $a_1 = -10$ and
 $a_n = -10 + 7(n - 1)$,
what are the first 3 terms?

If $a_1 = -5$ and
 $a_n = a_{n-1} + (n + 8)$,
what are the first 5 terms?

If $a_1 = 15$ and
 $a_n = a_{n-1} + (n + 4)$,
what is the sum of the first
3 terms?

If $a_1 = -4$ and
 $a_n = -4 - 3(n - 1)$,
what is the quotient
between the 4th term and
2nd terms?

My Business

My business, _____, plans to increase my customer base by _____ new customers each week.

My business starts the month with _____ customers in the first week.

No. of Weeks	Pattern	No. of Customers
1		
2		
3		
4		
5		
6		
n		

I plan to pay back the \$_____ I borrowed from investors. I will begin making monthly payments of \$_____ starting in the second month and will continue these payments until the debt is paid in full.

No. of Months	Pattern	Amount
1		
2		
3		
4		
5		
6		
n		

I'll make an initial deposit of \$_____, and then save and deposit \$_____ every month, starting in the second month.

No. of Months	Pattern	Amount
1		
2		
3		
4		
5		
6		
n		

Honors Level

What is the defining characteristic that separates an arithmetic sequence from any other sequence?

Explain the meaning of the term common difference (d) in the context of sequence growth or decay.

How does the explicit formula for an arithmetic sequence, $a_n = a_1 + d(n - 1)$, relate to the equation of a line ($y = mx + b$)?

Conceptually, what does the recursive formula ($a_n = a_{n-1} + d$) tell you about generating terms in an arithmetic sequence?

What is the relationship between the common difference and the second difference in a sequence?

End-of-Course Prep

2.2 Geometric Sequence

Warm-Up

Simplify the following expressions if $x = 3$.

$$4^{x-1}$$

$$3^{1-x}$$

$$-2 \cdot 10^{x-1}$$

Main Topic Geometric Sequence

Synergy, an online marketing company, has partnered with Allen to promote his lawn mowing business, "Mow Pros." They project that his client base will **double each month**.



In the first month, Mow Pros has 5 clients.

No. of Months	Pattern	No. of Clients
1		
2		
3		
4		
5		
6		
n		

T
A
S
K

1

- Identify the pattern.
- Write a formula.
- Use the formula to calculate the number of clients in the 5th month.

Main Topic **Geometric Sequence – Explicit Formula**

2, 6, 18, 54...				
Ratio: 3	No. of Terms	Factors	Exponential Expression	Explicit Formula
$a_1: 2$	1	2	2	2
$a_2: 6$	2	$2 \cdot 3$	$2 \cdot 3^1$	$2 \cdot 3^{2-1}$
$a_3: 18$	3	$2 \cdot 3 \cdot 3$	$2 \cdot 3^2$	$2 \cdot 3^{3-1}$
$a_4: 54$	4	$2 \cdot 3 \cdot 3 \cdot 3$		
a_n	n	$2 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \dots$	---	

96, 48, 24, 12...				
Ratio:	No. of Terms	Factors	Exponential Expression	Explicit Formula
$a_1:$	1	96		
$a_2:$	2	$96 \cdot \frac{1}{2}$		
$a_3:$	3	$96 \cdot \frac{1}{2} \cdot \frac{1}{2}$		
$a_4:$	4	$96 \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$		
a_n	n	$96 \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \dots$	---	

Explicit Formula

A formula that directly expresses the nth term of a sequence.

$$a_n = a_1 \cdot r^{n-1}$$

Identify the values of the first term (a_1) and the common ratio (r).

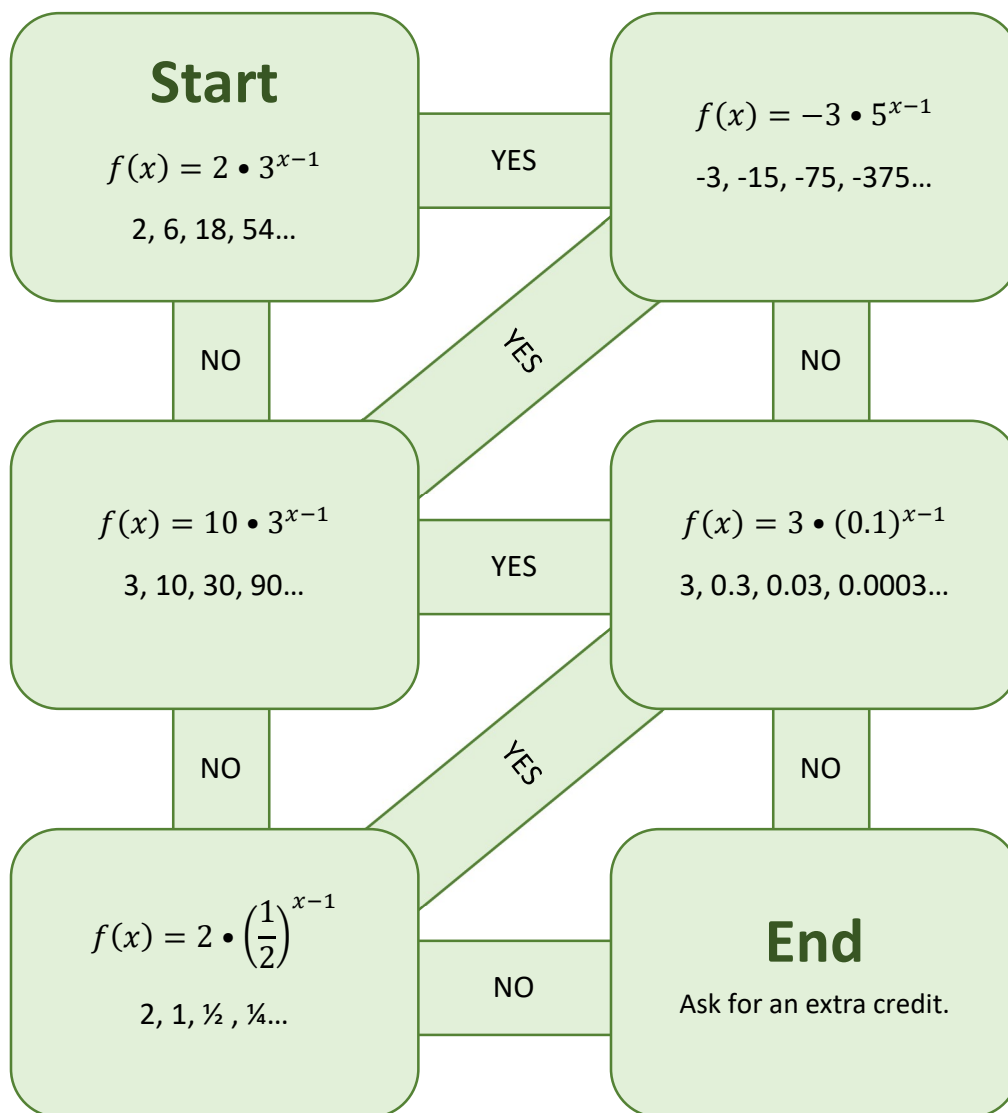
7, 14, 28....	-3, 12, -48...	64, 32, 16...
---------------	----------------	---------------



Need Help?

Explicit Formula Maze

The explicit formula of a sequence is given. Do you agree? If so, select **YES**; if not, select **NO**.



Main Topic Geometric Sequence - Recursive Formula

Recursive
Formula

A formula that defines a sequence by expressing each term in terms of the previous term(s).

$$a_n = a_{n-1} \cdot r$$

2, 6, 18, 54...	
Terms	Next Term = Previous Term • Ratio
$a_1 = 2$	---
$a_2 = 6$	$a_2 = 2 \cdot 3$
$a_3 = 18$	$a_3 = 6 \cdot 3$
$a_4 = 54$	
$a_5 =$	
a_n	

-3, -15, -75, -375...	
Terms	Next Term = Previous Term • Ratio
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	

2, 1, $\frac{1}{2}$, $\frac{1}{4}$...	
Terms	Next Term = Previous Term • Ratio
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	

3, 0.3, 0.03, 0.003...	
Terms	Next Term = Previous Term • Ratio
$a_1 =$	---
$a_2 =$	
$a_3 =$	
$a_4 =$	
$a_5 =$	
a_n	



Need Help?

Odd One Out

Determine both explicit and recursive formulas of the sequence.
Cross out the formula that does not belong to the group.

2, 8, 32, 128...

$$f(n) = 2 \cdot 4^{n-1} \quad a_3 = 8 \cdot 4 \quad f(n) = 2 \cdot 4^{n-2}$$

$$f(n) = -120 \cdot 0.5^{n-1} \quad a_6 = -7.5 \cdot 0.5 \quad a_4 = -30 \cdot 2$$

-120, -60, -30, -15...

0.1, 0.2, 0.4, 0.8...

$$f(n) = 0.1 \cdot 2^{n-1} \quad 0.8 = a_3 \cdot 2 \quad f(n) = 2 \cdot 0.1^{n-1}$$

$$f(n) = -3 \cdot 4^{n-1} \quad a_4 = -192 \cdot 4 \quad -192 = a_3 \cdot 4$$

-3, -12, -48, -192...

0.2, 1.2, 7.2, 43.2...

$$f(n) = 2 \cdot 6^{n-2} \quad a_3 = 1.2 \cdot 6 \quad 43.2 = a_3 \cdot 6$$

Solve each problem and show all steps.

Problem	Table/Work	Explicit Formula	Recursive Formula
Allen invests \$500 in a cryptocurrency that triples in value every year. What will the investment be worth after 5 years?			
A company's profits start at \$1,000. The profits are projected to increase by a factor of 1.5 every quarter. What will the company's profits be in the 2 years?			
A Mow Pros lawn mower, with an initial value of \$300, depreciates to half its value every 4 months. What is the value of the lawn mower after 1 year?			
A Mow Pros leaf blower, with an initial value of \$200, depreciates to one-third of its value every week. What is the value of the leaf blower after 2 months?			
Due to high demand, a company's initial fuel cost of \$12 doubles every 2 hours. What is the fuel cost after half a day (12 hours)?			

Honors Level

Define a geometric sequence and explain the role of the common ratio (r).

What must be true about the common ratio (r) for a geometric sequence to be alternating (switching between positive and negative terms)?

If the common ratio is a proper fraction (e.g., $r=1/2$), how does the magnitude of the terms change?

Describe a real-world scenario that is best modeled by a geometric sequence.

Contrast the growth rate of a geometric sequence with $r=2$ and an arithmetic sequence with $d=2$.

End-of-Course Prep

2.3 Arithmetic and Geometric Sequences Graphs

Warm-Up

Simplify the following exponential expressions.

$3 \cdot 5^2$

$3 \cdot 5^{-2}$

$-3 \cdot \left(\frac{1}{5}\right)^2$

Main Topic Arithmetic and Geometric Sequences Graphs



To promote Mow Pros, Allen placed yard signs in the James Landing and Jamesford Meadows neighborhoods. Here are the results of his efforts.

James Landing

Day No.	1	2	3	4	5
No. of Responses	3	7	11	15	19

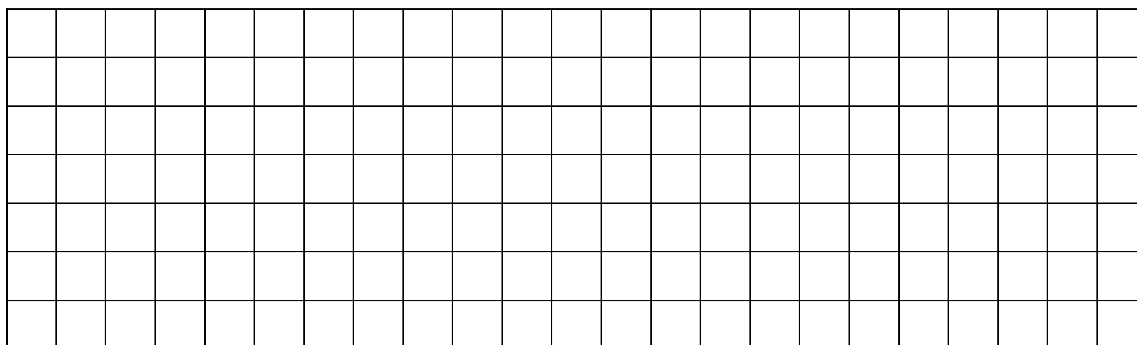
Jamesford Meadows

Day No.	1	2	3	4	5
No. of Responses	2	6	18	54	162

Graph the values in the table for James Landing

TASK

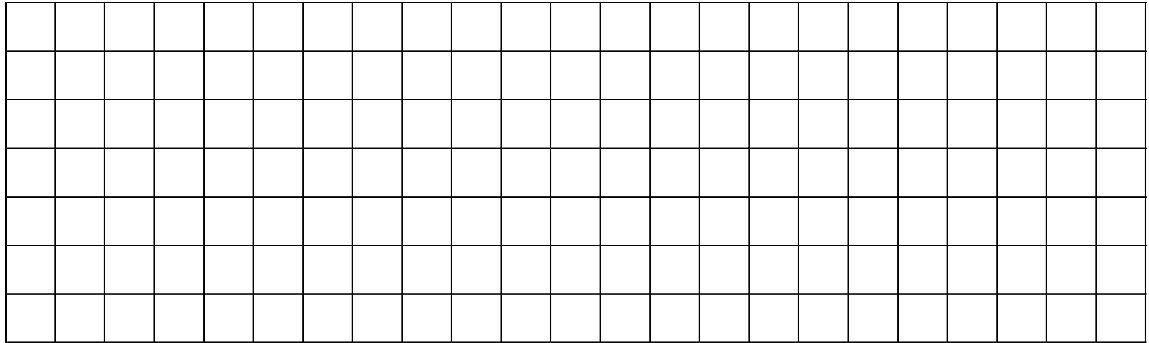
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T
A
S
K

2

Graph the values in the table for Jamesford Meadows



Write your observations between the graphs.

James Landing

Day No.	1	2	3	4	5
No. of Responses	3	7	11	15	19

Explicit Formula	
Recursive Formula	

Jamesford Meadows

Day No.	1	2	3	4	5
No. of Responses	2	6	18	54	162

Explicit Formula	
Recursive Formula	



As Allen's client base grew, he started tracking his fuel expenses. He spent \$46 the first week, with costs increasing by a constant \$12 each subsequent week.

Week No.	1	2	3	4
Amount				

Explicit Formula	Recursive Formula

State whether the sequence is increasing or decreasing.

$a_n = 7 + 10(n - 1)$	$a_n = -7 + 10(n - 1)$
$a_n = 7 - 10(n - 1)$	$a_n = 10(n - 1) - 7$
$a_n = 7 + (n - 1)10$	$a_n = a_{n-1} + d$
$a_n = a_{n-1} - d$	$a_n = d - a_{n-1}$

[illegible]

Month No.	1	2	3	4
Amount				

State whether the sequence is increasing or decreasing.

Math Blast

Tick It Off

Mark the box if a graph is straight or curve, increasing or decreasing, then explain your responses.

Explain

$a_n = 5 + 7(n - 1)$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = 8 - 2(n - 1)$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = 4n + 1$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = -n + 100$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = 5 \cdot 2^{n-1}$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = 4 \cdot -6^{n-1}$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = -8 \cdot 0.5^{n-1}$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = -1 \cdot -10^{n-1}$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = 50 \cdot 6^{n-1}$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

$a_n = -n + 2$	☐	Straight	☐	Increasing	
	☐	Curve	☐	Decreasing	

Cut-and-Paste

Cut out the information that will be provided by your teacher and place it in the correct boxes below.

Sequence			Pattern
Formula			Next Three Terms

Sequence			Pattern
Formula			Next Three Terms

Honors Level

What fundamental type of function (linear, quadratic, exponential, etc.) does the graph of an arithmetic sequence visually resemble, and why?

What fundamental type of function does the graph of a geometric sequence visually resemble, and why?

In the graph of an arithmetic sequence, how is the common difference (d) related to the corresponding function's properties?

Describe the visual appearance of the graph of a geometric sequence when $0 < r < 1$.

Why is it sometimes difficult to distinguish between an arithmetic and a geometric sequence graph just by looking at the first few points?

End-of-Course Prep

2.4 Terms of a Sequence

Warm-Up

Evaluate: $a = 5, b = -2, c = 3$

$3a + 8$

$12 - 5b$

$9 - 2(a + c)$

Main Topic Terms of a Sequence



MOW PROS
LAWN CARE

REFER A FRIEND, GET REWARDED!

HOW IT WORKS

1. Tell your friends about Mow Pros
2. They sign for a service
3. You both get \$25 off your next service!

SPREAD THE GREEN



www.mowpros.com

Mow Pros referral campaign has skyrocketed its revenue.

Week No.	1	2	3	4
Amount	60	75	90	105

How much is the revenue in 23rd week?

Solve each problem and show all steps.

Find the 1 st term of the sequence $a_n = 6n - 3$	Find the 3 rd term of the sequence $a_n = 12 - 2n$
Find the 8 th term of the sequence $a_n = 3 \cdot 2^{n-1}$	Find the 4 th term of the sequence $a_n = 5 \cdot \left(\frac{1}{2}\right)^{n-1}$

The function in the middle represents the value of the n th term in a sequence.

What are the first 5 terms?	What is the sum of the first 5 terms?
$f(n) = 3n - 5$	
What is the product between the 2 nd and 4 th terms?	What is the difference when the 3 rd term is subtracted from the 5 th term?

What are the first 5 terms?	What is the sum of the first 5 terms?
$t(n) = 4 - 2n$	
What is the quotient between the 2 nd and 4 th terms?	What is the difference when the 3 rd term is subtracted by the 5 th term?

What are the first 5 terms?	What is the sum of the first 5 terms?
$v(n) = n^2 + 1$	
What is the product between the square of the 2 nd term and the square of the 3 rd term?	What is the difference when the 4 th term is subtract from the 1 st term?



Need Help?

Main Topic	Missing Terms of Arithmetic Sequences
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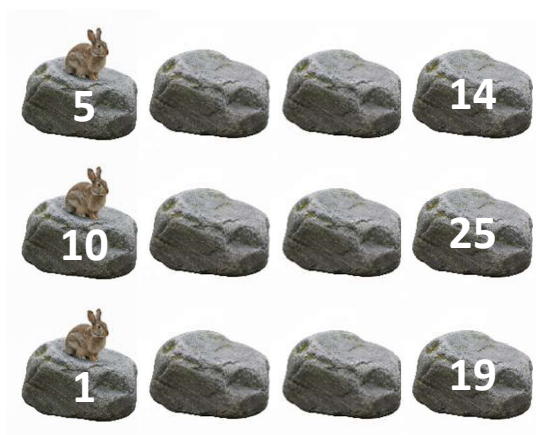
Allen leaned on his shovel, grateful for the break. His eyes caught a **trio of cotton-tailed rabbits** moving in a **nervous, quick dance**, flicking themselves lightly from one garden stone to the next.

- Write the missing number between the rocks.
- Fill out the table.



Write the difference of the sequence.	Create an expression showing how the difference was derived.	Write the number of hops from the first rock to the last rock.

- Write the missing numbers between the rocks.
- Fill out the table.



Write the difference of the sequence.	Create an expression showing how the difference was derived.	Write the number of hops from the first rock to the last rock.

Write a general formula to find the **difference** given the first and last terms of an arithmetic sequence.

Main Topic	Missing Terms of Sequences
------------	----------------------------

Find the missing terms of the sequence then find the sum.

1	2	3	4	5	6	7	Sum
7		21			42		

1	2	3	4	5	6	7	Sum
1			16			49	

1	2	3	4	5	6	7	Sum
	12			30		42	

1	2	3	4	5	6	7	Sum
50				30			

1	2	3	4	5	6	7	Sum
5		45				3645	

1	2	3	4	5	6	7	Sum
	512	256					

Stickies Gallery

Copy the equation, show complete work, and box the final answer on each sticky note.
Post the sticky notes next to the questions across the classroom.

$$a(n) = 5n + 3$$

What is the sum of
the 2nd and 4th
terms?

$$t(n) = 7 - 2n$$

What is the product
between the 3rd
and 4th terms?

$$h(n) = 5n + 3$$

What is the
difference between
the 3rd and 1st
terms?

3, 12, 21, 30 ...

What is the formula
of the sequence?

225, 180, 135, 90 ...

What is the sum of
the first 5 terms?

21, 36, 51, 66 ...

What are the next
3 terms?

Honors Level

What core characteristic of an arithmetic sequence creates a linear graph?

What core characteristic of a geometric sequence creates an exponential (curved) graph?

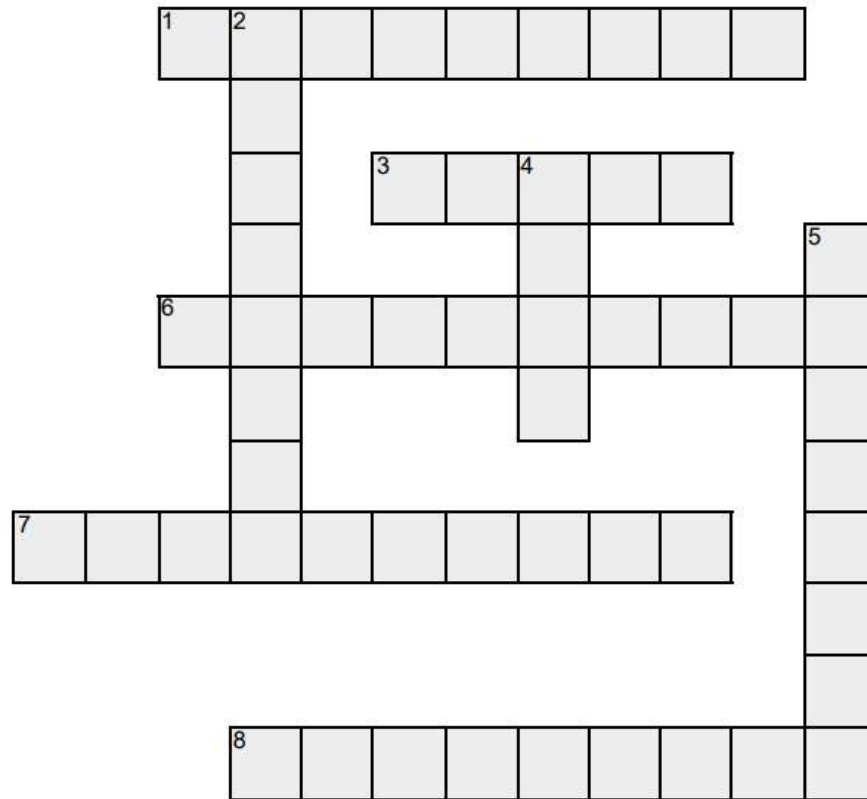
Why do the graphs of sequences, both arithmetic and geometric, consist of discrete points rather than continuous lines?

Explain why an arithmetic sequence with a large positive common difference (d) will eventually surpass a geometric sequence with a common ratio $r = 1.1$.

Why does the common ratio of a geometric sequence (r) never appear as the slope on the graph?

End-of-Course Prep

Sequences



Across	Down
1. A sequence where each term is obtained by multiplying a constant value from the previous term.	2. A formula that directly expresses the n th term of a sequence.
3. The constant value that is being multiplied from the previous term in a geometric sequence.	4. A number within a sequence.
6. The constant value that is being added from the previous term in an arithmetic sequence.	5. The basic concept of an ordered list of numbers.
7. A sequence where each term is obtained by adding a constant value from the previous term.	
8. A formula that defines a sequence by expressing each term in terms of the previous term(s).	



Unit 3 | Linear and Exponential Functions

Aviation

High School Mathematics 1

North Carolina Math 1 Standards

Unit 3

The Real Number System

Extend the properties of exponents to rational exponents.

NC.M1.N-RN.2	Rewrite algebraic expressions with integer exponents using the properties of exponents.
--------------	---

Seeing Structure in Expressions

Interpret the structure of expressions.

NC.M1.A-SSE.1	Interpret expressions that represent a quantity in terms of its context.
NC.M1.A-SSE.1a	a. Identify and interpret parts of a linear, exponential, or quadratic expression, including terms, factors, coefficients, and exponents.
NC.M1.A-SSE.1b	b. Interpret a linear, exponential, or quadratic expression made of multiple parts as a combination of entities to give meaning to an expression.

Creating Equations

Create equations that describe numbers or relationships.

NC.M1.A-CED.2	Create and graph equations in two variables to represent linear, exponential, and quadratic relationships between quantities.
---------------	---

Reasoning with Equations and Inequalities

Understand solving equations as a process of reasoning and explain the reasoning.

NC.M1.A-REI.1	Justify a chosen solution method and each step of the solving process for linear and quadratic equations using mathematical reasoning.
---------------	--

Interpreting Functions

Understand the concept of a function and use function notation.

NC.M1.F-IF.2	Use function notation to evaluate linear, quadratic, and exponential functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
--------------	--

Interpreting Functions <i>Interpret functions that arise in applications in terms of the context.</i>	
NC.M1.F-IF.5	Interpret a function in terms of the context by relating its domain and range to its graph and, where applicable, to the quantitative relationship it describes.
NC.M1.F-IF.6	Calculate and interpret the average rate of change over a specified interval for a function presented numerically, graphically, and/or symbolically.

Interpreting Functions <i>Analyze functions using different representations.</i>	
NC.M1.F-IF.7	Analyze linear, exponential, and quadratic functions by generating different representations, by hand in simple cases and using technology for more complicated cases, to show key features, including: domain and range; rate of change; intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximums and minimums; and end behavior.
NC.M1.F-IF.8 NC.M1.F-IF.8a NC.M1.F-IF.8b	Use equivalent expressions to reveal and explain different properties of a function. a. Rewrite a quadratic function to reveal and explain different key features of the function b. Interpret and explain growth and decay rates for an exponential function.
NC.M1.F-IF.9	Compare key features of two functions (linear, quadratic, or exponential) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).

Building Functions <i>Build a function that models a relationship between two quantities.</i>	
NC.M1.F-BF.1 NC.M1.F-BF.1a NC.M1.F-BF.1b	Write a function that describes a relationship between two quantities. a. Build linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two ordered pairs (include reading these from a table). b. Build a function that models a relationship between two quantities by combining linear, exponential, or quadratic functions with addition and subtraction or two linear functions with multiplication.

Linear, Quadratic, and Exponential Models <i>Construct and compare linear and exponential models and solve problems.</i>	
NC.M1.F-LE.1	Identify situations that can be modeled with linear and exponential functions, and justify the most appropriate model for a situation based on the rate of change over equal intervals.
NC.M1.F-LE.3	Compare the end behavior of linear, exponential, and quadratic functions using graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically.

Linear, Quadratic, and Exponential Models <i>Interpret expressions for functions in terms of the situation they model.</i>	
NC.M1.F-LE.5	Interpret the parameters a and b in a linear function $f(x) = ax + b$ or an exponential function $g(x) = ab^x$ in terms of a context.

3.1 Slope of a Line

Warm-Up

Simplify the following.

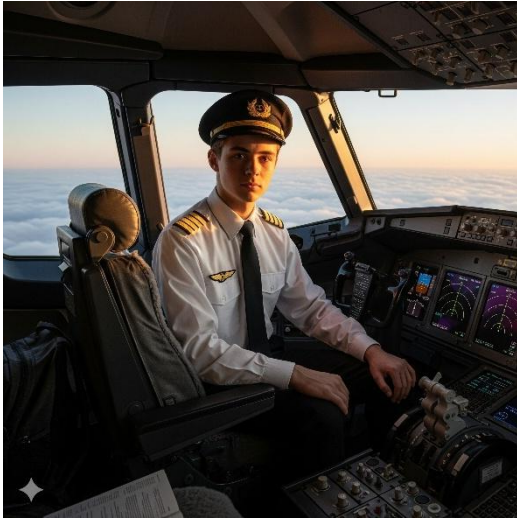
$$\frac{12}{15}$$

$$\frac{8+(-2)}{-3-9}$$

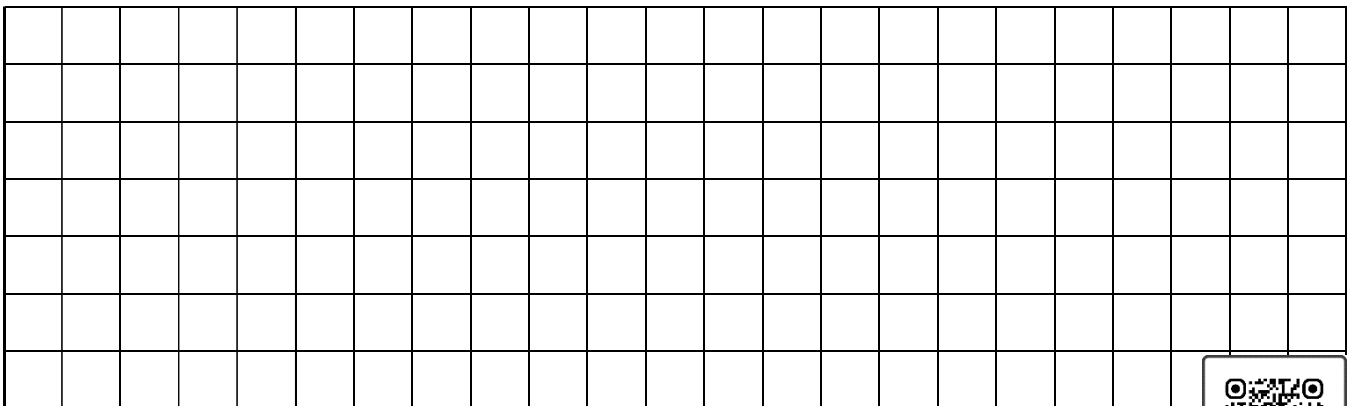
$$\frac{-8-(-2)}{3+(-9)}$$

Main Topic Slope of a Line

You are the pilot of a flight departing for Greensboro, North Carolina. You have just been cleared for takeoff by air traffic control.



- ☐ On a grid, draw an airport tower on the lower-right side and a plane on the lower-left side.
- ☐ From the plane, draw a takeoff path as a straight line.
- ☐ Ensure the path crosses through the corners of at least two squares on the grid.
- ☐ Choose and label two points on the path, then identify and write down their coordinates.



Need Help?

Do you know how to represent the steepness of the path in numerical form?
If not, follow the additional instructions below.

- ☐ Using the two points you identified from the graph, plot the 3rd point to create a right triangle when the points are connected.
- ☐ Determine the length of the vertical side of the triangle (the **rise**)
- ☐ Determine the length of the horizontal side (the **run**).

Slope

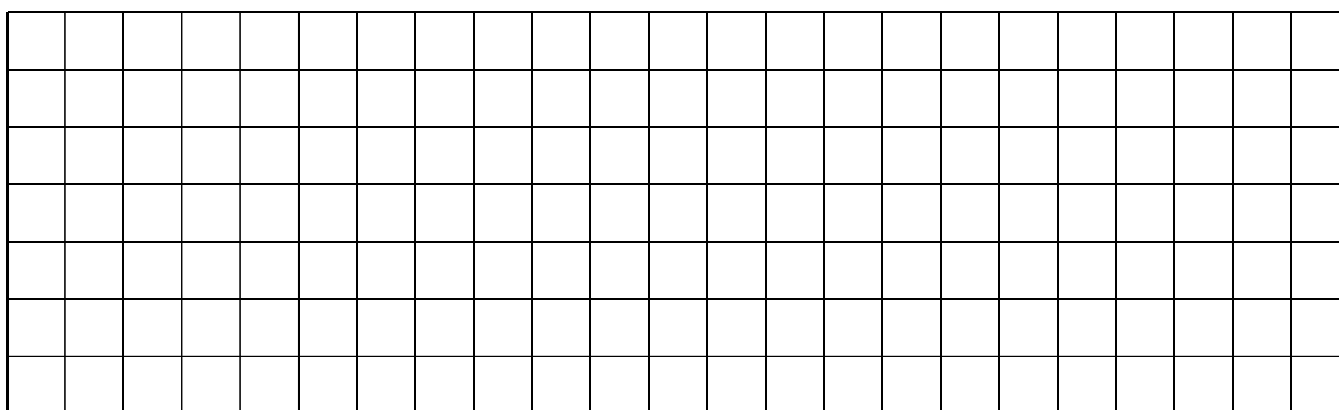
$$\frac{\text{rise}}{\text{run}} = \underline{\hspace{2cm}}$$

When the aircraft reaches _____ above the ground,
it covers _____ horizontal distance from the takeoff point.

- ☐ If the line is diagonal to the right (**increasing**), the *slope* is **positive**.
- ☐ If the line is diagonal to the left (**decreasing**), the *slope* is **negative**.

After several hours of flying, it's time for landing.

- ☐ Draw an airport tower on the lower left side of the grid.
- ☐ Draw a plane on the upper right side of the grid.
- ☐ From the plane, draw a straight landing path.
(make sure that the path crosses at least 2 corners of the grid)
- ☐ Locate two points on the path, label, and identify the coordinates of the points.



What is the slope of the landing path?

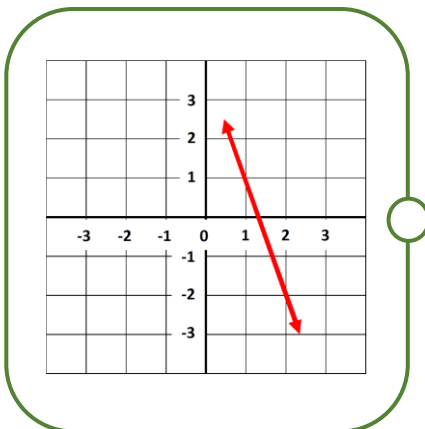
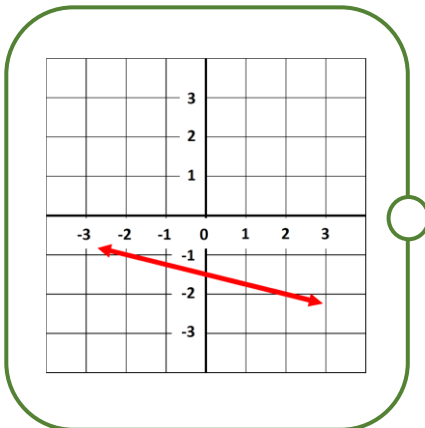
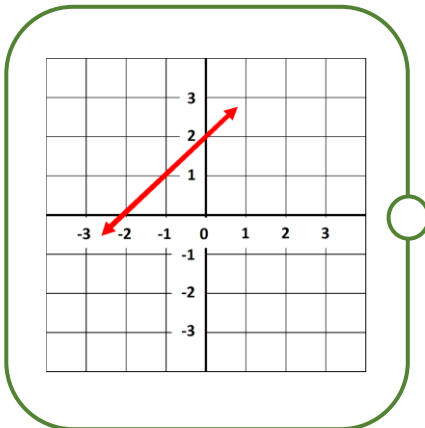


Need Help?

Slope Matching

Connect each graph to its matching slope in the middle column.

Column A



$$m = 0$$

$$m = \text{Undefined}$$

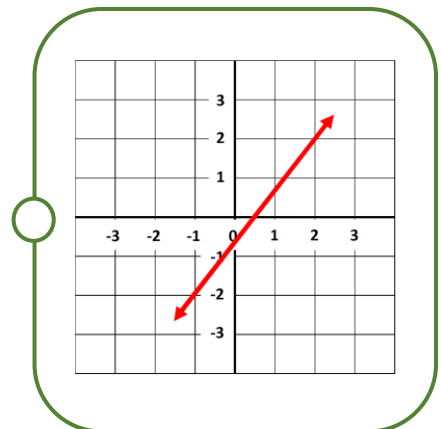
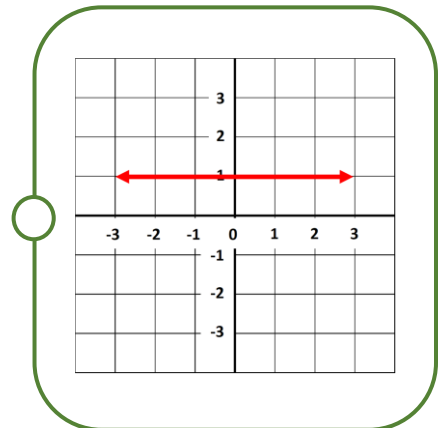
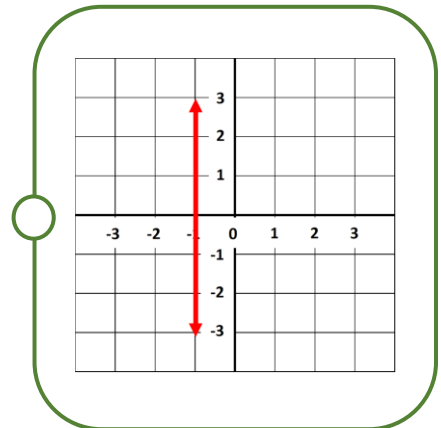
$$m = -\frac{1}{4}$$

$$m = -3$$

$$m = \frac{4}{3}$$

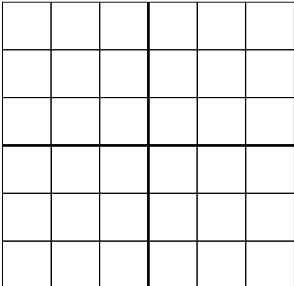
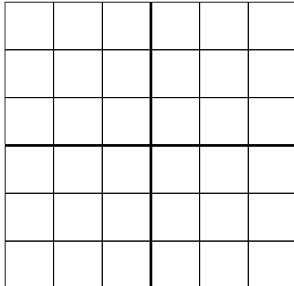
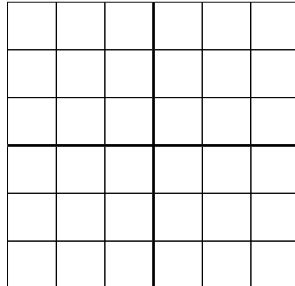
$$m = 1$$

Column B

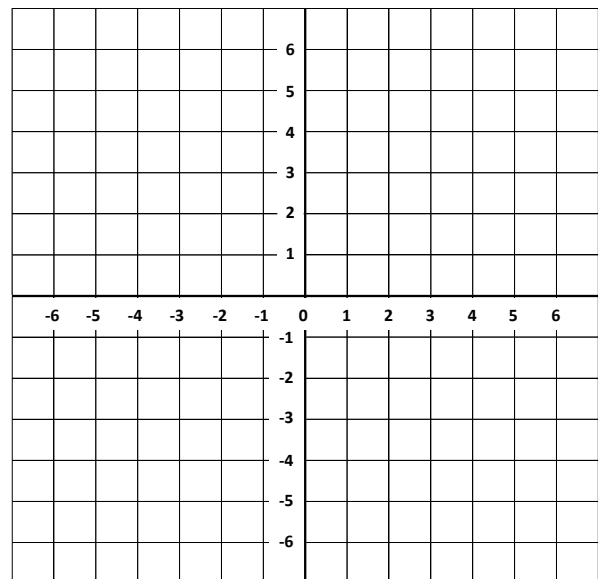


Main Topic **Slope of a Line Passing Two Points**

Find the slope of a line that passes through the points below.

P(-1, -2) and Q(0, 2) 	A(-2,3) and B(1, 0) 	S(1, -1) and T(-1, -1) 
--	--	---

- Plot points A(-4, -2) and B(3, 5).
- Plot point C(,) in the 2nd quadrant to create a right triangle.
- What is the length of the height (rise) of the triangle?
- Height (rise) Formula:
- What is the length of the base (run) of the triangle?
- Base (run) Formula:
- $Slope = \frac{Rise}{Run} = \underline{\hspace{2cm}}$


Slope

Slope, ***m***, describes the direction and the steepness of a line.

Use the slope formula to find the slope of a line passing through the points below.

P(-1, -2) and Q(0, 2)	A(-2,3) and B(-2, 0)	S(5, -1) and T(9, -1)
------------------------------	-----------------------------	------------------------------



Need Help?

Foldable

Ready, Set, Go!

Find the slope of a line that passes through the given points.

Ready

(2, 5) and (-8, 12)

Work with groupmates.

Set

(-3, -16) and (4, -7)

Work with a partner.

Go

(20, -39) and (7, -23)

Work on your own.

Honors Level

Solve each problem and show all steps.

Conceptually, what does the slope of a line represent in real-world applications?

What does a slope of zero ($m = 0$) indicate about the orientation of a line, and what kind of real-world rate of change does it represent?

How does the sign of the slope relate to the graphical direction of the line as you move from left to right?

Explain why the slope calculation, $\frac{y_2 - y_1}{x_2 - x_1}$, yields the same value regardless of which two points on the line are chosen.

If a line passes through the points (a,b) and (c,b) , what must its slope be, and why?

End-of-Course Prep

3.2 Slope-Intercept Form

Warm-Up

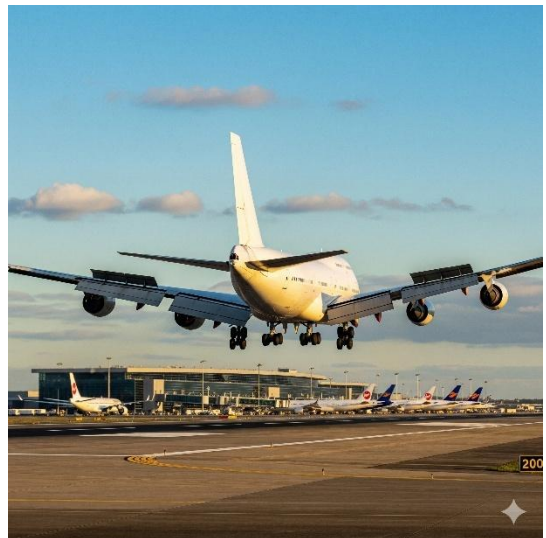
Answer the following questions.

1. How do you define a slope?
2. What is the sign of the slope of an increasing linear graph?
3. What is the sign of the slope of a decreasing linear graph?
4. What is the slope of a vertical line?
5. What is the slope of a horizontal line?

Main Topic Slope-Intercept Form

You are a flight student practicing a landing approach. Your flight instructor has given you a specific glide path to follow, which can be represented by a linear equation. The goal is to maintain the correct rate of descent to touch down at the beginning of the runway.

- ☐ The altitude of the aircraft (y) starts at a certain height and decreases as the aircraft approaches the runway.
- ☐ The distance to the runway (x) decreases over time.
- ☐ The rate of descent is constant, which represents the slope (m) of the linear equation.
- ☐ The initial altitude at a specific point on the approach is the y -intercept (b).



TASK

1

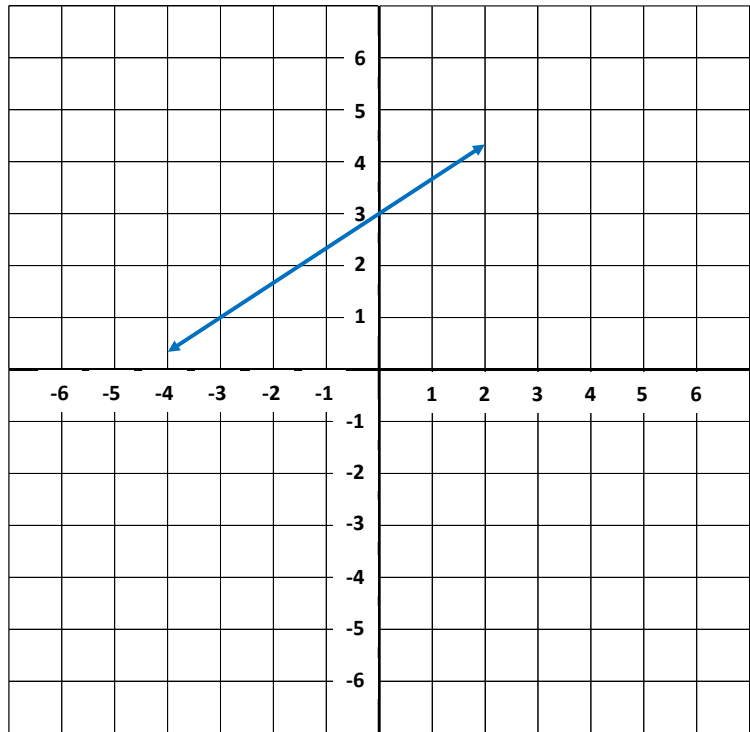
If your aircraft is at an altitude of 1,000 feet when it is 4 nautical miles from the runway, and you need to descend at a rate of -250 feet per nautical mile to maintain the correct glide path, what is the slope-intercept equation that models your descent?

Main Topic **Slope-Intercept Form**

- What is the **slope** of a line?

 $m =$

- What is the **y-intercept** of a line?

 $b =$

Slope-Intercept Form

A linear equation in the form of $y = mx + b$ that consists of slope, m , and y-intercept, b .



If you can identify the slope and the y-intercept of a line, then you can easily determine the equation of a line. That's how easy it is!

Example:

$$\text{slope}(m) = \frac{2}{3} \text{ and } y\text{-intercept}(b) = 3$$

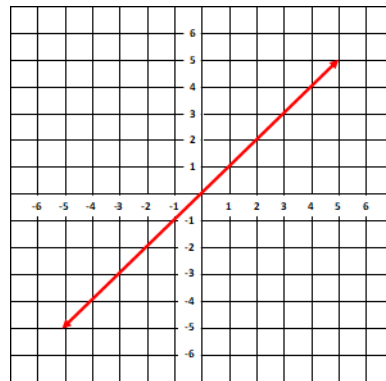
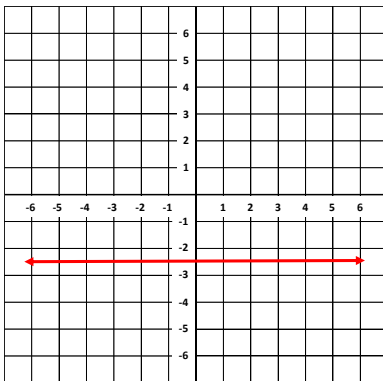
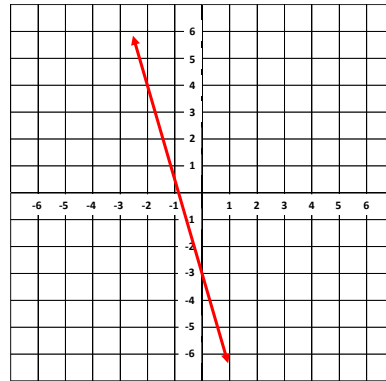
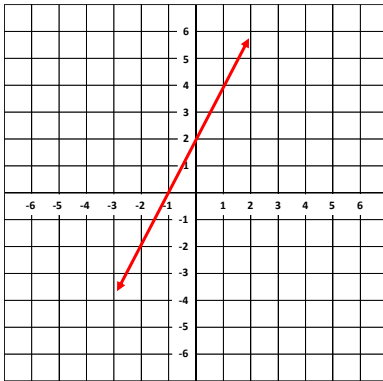
$$y = mx + b$$

$$y = \underline{\hspace{1cm}}x + \underline{\hspace{1cm}}$$



Need Help?

Find the equations of the lines.



Determine the slope and y-intercept of each equation.

State if the given line is increasing or decreasing.

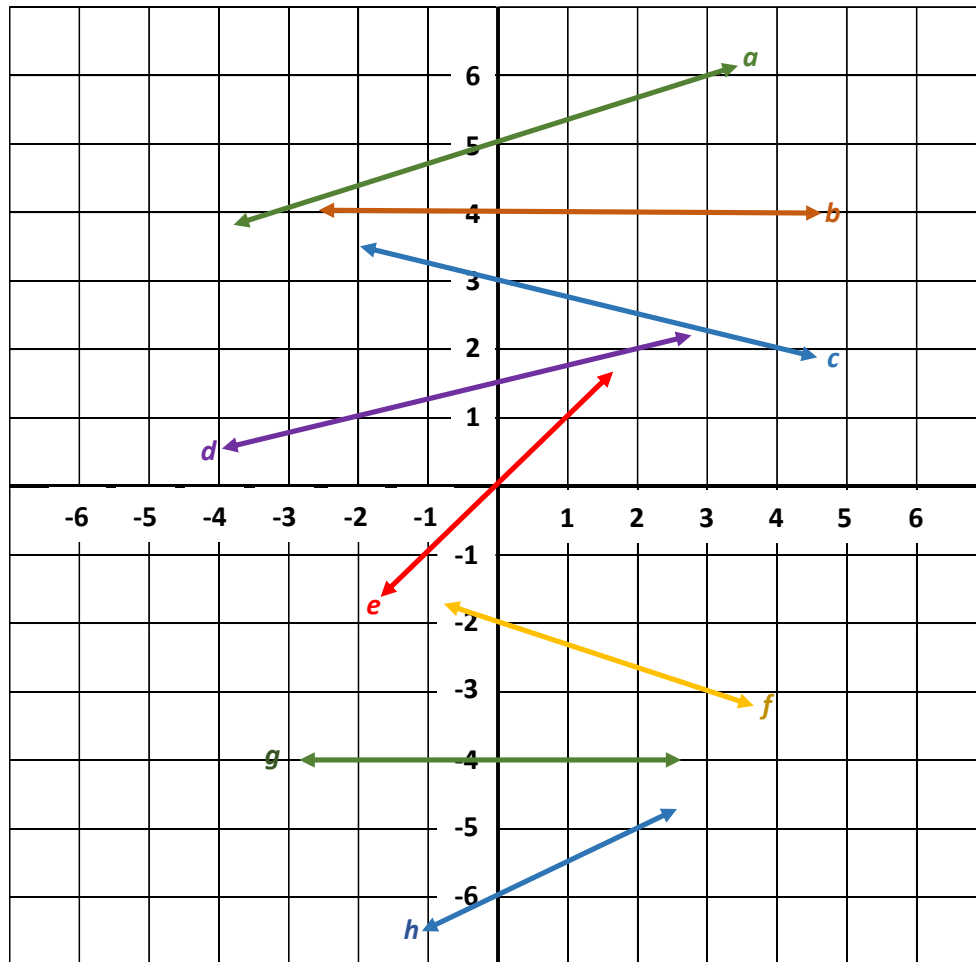
$y = 3x - 9$	$y = -3x - 9$	$y = 3 + 9x$
$y = 6 + 1(x - 1)$	$y = 4(x - 1) + 8$	$y = -4 - 3(x - 1)$
$y - 1 = -2(x - 1)$	$y + 5 = \frac{1}{2}x + 2$	$-y = 3 + 9x$



Need Help?

Speed Math

There are 8 graphs labeled **a** through **h**. Your teacher will call on one line at time then you will write the equation of the line in $y = mx + b$ form on your whiteboard.



Main Topic

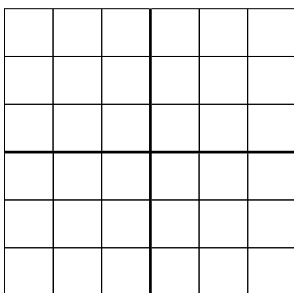
Graphing Linear Equations in Slope-Intercept Form

Identify the slope and the y-intercept, then graph the equation.

$$y = \frac{2}{3}x - 2$$

m =

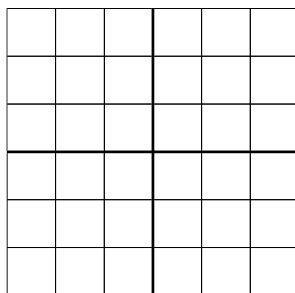
y-intercept=



$$y = -\frac{1}{2}x + 1$$

m =

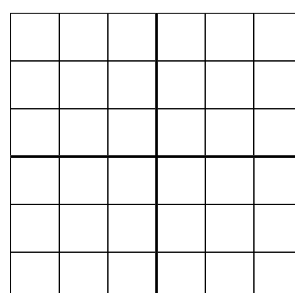
y-intercept=



$$y = 4x - 3$$

m =

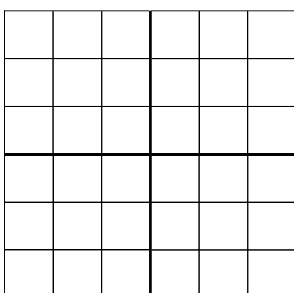
y-intercept=



$$y = x - 2$$

m =

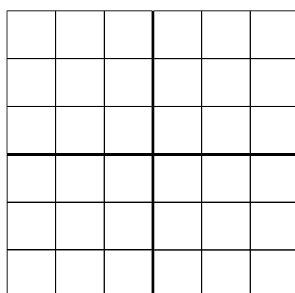
y-intercept=



$$y = -2x + 1$$

m =

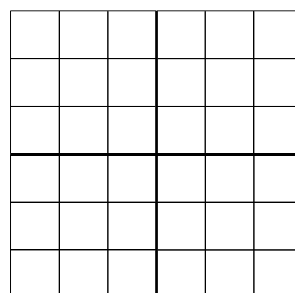
y-intercept=



$$y = x$$

m =

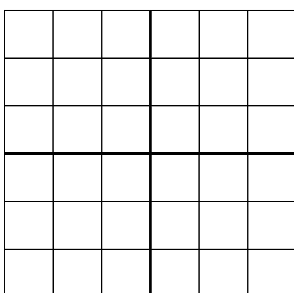
y-intercept=



$$y = -x$$

m =

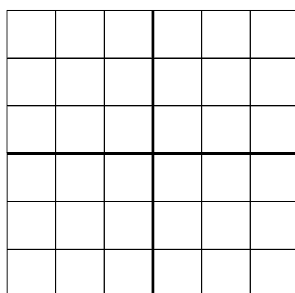
y-intercept=



$$y = 2$$

m =

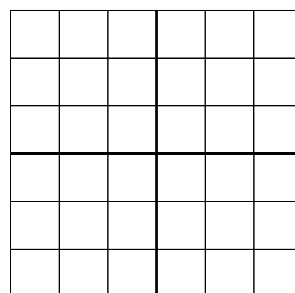
y-intercept=



$$x = -1$$

m =

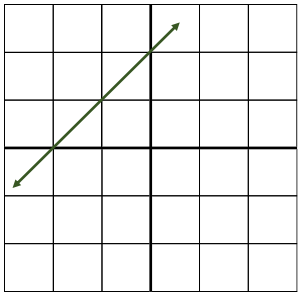
y-intercept=



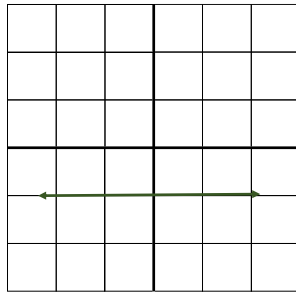
Need Help?

Take One

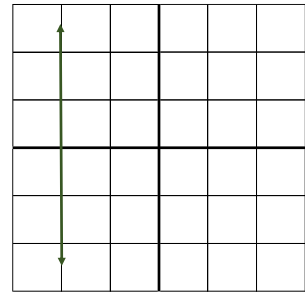
Find the cutout with the equation that matches each graph and paste it under the corresponding graph on this page. The cutouts are posted around the classroom.



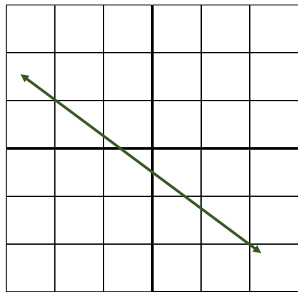
Paste here



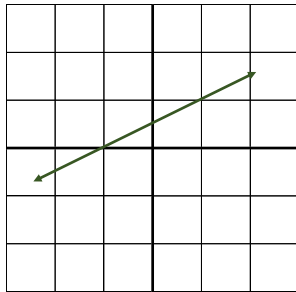
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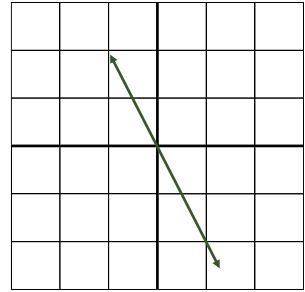
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Honors Level

Solve each problem and show all steps.

Explain the core concept of the slope-intercept form ($y = mx + b$) and why it is arguably the most useful form of a linear equation.

If the slope of a line is a fraction (e.g., $m = \frac{2}{5}$),
how is this interpreted when graphing the line from the y-intercept?

If an equation is given in standard form, $Ax + By = C$,
what conceptual step is required to convert it to slope-intercept form?

How is the x-intercept of a line related to its slope-intercept form?
(Provide a conceptual explanation, not a formula.)

If you have an equation that models the total cost (C) of a service based on time (t),
 $C = mt + b$, what real-world quantity does the y-intercept (b) represent?

End-of-Course Prep

3.3 Linear Equations in Standard Form

Warm-Up

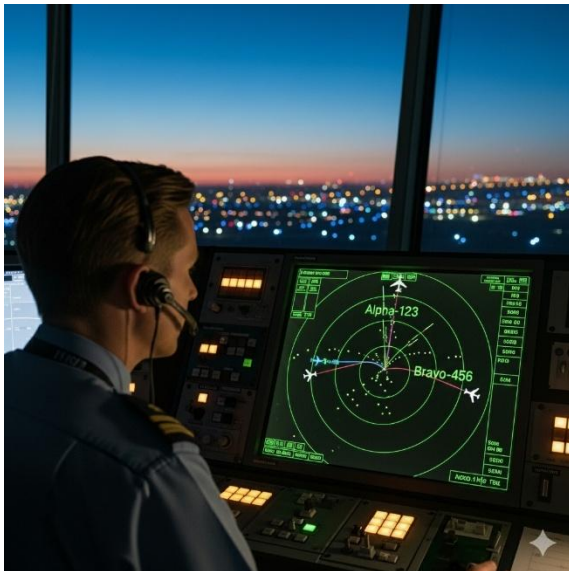
Solve for x .

$$x + 5 = 2$$

$$x - 5 = 2$$

$$x - 5 = -2$$

Main Topic Linear Equations in Standard Form



Two commercial airliners, **Alpha-123** and **Bravo-456**, are on approach to the same navigational waypoint before beginning their final descent. Air Traffic Control needs to manage their approach times to ensure a safe and efficient sequence.

- **Alpha-123** is a heavier, cargo aircraft flying at a steady speed of **450 knots** (nautical miles per hour).
- **Bravo-456** is a faster passenger jet traveling at **550 knots**.

The total combined distance they must cover to reach the waypoint is **4,950 nautical miles**. The flight plan requires a specific coordinated arrival time, meaning the combined total time they spend flying to that point must not exceed a certain value.

This relationship can be represented using a linear equation in standard form.

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Standard Form

A linear equation in standard form is expressed in $Ax + By = C$ form. Notice that the constant is isolated on the other side of the equation.

Slope-Intercept Form

$$y = 2x + 5$$

Standard Form

Ax	By	=	C
x	y	=	
x	y	=	

Slope-Intercept Form

$$y = -\frac{2}{3}x + 5$$

Standard Form

Ax	By	=	C
x	y	=	
x	y	=	

Slope-Intercept Form

$$y = \frac{2x - 5}{3}$$

Standard Form

Ax	By	=	C
x	y	=	
x	y	=	



Need Help?

Fill in the blank

Express the following equations in standard forms.

$$y = 8 - 3x$$

Ax	By	=	C
___x	___y	=	___
___x	___y	=	___

$$6 - 5y = 2x$$

Ax	By	=	C
___x	___y	=	___
___x	___y	=	___

$$y - 7 = 2(x - 5)$$

Ax	By	=	C
___x	___y	=	___
___x	___y	=	___

$$y + 5 = -\frac{1}{2}(6x - 8)$$

Ax	By	=	C
___x	___y	=	___
___x	___y	=	___

$$y + 4x = 2(8 - 3x)$$

Ax	By	=	C
___x	___y	=	___
___x	___y	=	___

$$6 - 5y = 2(x - 4y)$$

Ax	By	=	C
___x	___y	=	___
___x	___y	=	___

Quick Math

Express $y - 7 = 2(x - 5)$ in $y = mx + b$ form.

Main Topic **Linear Equations in Slope-Intercept Form ($y = mx + b$)**

Standard Form

$2x - 5y = 10$

Slope-Intercept Form

y	=	mx	b
y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$

$2x + 5y = 10$ <table border="1"> <tr> <td>y</td> <td>=</td> <td>mx</td> <td>b</td> </tr> <tr> <td>y</td> <td>=</td> <td>$\underline{\hspace{1cm}}x$</td> <td>$\underline{\hspace{1cm}}$</td> </tr> </table>	y	=	mx	b	y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$	$-2x + 5y = 10$ <table border="1"> <tr> <td>y</td> <td>=</td> <td>mx</td> <td>b</td> </tr> <tr> <td>y</td> <td>=</td> <td>$\underline{\hspace{1cm}}x$</td> <td>$\underline{\hspace{1cm}}$</td> </tr> </table>	y	=	mx	b	y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$
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$6y - 12x = 24$ <table border="1"> <tr> <td>y</td> <td>=</td> <td>mx</td> <td>b</td> </tr> <tr> <td>y</td> <td>=</td> <td>$\underline{\hspace{1cm}}x$</td> <td>$\underline{\hspace{1cm}}$</td> </tr> </table>	y	=	mx	b	y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$	$6y + 12x = 24$ <table border="1"> <tr> <td>y</td> <td>=</td> <td>mx</td> <td>b</td> </tr> <tr> <td>y</td> <td>=</td> <td>$\underline{\hspace{1cm}}x$</td> <td>$\underline{\hspace{1cm}}$</td> </tr> </table>	y	=	mx	b	y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$
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$2x - 5y = 20$ <table border="1"> <tr> <td>y</td> <td>=</td> <td>mx</td> <td>b</td> </tr> <tr> <td>y</td> <td>=</td> <td>$\underline{\hspace{1cm}}x$</td> <td>$\underline{\hspace{1cm}}$</td> </tr> </table>	y	=	mx	b	y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$	$2x + 5y = 20$ <table border="1"> <tr> <td>y</td> <td>=</td> <td>mx</td> <td>b</td> </tr> <tr> <td>y</td> <td>=</td> <td>$\underline{\hspace{1cm}}x$</td> <td>$\underline{\hspace{1cm}}$</td> </tr> </table>	y	=	mx	b	y	=	$\underline{\hspace{1cm}}x$	$\underline{\hspace{1cm}}$
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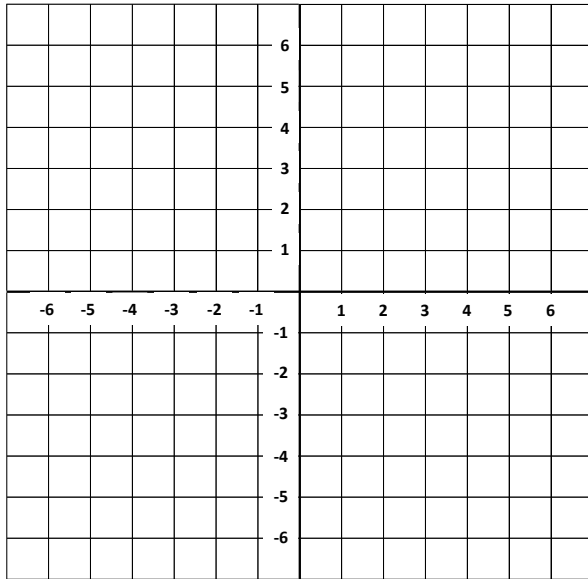


Need Help?

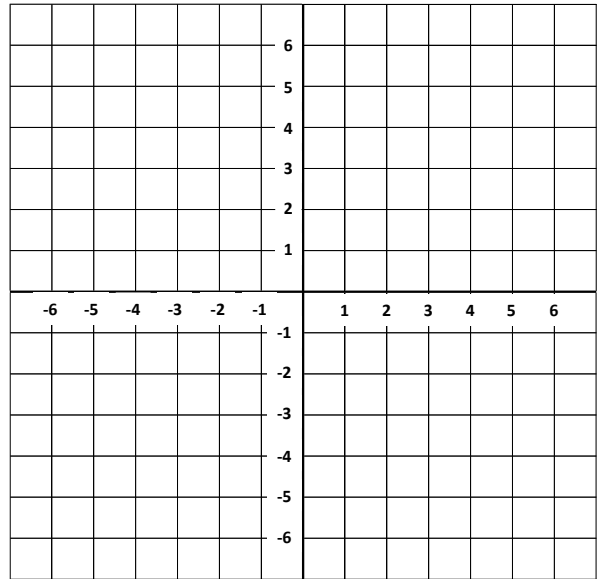
Linear Graphs

Graph

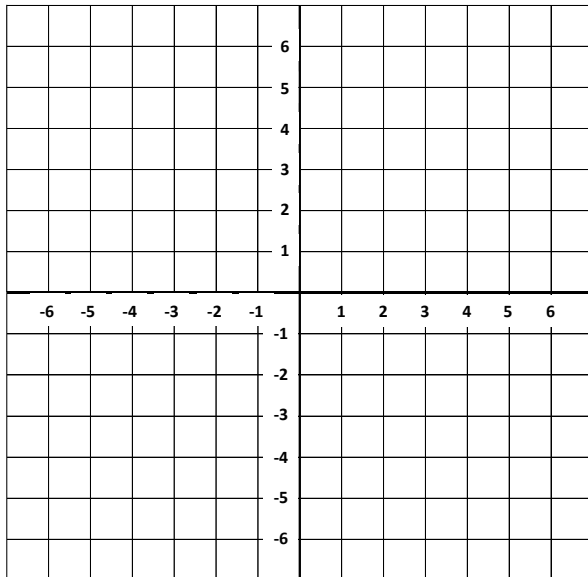
$$6x + 2y = 6$$



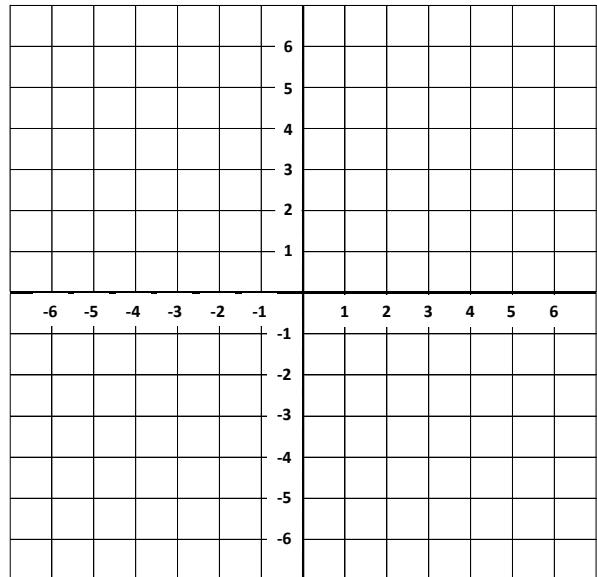
$$2x - 3y = 12$$



$$4y - 8x = 16$$



$$-3y = 12$$



Honors Level

Solve each problem and show all steps.

What is the defining characteristic of the Standard Form of a linear equation, $Ax + By = C$, and what restrictions are usually placed on A , B , and C ?

How can you determine if two lines in Standard Form are parallel without converting them to slope-intercept form?

How does the Standard Form, $Ax + By = C$, quickly reveal the coordinates of the x-intercept?

How does the Standard Form, $Ax + By = C$, quickly reveal the coordinates of the y-intercept?

If the coefficient $A = 0$ in the equation $Ax + By = C$, describe the type of line and its slope.

End-of-Course Prep

3.4 Point-Slope Form

Warm-Up

Solve for x .

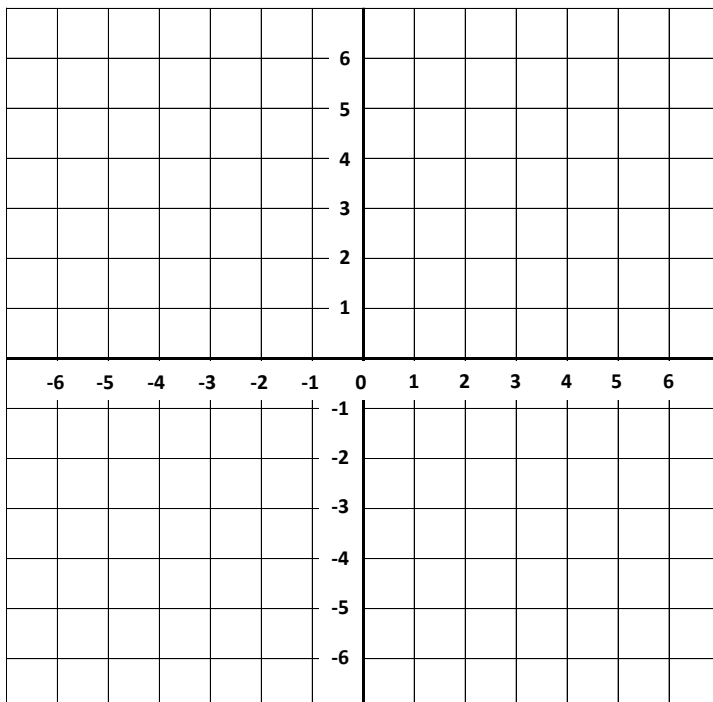
$$2x - 1 = 5$$

$$-1(3 - x) = 5$$

$$\frac{1}{5}(5x - 20) = 7$$

Main Topic Point-Slope Form

An **Air Traffic Controller (ATC)** is responsible for ensuring the safe and efficient movement of aircraft on the ground and in the air. Pilots communicate directly with ATC to know runway condition, weather, and other necessary information regarding the flight.



Equation of the Line

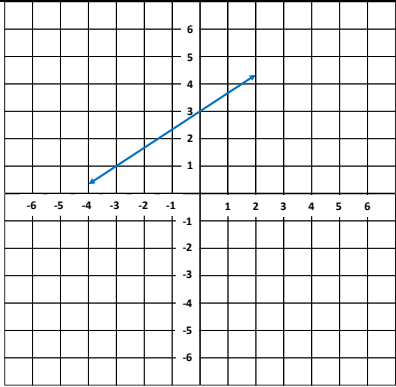
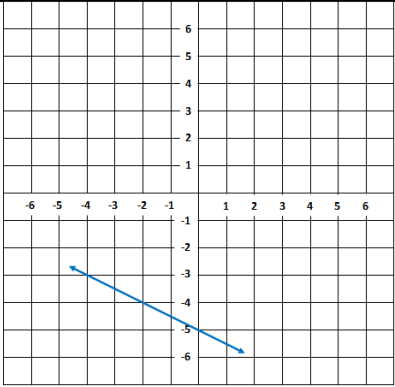
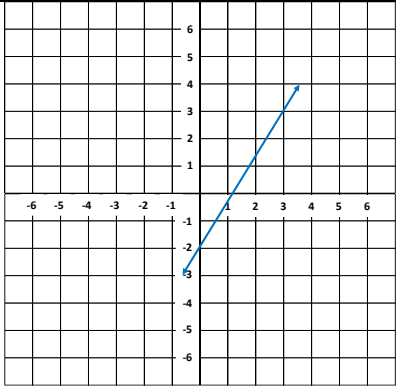
ATC has instructed the pilot to prepare for landing. The aircraft starts descending at $(6, 2)$ with a slope of $-\frac{1}{6}$.

- Illustrate the landing path in the grid.
- Find the equation of the landing path.



Need Help?

Find the equations of the lines.

		
$P(0, 5)$ $m = \frac{3}{2}$	$P(0, -10)$ $m = \frac{2}{5}$	$P(0, -4)$ $m = 1$

Point-Slope Form

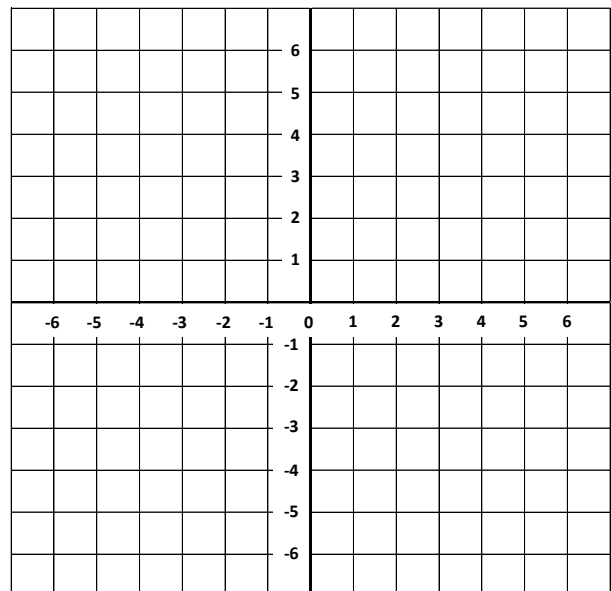
Use Point-Slope Form to find the equation of a line that passes through a given point with a given slope.

Equation of the Line

ATC has instructed you to prepare for landing.
You can start descending at $(-2, 6)$ with a slope of -1 .
Illustrate the landing path in the grid.

Find the equation of the landing path.

- What is the formula to find the slope of a line that passes through two points?
- Because there is only one point that is given, replace y_2 with y and x_2 with x .
- Plugin -1 to m , -2 to x_1 , and 6 to y_1 .
- Solve for y to express the equation in $y = mx + b$ form.



Need Help?

Bingo Prep**Bingo Preparation:**

- Divide the questions equally among your group.
- Find the equation of each line.
- Write the question number, show complete work on an index card, then turn it in.

1. $(3, -2)$ and $m=5$

9. $(-5, -3)$ and $m=1/5$

17. $(-2, -4)$ and $m=3$

2. $(-3, -2)$ and $m=5$

10. $(-5, -3)$ and $m=-2$

18. $(-2, -4)$ and $m=-3$

3. $(3, 2)$ and $m=5$

11. $(2, 5)$ and $m=1/2$

19. $(5, 4)$ and $m=3$

4. $(3, -2)$ and $m=-5$

12. $(-2, 5)$ and $m=3$

20. $(-5, 4)$ and $m=3$

5. $(-3, -2)$ and $m=1/3$

13. $(-2, -5)$ and $m=3$

21. $(-5, -4)$ and $m=3$

6. $(-3, 2)$ and $m=-5$

14. $(-2, -5)$ and $m=-3$

22. $(-5, -4)$ and $m=-3$

7. $(5, 3)$ and $m=2$

15. $(2, 4)$ and $m=1/4$

23. $(5, 4)$ and $m=1/2$

8. $(-5, 3)$ and $m=2$

16. $(-2, 4)$ and $m=3$

24. $(5, -4)$ and $m=-1/2$

- Randomly fill out the bingo card with equations of the lines.
- Your teacher shuffles the index cards, picks a card, calls out the question number, and reads the equation of a line.
- Cross out the box that contains the equation.
- A player with five boxes that are crossed out horizontally, vertically, or diagonally wins the game.

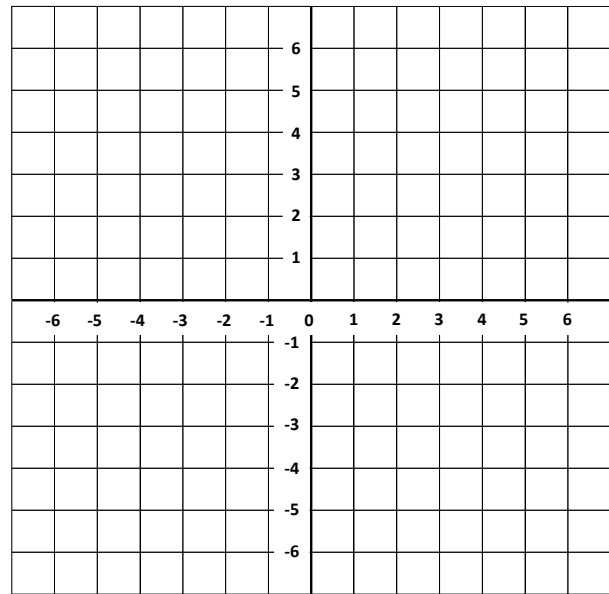
Bingo

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		FREE		

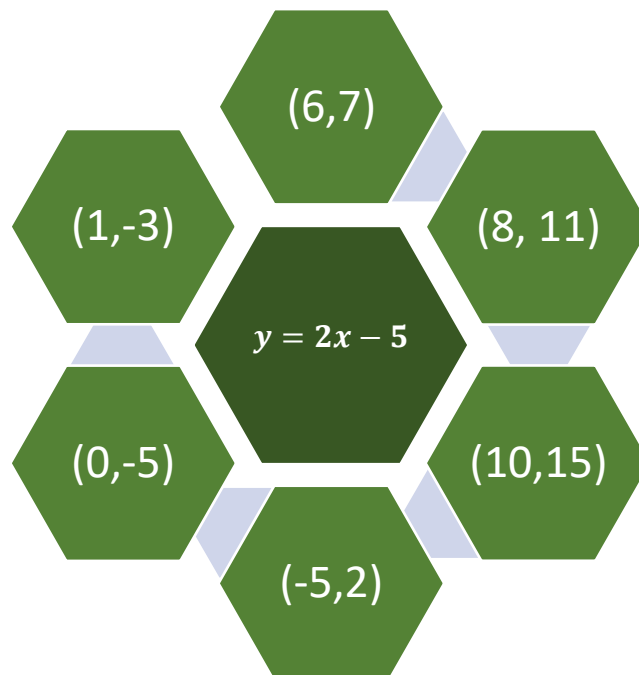
y-Intercept Form and a Point

An ATC is monitoring aircraft FJ260 as it takes off. The computer generates an equation of the takeoff path at $y = \frac{1}{6}x + 3$.

How do you determine if a plane will pass coordinates (12,5)?

**Odd One Out**

Cross out an ordered pair that is **not** on the graph.



Need Help?

Honors Level

Solve each problem and show all steps.

Explain the conceptual origin of the Point-Slope Form equation, $y - y_1 = m(x - x_1)$, by relating it back to the definition of slope.

Why is it impossible to write a vertical line in Point-Slope Form?

How does the Point-Slope Form naturally lend itself to determining whether two lines are parallel?

Why is Point-Slope Form considered the most useful format for deriving the equation of a line when given any two points?

What does the term $(x - x_1)$ conceptually represent in the equation $y - y_1 = m(x - x_1)$?

End-of-Course Prep

3.5 Two Points on a Line

Warm-Up

Solve for y .

$$2x - 5 = y - 1$$

$$2x - 5 = -y - 1$$

$$-\frac{3}{2}(2x - 6) = y - 1$$

Main Topic Two Points on a Line



Passing Two Points

A message on the aircraft's dashboard alerting the pilot about the elevations ahead. The message suggests that the plane takes a route passing coordinates **$(-3, 7)$** and **$(9, 6)$** .

What is the equation of the route in $y = mx + b$ form?

Step 1: Solve for the slope of a line passing through $(-3, 7)$ and $(9, 6)$.

Step 2: Use the slope and one of the points in the point-slope form, $m = \frac{y - y_1}{x - x_1}$.

Step 3: Solve for y .



Need Help?

Two Steps Method

Step 1: Find the slope using $m = \frac{y_2 - y_1}{x_2 - x_1}$.

Step 2: Use the slope and one of the points in $m = \frac{y - y_1}{x - x_1}$.

Find the equation of a line that passes through the given points.

(-7, 10) and (8, 15)	(23, -4) and (10, -55)
(3, 9) and (-1, 5)	(-1, 8) and (6, -12)
(9, 5) and (8, 5)	(3, -4) and (3, -8)

Agree or Disagree?

Find the equation of a line that passes through the given points.

Find a partner to agree with or disagree with your work.

$(-1, -8)(0, -3)$

Disagree?
Show correct
work here.

$(-4, -12)(1, 3)$

Disagree?
Show correct
work here.

$(1, 5)(2, 12)$

Disagree?
Show correct
work here.

Honors Level

Solve each problem and show all steps.

Explain the relationship between the two-point form and the point-slope form $(y - y_1 = m(x - x_1))$.

Why does the two-point form fail (become undefined) if the two given points have the same x-coordinate, i.e., $x_1 = x_2$?

What does the two-point form simplify to if the two given points have the same y-coordinate, i.e., $y_1 = y_2$?

Can the two-point form be used to find the equation of any straight line? Explain the exception.

If the slope m is known to be 3, how can you adapt the two-point form to verify the slope calculation using two points (1, 4) and (3, 10)?

End-of-Course Prep

3.6 Parallel Lines

Warm-Up

Solve for y.

$$4 = \frac{y-5}{x+2}$$

$$\frac{3}{2} = \frac{y-(-5)}{x+2}$$

$$-\frac{3}{2} = \frac{y-(-5)}{x-2}$$

Main Topic Parallel Lines

Two small private aircraft flying in a designated flight corridor. To ensure they don't get too close to each other while following the same general direction, they must fly on parallel paths.

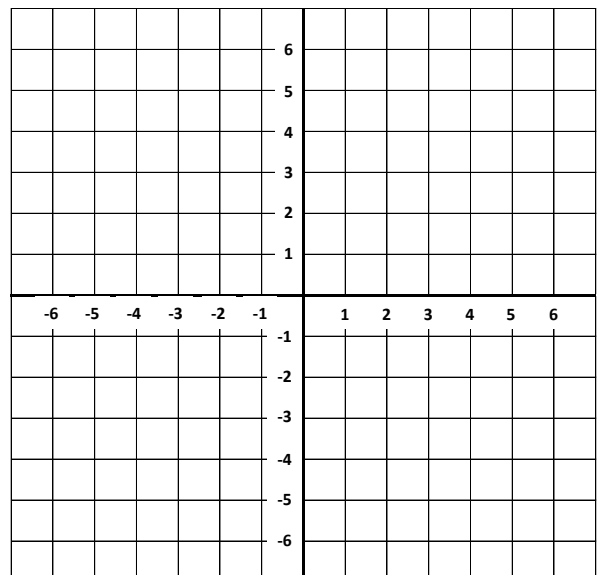


- ☐ **Aircraft A** is flying along a path that passes through a point (1, 3), where the coordinates represent 1 miles east and 3 miles north of a key navigational beacon.
- ☐ **Aircraft B** is flying along a parallel path that passes through a point (5, 2).

TASK

1

- ☐ Draw the paths of both aircraft in any direction.
- ☐ What strategies did you apply to ensure the aircraft maintain the same distance from each other?

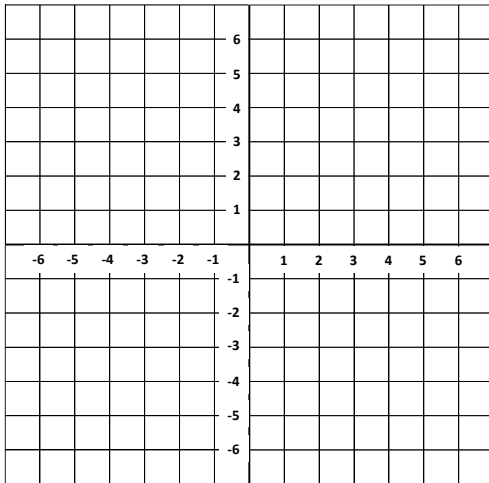


Parallel Lines

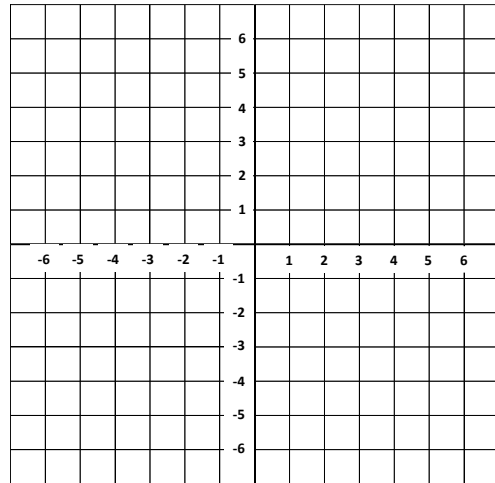
Parallel lines are coplanar (lie in the same plane) straight lines that have the same slope.

Graph a line that is parallel to the given line.

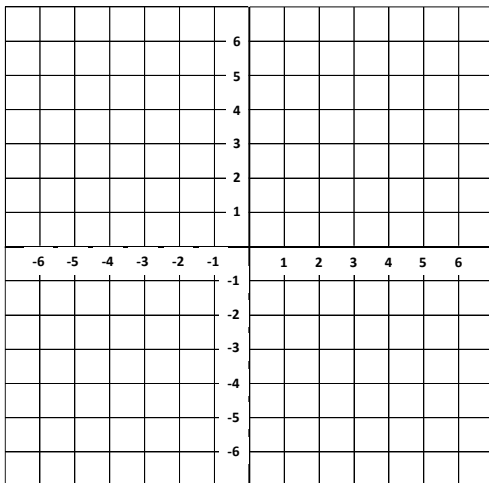
$$y = \frac{2}{5}x + 3$$



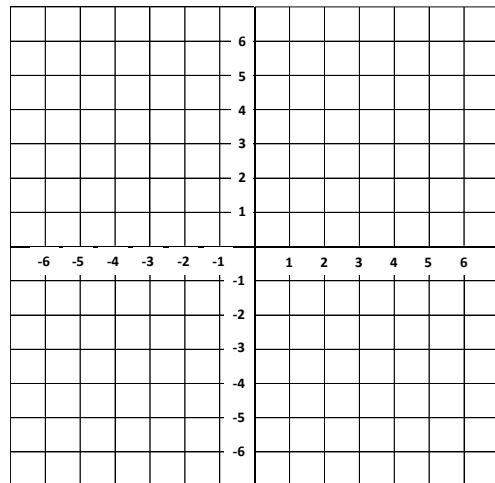
$$y = -\frac{3}{2}x + 1$$



$$y = x - 4$$



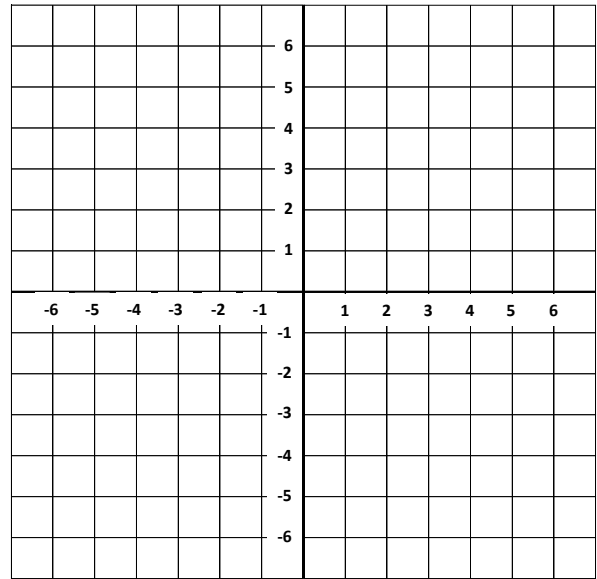
$$y = 4$$



TASK

2

- ☐ Graph: $y = \frac{2}{5}x - 3$ (1st line)
- ☐ Graph a 2nd line that passes through $(-2, -1)$ and parallel to $y = \frac{2}{5}x - 3$.
- ☐ What is the equation of the 2nd line?



Find the equation of a second line that passes through a given point and is parallel to the first line.

P(-5, 3)	1 st Line: $y = -\frac{3}{7}x - 5$	P(6, -10)	1 st Line: $y = 4x - 1$
P(0, 3)	1 st Line: $y = \frac{2}{9}x - 8$	P(7, 0)	1 st Line: $y = -\frac{7}{3}x - 2$

Quick Math

Which equation below is parallel to $y = \frac{4}{5}x + 13$ and passing through $(10, 5)$?

$$4x + 5y - 13 = 0$$

$$5y - 4x + 15 = 0$$



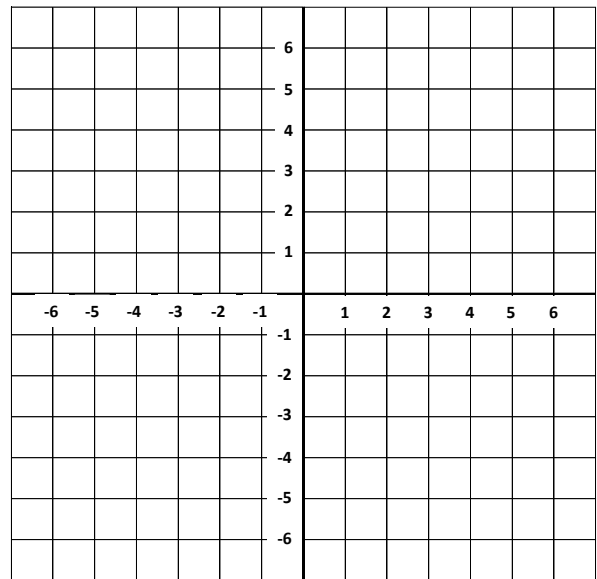
Need Help?

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Draw a parallelogram and label the vertices with A, B, C, and D.

- ☐ What is the slope of side AB?
- ☐ What is the slope of side BC?
- ☐ What is the slope of side CD?
- ☐ What is the slope of side AD?
- ☐ What is the equation of side AB?
- ☐ What is the equation of side BC?



Solve each problem and show all steps.

What is the equation of the line that is parallel to $y=5x+2$ and passes through the point $(1,-3)$?	Find the equation of a line that passes through the point $(4,0)$ and is parallel to the line $y=-2x+10$.
What is the equation of the line that is parallel to $2x+y=7$ and passes through the point $(-1,-5)$?	Find the equation of a line parallel to the line passing through points $(3,6)$ and $(1,2)$, and passes through the point $(0,4)$.
The line $5x-4y=20$ is parallel to a new line that passes through the point $(4,1)$. What is the equation of the new line in standard form?	What is the equation of a line parallel to the x-axis and passing through the point $(-2,3)$?

Parallel Lines Matching

Work with a partner to solve one column each.
Connect the shapes that contain parallel lines.

$$y - 2x + 5 = 0$$

$$6x + 3y = -3$$

$$10x + 2y = 12$$

$$10y - 6x = -10$$

$$2x + y = -1$$

$$6x - 3y = -15$$

$$8x + 12y - 60 = 0$$

$$-x + 2y = -6$$

$$4x - 8y - 24 = 0$$

$$-20x - 4y = -24$$

$$5y - 3x = -5$$

$$2x + 3y - 15 = 0$$

Honors Level

Solve each problem and show all steps.

What is the fundamental property of the slopes of two distinct non-vertical lines that are parallel?

Why can two parallel lines in the coordinate plane never intersect?

Can a horizontal line ($y = k$) ever be parallel to a vertical line ($x = h$)? Why or why not?

Why is the concept of parallel lines essential when solving geometric problems involving parallelograms?

Can the equations $2x + 3y = 6$ and $4x + 6y = 12$ represent two distinct parallel lines? Why or why not?

End-of-Course Prep

3.7 Perpendicular Lines

Warm-Up

Write anything that you know about the following terms.

Parallel lines

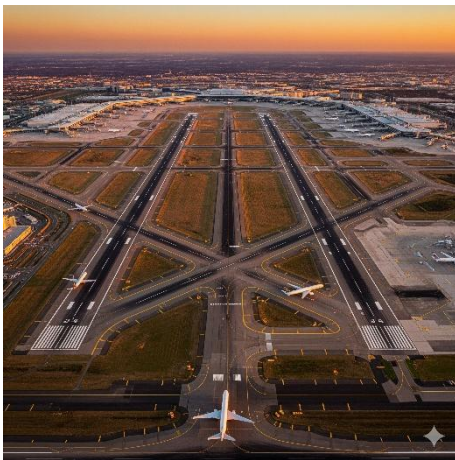
Perpendicular

Reciprocal

Counterclockwise

Main Topic Perpendicular Lines

Imagine two aircraft, **Flight 123** and **Flight 456**, approaching an intersection point near an airport. This intersection can be represented as the point where two perpendicular lines meet on a coordinate plane.

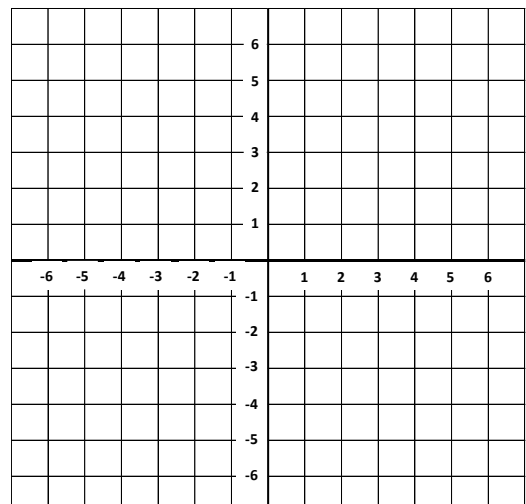


- ☐ **Flight 123** is on its final approach path, flying along a line that can be described by the equation: $y = 2x + 1$
- ☐ **Flight 456** is on a holding pattern, preparing to cross Flight 123's path. To ensure safety, Air Traffic Control directs Flight 456 to follow a path that is **perpendicular** to Flight 123's path and passes through a specific coordinate, for example, the point $(4, -1)$.

Draw the paths and find the equation for
Flight 456's path.

T
A
S
K

1



T
A
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K

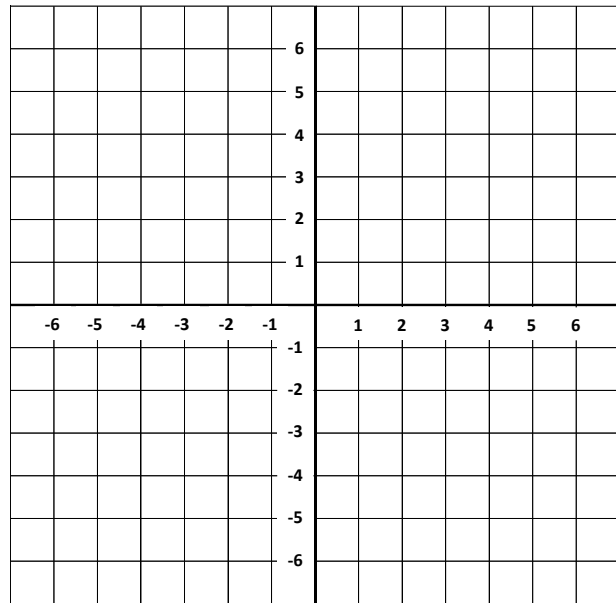
2

Line 1

- Plot (3, 3) and (0, -2).
- Draw a line passing those points.
- What is the slope of the line?

Line 2

- Rotate *line 1* 90° counterclockwise.
- What is the slope of *line 2*?

**Observations:**

- What kind of angle did the lines form?
- Are the lines parallel or perpendicular to each other? Explain.
- What do you notice about the slopes of the lines?
- What is your general observation about the lines that are perpendicular to each other?

**Perpendicular
Lines**

Perpendicular lines are coplanar (lie in the same plane) straight lines that have opposite reciprocal slopes with each other.

Identify the slope of a line that is perpendicular to the given lines.

$$y = \frac{4}{5}x - 7$$

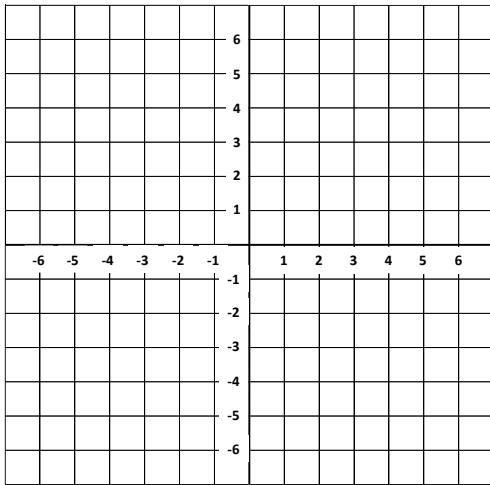
$$y = 12 - 8x$$



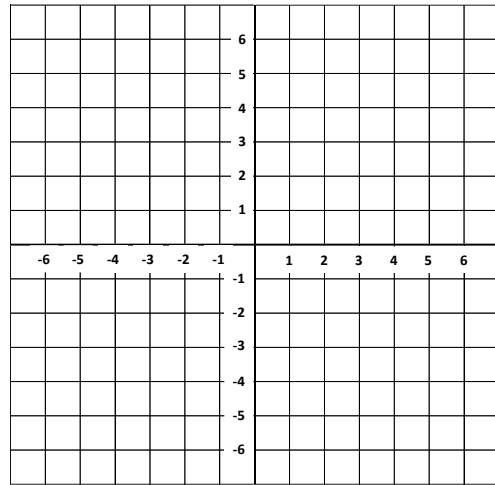
Need Help?

Graph a line that is perpendicular to the given line.

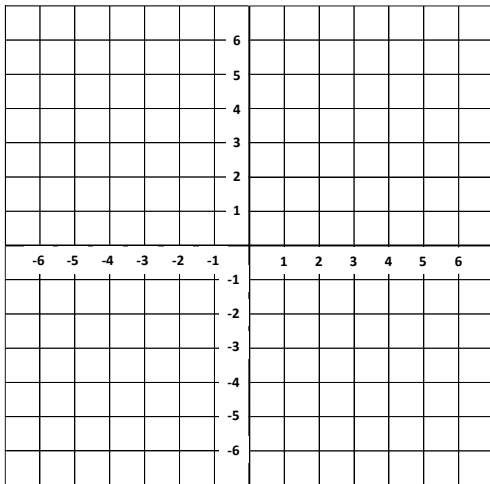
$$y = \frac{2}{5}x + 3$$



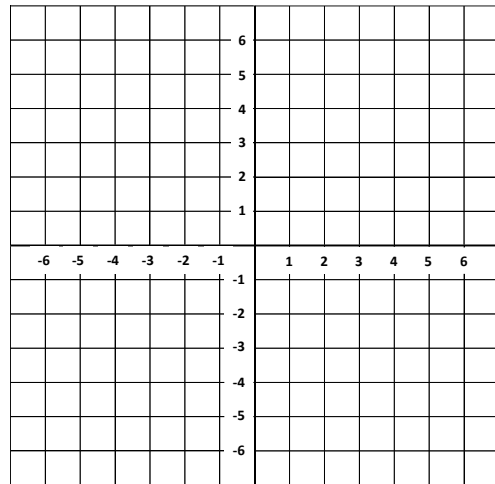
$$y = -\frac{3}{2}x + 1$$



$$y = x - 4$$



$$y = 4$$



Quick Math

Circle the lines that are perpendicular to each other.

$$5x + 4y = 4$$

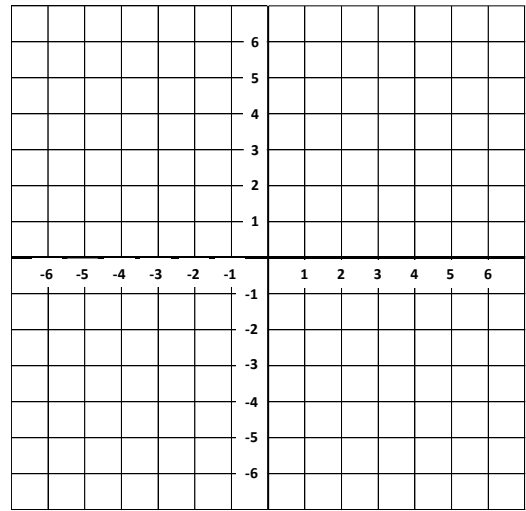
$$y = \frac{5}{4}x - 3$$

$$5y - 4x - 10 = 0$$

T
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K

3

- ☐ Graph: $y = \frac{2}{5}x - 3$ (1st line)
- ☐ Graph a 2nd line that passes through $(-2, -1)$ and perpendicular to $y = \frac{2}{5}x - 3$.
- ☐ What is the equation of the 2nd line?



Find the equation of the 2nd line that passes through a given point and perpendicular to the 1st line.

P(-5, 3)	1 st Line: $y = -\frac{3}{7}x - 5$	P(6, -10)	1 st Line: $y = 4x - 1$
P(0, 3)	1 st Line: $y = \frac{2}{9}x - 8$	P(7, 0)	1 st Line: $y = -\frac{7}{3}x - 2$

Quick Math

Which equation below is perpendicular to $y = \frac{3}{2}x + 1$ and passing through $(10, 5)$?

$$2y - 3x = 10$$

$$2x + 3y = 35$$

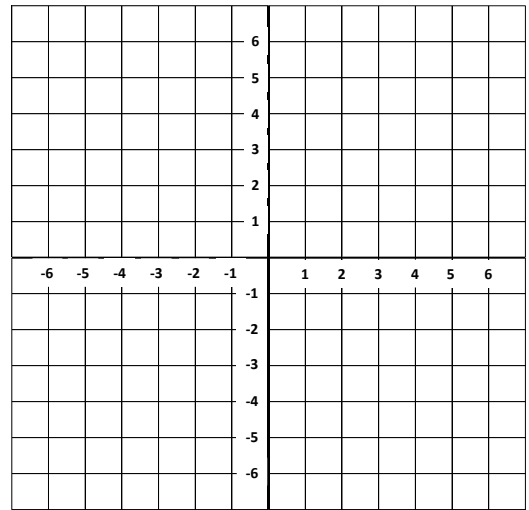


Need Help?

T
A
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K

4

- ☐ Draw a rectangle and label the vertices with A, B, C, and D.
- ☐ What is the slope of side AB?
- ☐ What is the slope of side BC?
- ☐ What is the slope of side CD?
- ☐ What is the slope of side AD?

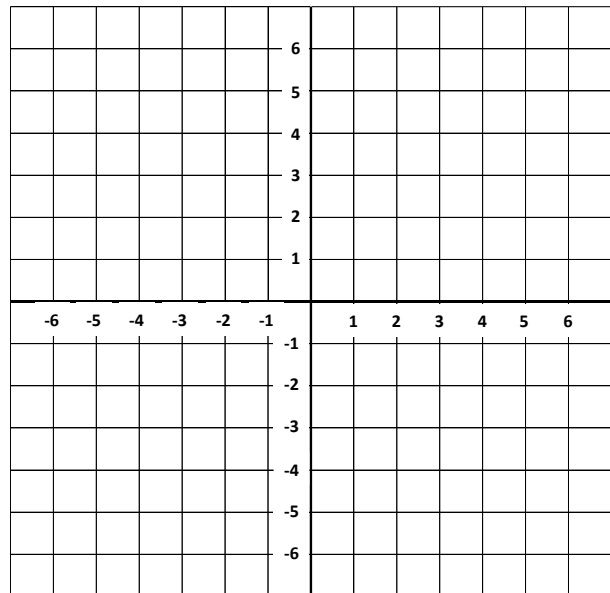


- ☐ What is the equation of side AB?
- ☐ What is the equation of side BC?

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K

5

- ☐ Draw a kite and label the vertices with A, B, C, and D.
- ☐ What are the slopes of the diagonals?
- ☐ What are the equations of the diagonals?



Perpendicular Lines Matching

Find a partner and let your partner solve the other column.
Match the lines that are perpendicular to each other by connecting the shapes.

$$2y - 4x = -10$$

$$-9x + 3y - 12 = 0$$

$$x + 3y - 6 = 0$$

$$9x + 6y = -6$$

$$8x + 4y = -20$$

$$x + 2y = 10$$

$$-8x + 12y = 12$$

$$-x + 2y - 10 = 0$$

$$3y - x - 6 = 0$$

$$y - 2x - 10 = 0$$

$$\frac{1}{2}x + y = 5$$

$$3x + y = 1$$

Honors Level

Solve each problem and show all steps.

Define perpendicular lines in terms of their intersection and the angles they form.

State the core relationship between the slopes of two non-vertical perpendicular lines.

Explain what the negative reciprocal relationship conceptually means for the graph of the line.

Two lines are perpendicular. What can you definitively say about their y-intercepts?

What condition must be met for a square or a rectangle to be formed by the intersection of two pairs of lines?

End-of-Course Prep

3.8 Features of Exponential Functions

Warm-Up

Fill out the table.

Exponential Form	2^{-3}	2^{-2}	2^{-1}	2^0	2^1	2^2	2^3	2^4
Simplified Form								

Present a logical explanation why 2^0 is equal to 1. (Hint: Pay attention to the pattern in the table)

Main Topic Exponential Functions



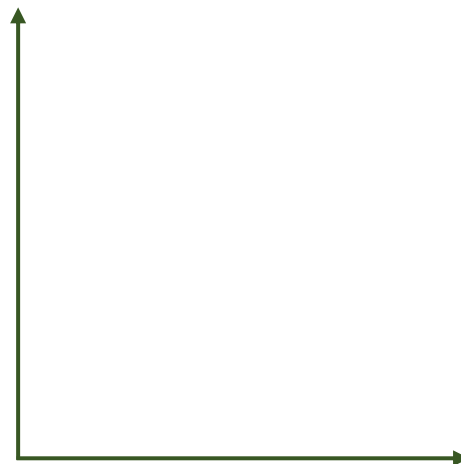
A flight demonstration team is performing an airshow maneuver called the "Exponential Climb." Instead of climbing at a steady rate, the pilot adjusts the engines so the jet's altitude **doubles** every **10 seconds**. A jet begins its climb from a starting **altitude of 100 feet**.

TASK

1

- ☐ Create a graph with the **x-axis** representing **Time** in seconds and the **y-axis** representing the **Altitude** in feet.

Write your observations of the graph.



Main Topic **Features Exponential Functions**

- ☐ Grab a piece of paper.
- ☐ Fold the paper in the middle.

No. of Creases	0	1	2	3	4	5	6	7
No. of Regions								
Exponential Expression								

- ☐ What is the general formula for n as the number of crease?
- ☐ Graph the function and identify the features of the function.

**T
A
S
K**
2

Domain:

Range:

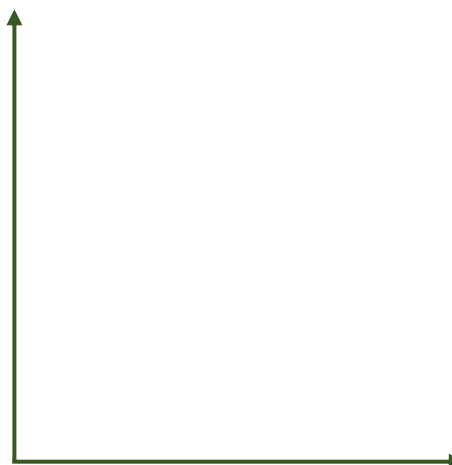
x-intercept:

y-intercept:

Left End-Behavior:

Right End-Behavior:

Increasing or Decreasing?



$$f(x) = 3^x + 2$$

Domain	Range	x-intercept	y-intercept	Left End Behavior	Right End Behavior	Increasing or Decreasing?

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

Domain	Range	x-intercept	y-intercept	Left End Behavior	Right End Behavior	Increasing or Decreasing?

The Physics: The air pressure outside the aircraft decreases **exponentially** as the altitude increases. For every additional foot you climb, the pressure drops by a certain percentage of its current value. However, the pressure never truly reaches zero; there's always some minimal atmospheric pressure, even in space. This minimum pressure represents our asymptote.



The Math: Let's create a simplified model.

- ☐ Let $P(t)$ be the cabin pressure in psi (pounds per square inch) at time t in seconds after the decompression event begins.
- ☐ The cabin starts at a comfortable pressure of 11 psi, so our initial value is 11.
- ☐ The outside pressure at the aircraft's cruising altitude is very low, let's say 3 psi.
- ☐ The pressure differential will cause the cabin pressure to decay exponentially toward the outside pressure.
- ☐ A possible function to model this could be:

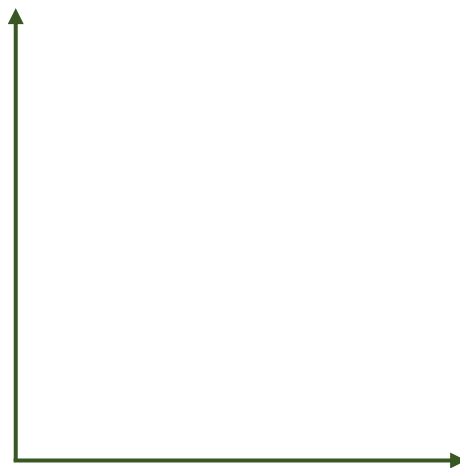
$$P(t) = 8 \cdot \left(\frac{1}{2}\right)^t + 3$$

- ☐ The term $8 \cdot \left(\frac{1}{2}\right)^t$ models the exponential decay of the pressure difference (11 psi - 3 psi = 8 psi).
- ☐ The term +3 is the **vertical translation** or shift.

TASK

3

- ☐ Graph $P(t) = 8 \cdot \left(\frac{1}{2}\right)^t + 3$ using a graphing program.
- ☐ Copy the graph on the right.
- ☐ Trace the vertical translation.
- ☐ Label the vertical translation with "Asymptote".
- ☐ Describe "Asymptote" using your own words.



Circle the asymptote of the functions.

$$f(x) = 5^x - 8$$

$$f(x) = 12 - 2^x$$

$$f(x) = \left(\frac{1}{2}\right)^x + 3$$

$$f(x) = 3(0.25)^x$$

Foldable 1

Foldable 2

Foldable 3

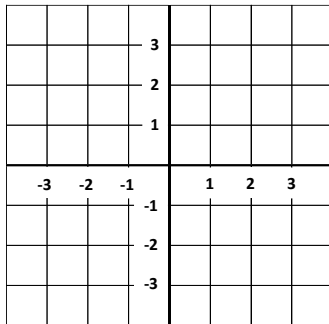
Foldable 4

Foldable 5

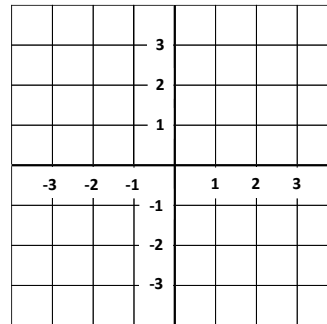
End-of-Course Prep

3.9 Transformations of Linear and Exponential Functions

Warm-Up



Plot triangle A(3, 0), B(1, 3), and C(1, -1) then translate it 2 units left.



Plot triangle A(3, 0), B(1, 3), and C(1, -1) then reflect it over the y-axis.

Main Topic Transformations of Linear Functions

Air Traffic Control: A Change in Altitude ✈️

Imagine an air traffic controller directing a plane on a long-distance flight. The plane is already at its cruising altitude of 30,000 feet. However, due to a weather system ahead, the controller instructs the pilot to ascend to a new, higher cruising altitude of 35,000 feet. This change in altitude is a perfect real-world example of a vertical translation of an exponential function.

TASK

3

- A plane's ascent to its first cruising altitude can be modeled by an exponential function.

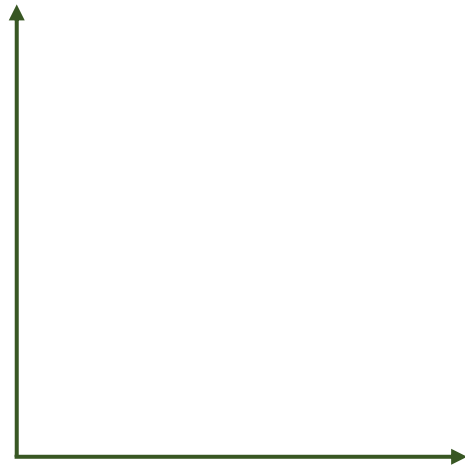
$$A(t) = 30,000 - 30,000 \cdot (0.95)^t$$

Vertical Translation

$$A(t) = 30,000 - 30,000 \cdot (0.95)^t + 5,000$$

$$A(t) = 35,000 - 30,000 \cdot (0.95)^t$$

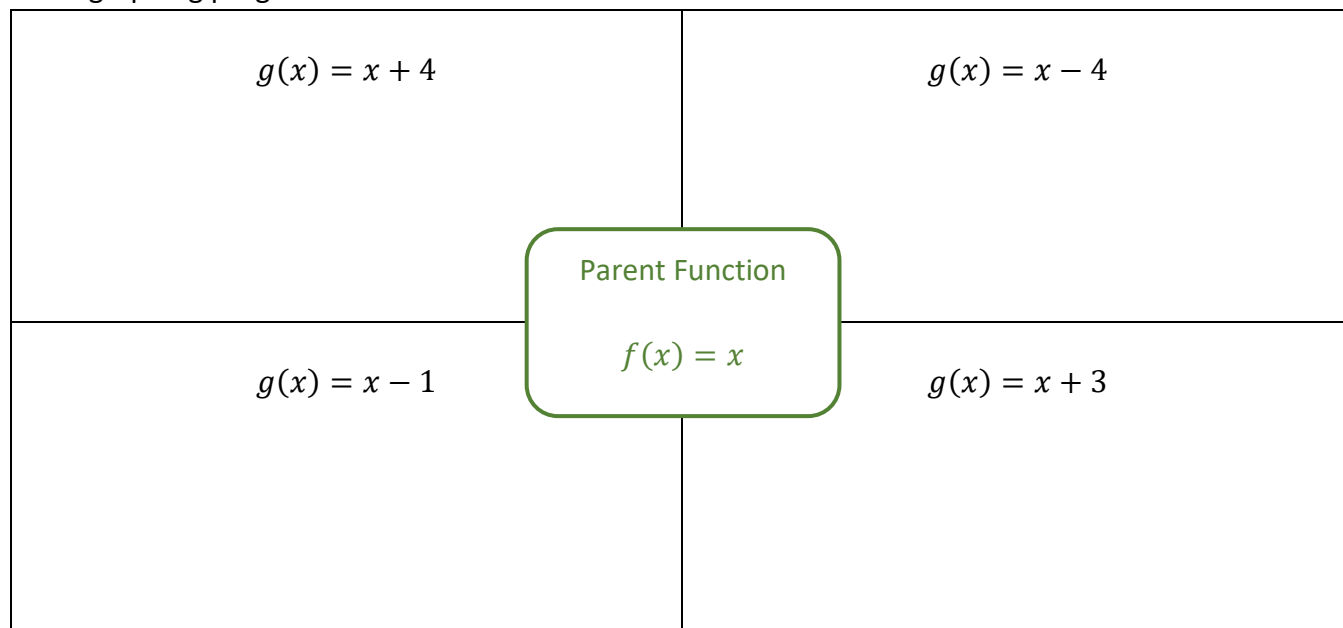
Illustrate the scenario on the right.



$$A(t) = 35,000 - 30,000 \cdot (0.95)^t$$

Domain	Range	x-intercept	y-intercept	Left End Behavior	Right End Behavior	Increasing or Decreasing?

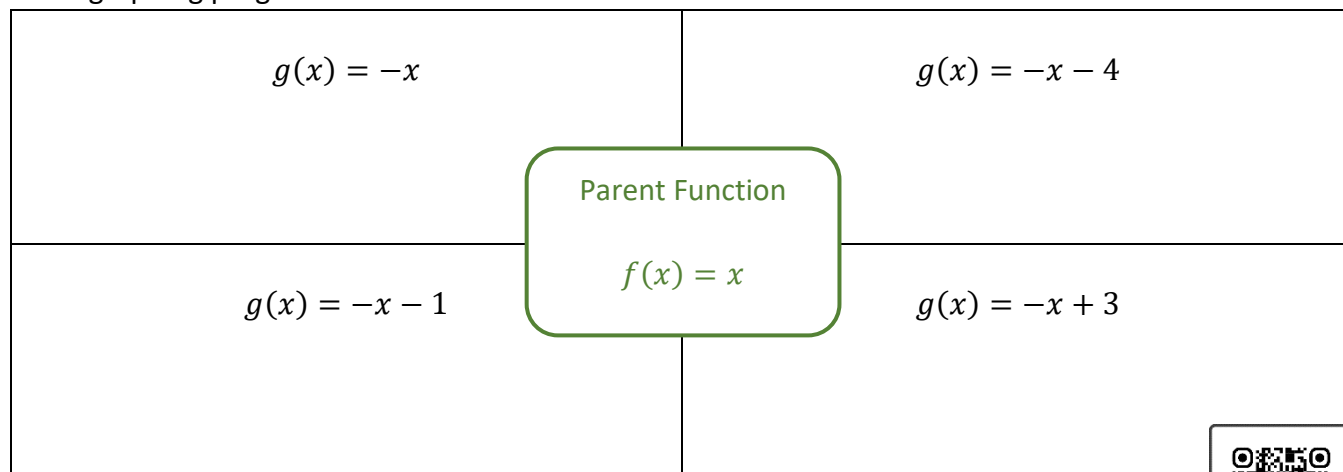
Use a graphing program to determine the transformation in each box.



Translation

Write a general observation when $f(x) = x$ is added with constants 4, -4, -1, and 3.

Use a graphing program to determine the transformation in each box.



Need Help?

Reflection

Write a general observation when the sign of the coefficient of $f(x) = x$ is changed.

Use a graphing device to determine the transformation in each box.

$g(x) = 2x$	$g(x) = \frac{1}{2}x$
$g(x) = 5x$	$g(x) = \frac{1}{4}x$

Parent Function
 $f(x) = x$

Vertical and Horizontal Stretch

Write a general observation when the coefficient of $f(x) = x$ is greater than 1 or less than -1.

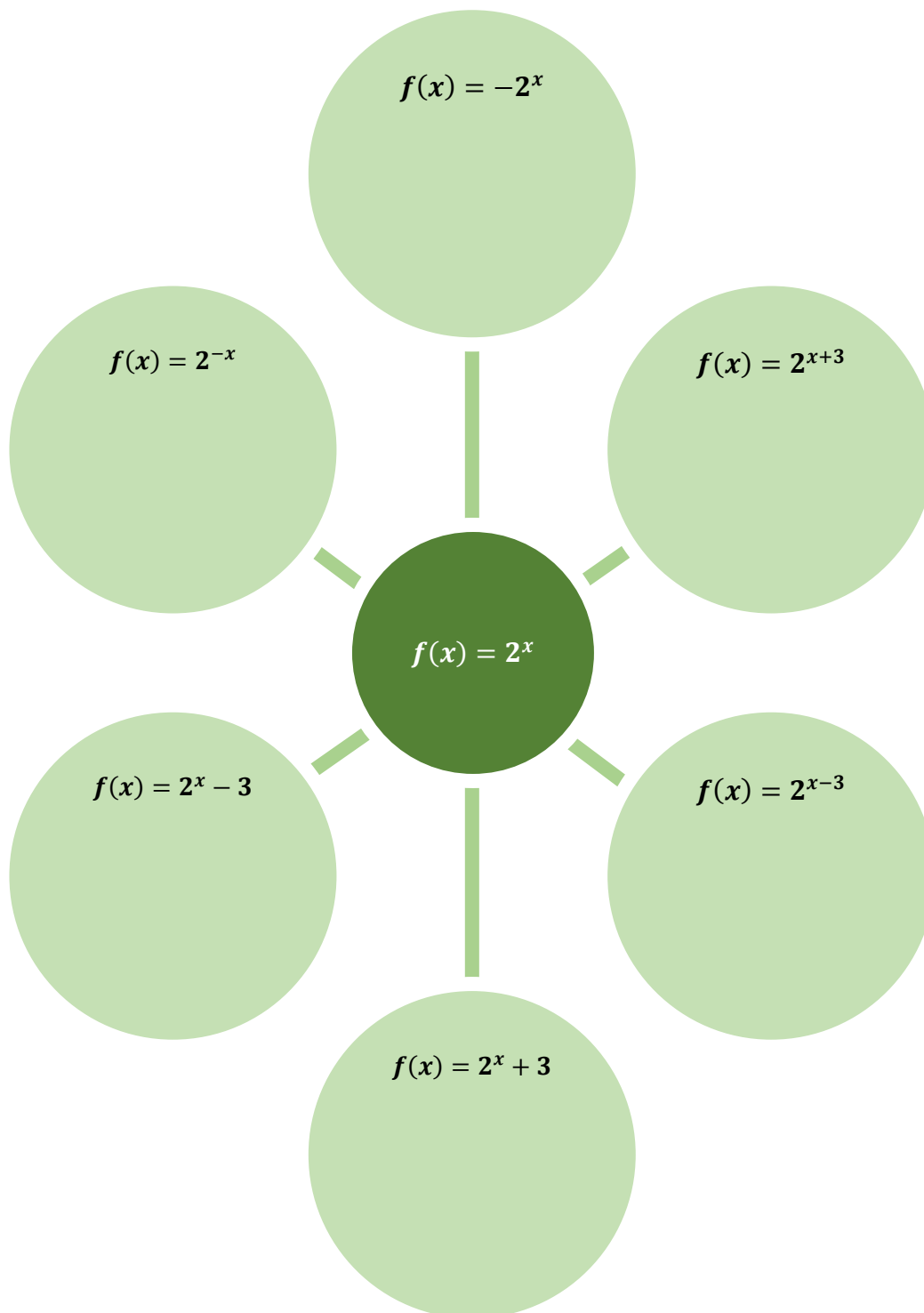
Write a general observation when the coefficient of $f(x) = x$ is between -1 to 1.

Using your own words to describe the transformations exponential functions.

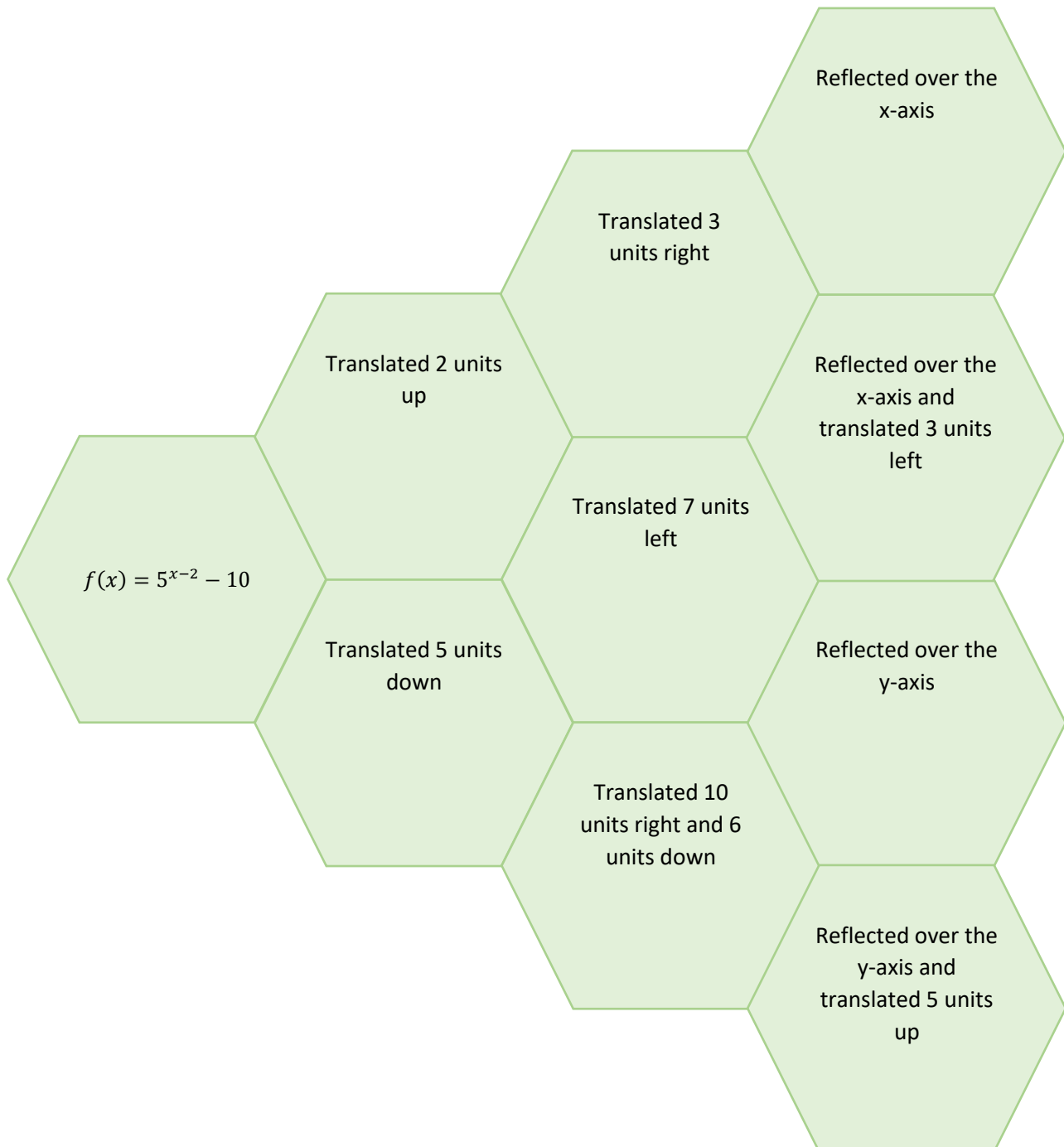
Translation	
Reflection	
Vertical Stretch	
Horizontal Stretch	

Main Topic Transformations of Exponential Functions

List the transformation(s) below the given function in each shape with respect to the parent function $f(x) = 2^x$.

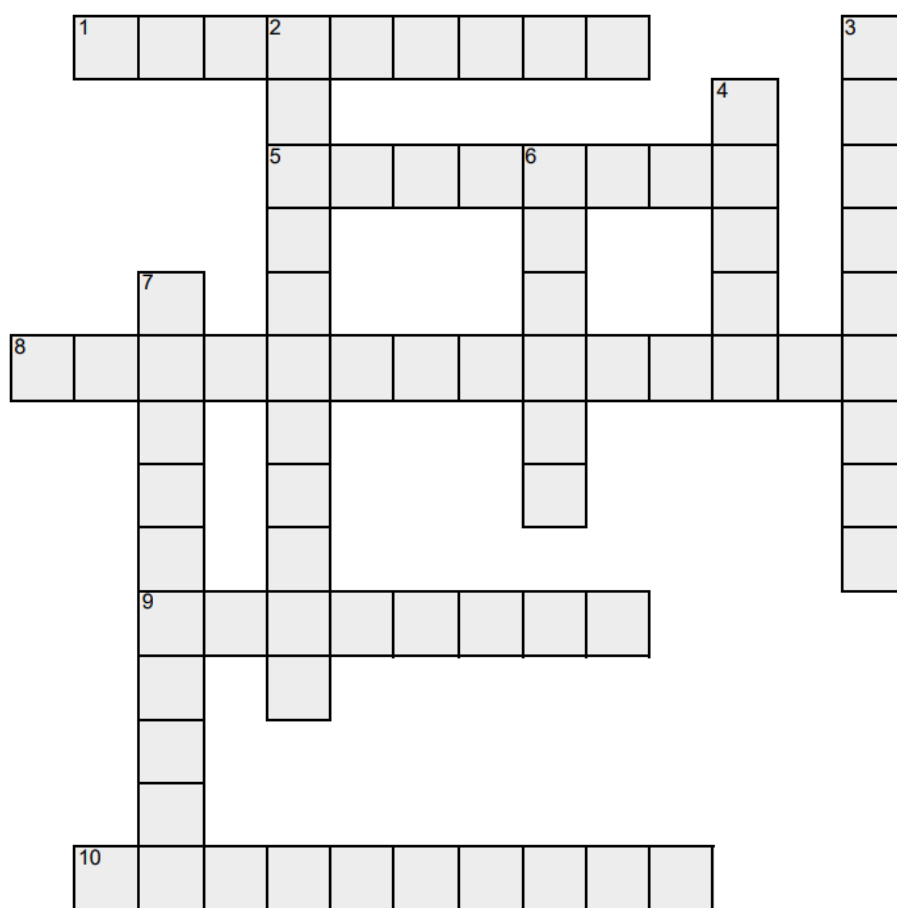


Write the equations of the functions given the transformation rules with respect to $f(x) = 5^{x-2} - 10$.



End-of-Course Prep

Linear and Exponential Functions



Across	Down
1. A point of intersection between the graph and an axis.	2. A function that represents a relationship where the rate of change is proportional to the current value of the function
5. Are coplanar (lie in the same plane) straight lines that have the same slope.	3. A straight line where a graph continues to approach it but will never intersect it.
8. A linear equation in the form of $y = mx + b$ that consists of slope, m , and y-intercept, b . Hint: Enter the term without the hyphen (dash).	4. The steepness of a line and it describes the direction of a line. It is also called a rate of change.
9. A linear equation expressed in $Ax + By = C$ form.	6. A function whose slope (rate of change) is constant.
10. A function where its output values (y-values) consistently get smaller as its input values (x-values) increase.	7. A formula that can be used to find the equation of a line that passes through a given point with a given slope. Hint: Enter the term without the hyphen (dash).



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