PATHWAY 2 CAREERS

P2C Math

SAMPLE KIT

PATHWAY 2 CAREERS

P2C Math Bridge: Connecting Math to Meaningful Futures

P2C Math delivers a flexible, career-connected math curriculum for Pre-Algebra through Algebra II. Each course integrates real occupations, career stories, and Quantile® measures—helping educators tailor instruction, track growth, and show students how math connects to the world beyond the classroom.

This sample kit includes:

- The table of contents for each course:
  - Pre-Algebra - Page 3
  - Algebra I - Page 20
  - Geometry - Page 44
  - Algebra II - Page 65
- One full lesson sample from each course (student edition):
  - Pre-Algebra - Page 11
  - Algebra I - Page 31
  - Geometry - Page 54
  - Algebra II - Page 78

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About Pathway2Careers (P2C)

At Pathway2Careers (P2C), we believe that when education becomes relevant, learners fully engage. Our mission is straightforward: revolutionize education by challenging the current approach and motivating student learning through career-connected relevance. This mission drives our vision of improving students' prospects by connecting the time and energy they spend in the classroom with meaningful career paths. In doing so, we aim to transform not just the future prosperity of individual students, but the economies of entire communities.

What sets P2C apart is our commitment to evidence-based solutions. Every product, resource, and strategy we design is grounded in rigorous research. By uncovering, exploring, and sharing the most timely and relevant findings—and through the insights generated by our in-house research team—we tackle the biggest challenges facing education today. Our approach ensures that the career-connected learning experiences we create are not only innovative but also effective.

Learn more at p2c.org

PATHWAY 2 CAREERS

P2C Math: Pre-Algebra

Table of Contents & Pacing

Total # of Days 111-182

	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
1. Transformational Geometry						**13-21**
P-1.1	Translations	Exploration	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4	1, 6, 7	Multiple	1
P-1.2	Apply Translations	Application	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4	1, 5, 8	Computer Numerically Controlled Tool Programmers	1-2
P-1.3	Reflections	Exploration	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4	4, 6, 7	Multiple	1
P-1.4	Apply Reflections	Application	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4	4, 5, 7	Automotive Engineers	1-2
P-1.5	Rotations	Exploration	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4	2, 3, 7	Multiple	1
P-1.6	Apply Rotations	Application	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3, 8.G.A.4	1, 4, 5, 7	Aerospace Engineering and Operations Technologists and Technicians	1-2
P-1.7	Investigate Symmetry	Application	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2	1, 2, 4	Carpenters	1-2
P-1.8	Congruent Figures	Exploration	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2, 8.G.A.3	1, 2, 7	Multiple	1
P-1.9	Use Rigid Motions to Show Congruent Figures	Application	8.G.A.1.a, 8.G.A.1.b, 8.G.A.1.c, 8.G.A.2	4, 5, 7	Special Effects Artists and Animators	1-2
P-1.10	Dilations	Exploration	8.G.A.3	2, 3, 7	Multiple	1
P-1.11	Apply Dilations	Application	8.G.A.3	1, 2, 4	Interior Designers	1-2
P-1.12	Similar Figures	Exploration	8.G.A.4	1, 5, 7	Multiple	1-2
P-1.13	Perimeters and Areas of Similar Figures	Exploration	8.G.A.4	1, 7, 8	Multiple	1-2
2. Equations and Inequalities						**14-23**
P-2.1	Operations with Rational Numbers	Exploration	7.NS.A.3	1, 6, 7	Multiple	1-2
P-2.2	Simplify Expressions	Exploration	7.EE.A.1	1, 2, 7	Multiple	1-2

"P" denotes that the lesson is a Project and may be omitted or abbreviated at the discretion of the teacher/district. Pacing for these lessons is not included in the chapter or course totals.

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	P-9.4	Rational Numbers	Exploration	8.NS.A.1	1, 2, 4	Multiple	1
	P-9.5	Irrational Numbers	Exploration	8.NS.A.1	1, 2, 4	Multiple	1
	P-9.6	The Pythagorean Theorem	Exploration	8.G.B.6, 8.G.B.7	2, 3, 8	Multiple	1-2
	P-9.7	Apply the Pythagorean Theorem	Application	8.G.B.7	1, 4, 5	Plumbers, Pipefitters and Steamfitters	1-2
	P-9.8	Find Distances Using the Pythagorean Theorem	Application	8.G.B.7, 8.G.B.8	1, 2, 4	Architectural and Civil Drafters	1-2
	P-9.9	The Converse of the Pythagorean Theorem	Exploration	8.G.B.6	1, 4, 7	Multiple	1-2
	P-9.10	Apply the Converse of the Pythagorean Theorem	Application	8.G.B.7	1, 2, 4	Construction and Building Inspectors	1-2
P	P-9-P	The Number System	Project (Information Technology)	8.NS.A.1, 8.NS.A.2	1, 2, 3, 5	Web Developers	3-6
10. Measurement and Volume							**10-16**
	P-10.1	Find Circumference and Area of Circles	Exploration	7.G.B.4	4, 5, 8	Multiple	1
	P-10.2	Apply Area of Circles	Application	7.G.B.4	1, 4, 6	Market Research Analysts and Marketing Specialists	1-2
	P-10.3	Find Volume of Cylinders	Exploration	8.G.C.9	1, 2, 4, 6	Multiple	1
	P-10.4	Apply Volume of Cylinders	Application	8.G.C.9	1, 2, 4, 5	Geological Technicians	1-2
	P-10.5	Find Volume of Cones	Exploration	8.G.C.9	2, 5, 7	Multiple	1
	P-10.6	Apply Volume of Cones	Application	8.G.C.9	2, 5, 7	Chefs and Head Cooks	1-2
	P-10.7	Find Volume of Spheres	Exploration	8.G.C.9	1, 4, 6	Multiple	1
	P-10.8	Apply Volume of Spheres	Application	8.G.C.9	1, 2, 6	Secondary School Teachers	1-2
	P-10.9	Find Volume of Composite Solids	Exploration	8.G.C.9	1, 2, 4, 6	Multiple	1-2
	P-10.10	Apply Volume of Composite Solids	Application	8.G.C.9	1, 2, 4	Mobile Heavy Equipment Mechanics	1-2

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P2C Math

Sample Lesson: Student Edition

LESSON 4.9

Apply Graphs of Proportional Relationships

CAREER SPOTLIGHT: Manufacturing Engineers

Occupation Description

Industrial engineers find ways to eliminate wastefulness in production processes. They devise efficient systems that integrate workers, machines, materials, information, and energy to make a product or provide a service.

Some industrial engineers, called manufacturing engineers, focus entirely on the automated aspects of manufacturing processes. They design manufacturing systems to optimize the use of computer networks, robots, and materials.

Education

Industrial engineers typically need a bachelor's degree in industrial engineering or industrial engineering technologies. However, many industrial engineers have degrees in mechanical engineering, electrical engineering, manufacturing engineering, or general engineering. Students interested in studying should take high school courses in mathematics, such as algebra, trigonometry, and calculus; computer science; and sciences such as chemistry and physics.

Potential Employers

The largest employers of industrial engineers are as follows:

Transportation equipment manufacturing	18%
Computer and electronic product manufacturing	13%
Professional, scientific, and technical services	12%
Machinery manufacturing	8%
Fabricated metal product manufacturing	6%

Watch a Video about industrial engineers:
https://cdn.careeronestop.org/OccVids/OccupationVideos/17-2112.00.mp4

Career Cluster

Science, Technology, Engineering & Mathematicss

Career Pathway

Engineering and Technology

Career Outlook

- Salary Projections:
  Low-End Salary, $57,950
  Median Salary, $88,950
  High-End Salary, $136,930
- Jobs in 2019:
- Job Projections for 2029:

Algebra Concepts

- Make and use graphs of proportional relationships.
- Interpret graphs of proportional relationships.

Is this a good career for me?

Manufacturing engineers:

- Analyze operational data to evaluate operations, processes or products.
- Resolve operational performance problems.
- Develop technical methods or processes.
- Implement design or process improvements.
- Determine operational methods.

Photo credit: Monkey Business Images/Shutterstock.com

Lesson Objective

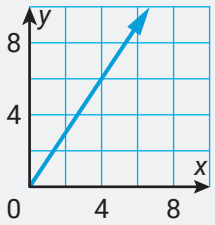
In this lesson, you will look at how manufacturing engineers use proportional relationships to model manufacturing problems and use graphs of these relationships to make predictions and solve the problems.

The following information will be used to solve problems in this lesson.

Proportional Relationships

The graph of a proportional relationship is a straight line through the origin that has a slope equal to the unit rate of the proportional relationship.

The graph shown has a slope of 1.5, so the unit rate is 1.5.



1 Step Into the Career: Graphing a Relationship Defined by a Table

Ravi is a manufacturing engineer who oversees the orange juice bottling operation at a factory. The table gives the number of bottles y the factory can produce in x hours.

Hours, x	3	7	11	19	23
Thousands of Bottles, y	3.6	8.4	13.2	22.8	27.6

Graph the given relationship. Then use the graph to determine whether the factory can produce enough bottles in one work week (40 hours) to fill an order for 50,000 bottles.

Devise a Plan

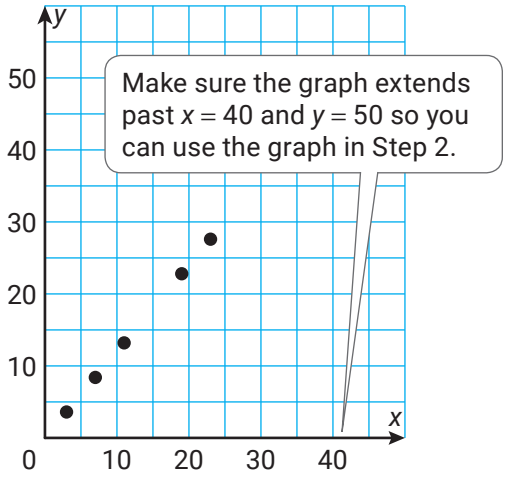
Step 1: Graph the relationship defined by the table.

Step 2: Use the graph to predict how long it will take the factory to produce 50,000 bottles.

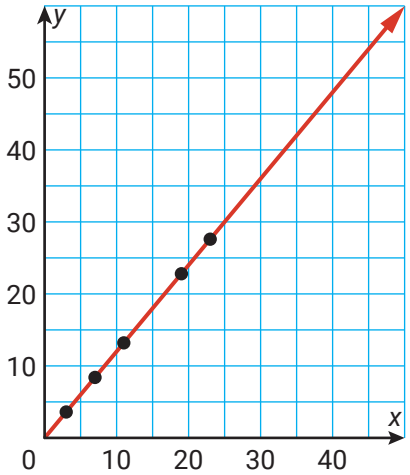
Walk Through the Solution

Step 1: Graph the relationship defined by the table.

Plot the points on a coordinate plane.



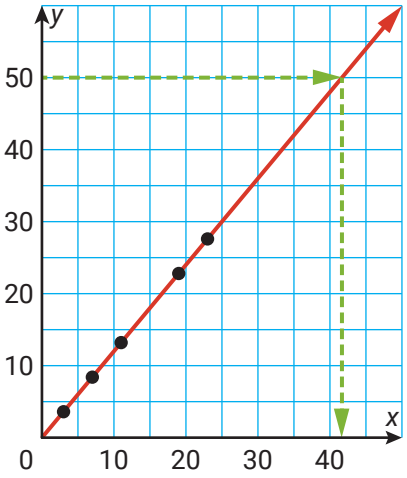
Draw a line that starts from the origin through all the plotted points.



Step 2: Use the graph to predict how long it will take the factory to produce 50,000 bottles.

Draw a horizontal line from $y = 50$ on the y-axis to the graph. Then draw a line down to the x-axis to see if the corresponding x-value is greater than, less than, or equal to 40.

The factory will take about 42 hours to produce 50,000 bottles, so the factory will be unable to produce the needed number of bottles in one work week.



On the Job: Apply Graphing a Relationship Defined by a Table

1. Diana is a manufacturing engineer who oversees the bottling operation at a factory. The table gives the number of bottles y the factory can produce in x hours.

Hours, *x*	5	12	18	27	34
Thousands of Bottles, *y*	1.5	3.6	5.4	8.1	10.2

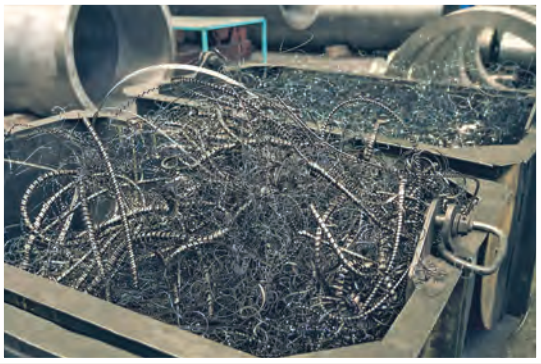
a. Graph the given relationship.

b. Use the graph to determine how many bottles the factory can produce if the factory is in operation for 50 hours.

Photo credit: Mongkolchon Akesin/Shutterstock.com

2 Step Into the Career: Graphing a Relationship Defined by an Equation

Fernando is a manufacturing engineer who is trying to reduce waste for a machine that shaves metal off of aluminum discs to create car parts. The machine produces y kilograms of waste every x hours according to the equation $y = \frac{7}{3}x$. How long does it take the machine to create 56 kg of waste?



Devise a Plan

Step 1: Graph the relationship defined by the equation.

Step 2: Use the graph to predict how long it will take the machine to produce 56 kilograms of waste.

Walk Through the Solution

Step 1: Graph the relationship defined by the equation.

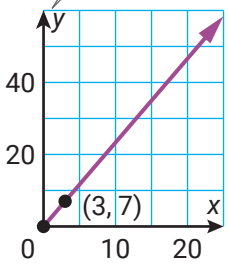
Make sure the graph extends past $y = 56$ and $x = 2000$ so you can use the graph in Step 2.

Plot the point (0, 0) on a coordinate plane because every proportional relationship satisfies (0, 0). Substitute a convenient number into the equation to find a second point, such as $x = 3$.

$y = \frac{7}{3}x$ Write the equation.

$y = \frac{7}{3}(3)$ Substitute 3 for x.

$y = 7$ Multiply.

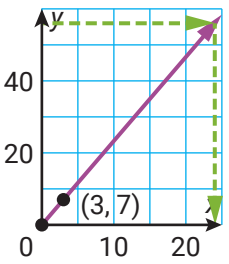


Plot the point (3, 7) on the coordinate plane. Draw a line through the two points.

Step 2: Use the graph to predict how long it will take the machine to produce 56 kilograms of waste.

Draw a horizontal line from $y = 56$ on the y-axis to the graph. Then draw a line down to the x-axis to determine the corresponding value of x.

The machine will take 24 hours to produce 56 kilograms of waste.



On the Job: Graphing a Relationship Defined by an Equation

2. Fernando is a manufacturing engineer who is trying to reduce waste at a sawmill. For every piece of plywood produced by the mill, the mill generates sawdust and wood chips according to the equation $y = 1.8x$, where y is the mass of wood waste in kilograms and x is the number of hours of production.

a. Graph the proportional relationship defined by the equation.

b. How long does it take the mill to produce 63 kilograms of waste?

3 Step Into the Career: Graphing Relationships Defined by a Description

Val is a manufacturing engineer who is determining the costs of production at a bread factory. The cost of packaging a certain type of Italian bread at the factory is $6.30 for every 300 loaves of bread produced. Determine whether an order of 2,000 loaves of bread can be filled with $42 of packaging.

Devise a Plan

Step 1: Graph the relationship defined by the verbal description.

Step 2: Use the graph to predict how many loaves of bread can be packaged for $42.

Walk Through the Solution

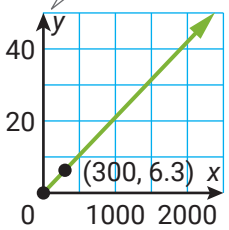
Step 1: Graph the relationship defined by the verbal description.

Make sure the graph extends past $y = 42$ so you can use the graph in Step 2.

Let x represent the number of loaves produced and y represent the cost of packaging.

Plot the point (0, 0) on a coordinate plane, because every proportional relationship satisfies (0, 0).

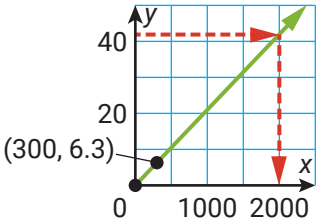
The verbal description represents a second point on the graph, (300, 6.3). So, plot the point (300, 6.3). Then draw a line through the two points.



Step 2: Use the graph to predict how many loaves of bread can be packaged for $42.

Draw a horizontal line from $y = 42$ on the y-axis to the graph. Then draw a line down to the x-axis to determine the corresponding value of x.

$42 is just enough to package 2,000 loaves of bread, so the order can be filled using $42 of packaging.



On the Job: Graphing a Relationship Defined by a Description

3. Demetrius is a manufacturing engineer who is overseeing production of cartons of milk. The cartons are shipped in palettes such that each palette contains 25 boxes which contain a grand total of 500 cartons of milk.

a. Graph the proportional relationship defined by the verbal description.

b. How many boxes are needed to package 12,000 cartons of milk?

Career Spotlight: Practice

4. Ysenia is a manufacturing engineer at a factory that makes parts for automobiles. The company produces shock absorbers according to the table shown.

a. Graph the proportional relationship defined by the table.

b. How many shock absorbers does the factory produce in one day?

c. How many days would it take the factory to produce 34,000 shock absorbers?

Days, x	2	5	10	17	28
Number of parts, y	800	2000	4000	6800	11,200

5. A praline factory packs pralines in boxes according to the equation $y = 16x$, where y is the number of pralines and x is the number of boxes.

a. Graph the proportional relationship defined by the equation.

b. Use the graph to determine whether 30 boxes of pralines is enough to feed a party that requires 500 pralines.

QUICK TIP

In part (b), you can start with the given y-value and find the corresponding x-value, or you can start with the given x-value and find the corresponding y-value.

6. Pablo is a manufacturing engineer at a computer chip production plant. The plant can produce 120 computer chips per hour. If a computer company orders 3500 computer chips, can they receive the order in 4 working days? Assume that the plant operates 8 hours per day.

Devise a Plan

Step 1: Graph the proportional relationship defined by the verbal description.

Step 2: _____?_____

Step 3: _____?_____

Career Spotlight: Check

7. Jabari is a manufacturing engineer who operates a factory that makes television sets. The factory produces y televisions in x hours according to the equation $y = 28x$. Jabari receives a work order that asks for the production of a certain number of televisions in a 40-hour work week. Which of the following work orders could be completed in a work week?

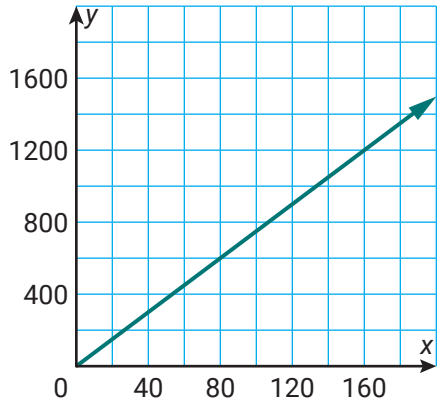
a. 800 **b.** 900 **c.** 1000 **d.** 1100 **e.** 1200 **f.** 1300

Photo credit: industryviews/Shutterstock.com; industryviews/Shutterstock.com; Bigone/Shutterstock.com

8. Sari is a manufacturing engineer at a factory that makes window panes. The number of window panes that the factory can produce in a day is directly proportional to the number of workers that day. During the previous day, the factory produced 24 window panes with 10 people working. How many people does Sari need in the factory to produce 60 window panes?

a. 25 **b.** 36 **c.** 46 **d.** 50

9. A factory packages 5-pound bags of apples that are sold in grocery stores. The factory produces bags of apples according to the proportional relationship shown in the graph, where x is the time in minutes and y is the number of bags of apples produced. Complete the table with the correct amounts to describe the proportional relationship.



Minutes, x	Bags Produced, y
40	300
	750
160	
	1425

10. Jamal is a manufacturing engineer at a facility that produces cars. His team can assemble the frame of a car at a rate such that they can produce 21 car frames in 2 hours. Complete the sentence by selecting values from the panel so that it is true.

Jamal's team can assemble enough car frames to complete an order of _____ car frames in _____ hours and 40 minutes.

6	8	10
56	70	105

PATHWAY 2 CAREERS

P2C Math: Algebra I

Table of Contents & Pacing

Total # of Days 126-185

		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
1. Algebra Foundations							8-12
	A-1.1	Real Numbers	Exploration	N-RN.B.3	1, 2, 3	Multiple	1
	A-1.2	Quantities and Measurement	Exploration	N-Q.A.1, N-Q.A.2, N-Q.A.3	1, 2, 4	Multiple	1
	A-1.3	Applying Dimensional Analysis	Application	N-Q.A.1, N-Q.A.3	4, 6, 7	Dental Laboratory Technicians	1-2
	A-1.4	Modeling with Quantities	Application	N-Q.A.1, N-Q.A.2	1, 2, 4	Terrazzo Workers and Finishers	1-2
	A-1.5	Precision and Accuracy	Application	N-Q.A.1, N-Q.A.3	1, 2, 4	Environmental Science and Protection Technicians	1-2
	A-1.6	Algebraic Expressions	Exploration	A-SSE.A.1.a, A-SSE.A.1.b	1, 2, 7	Multiple	1
	A-1.7	Writing and Simplifying Algebraic Expressions	Exploration	A-SSE.A.1.a	2, 4, 7	Multiple	1
	A-1.8	Structure of Expressions	Application	A-SSE.A.1.a, A-SSE.A.1.b	1, 4, 7	Economics Teachers, Postsecondary	1-2
P	A-1-P	Seeing Structure in Expressions	Project (Information Technology)	A-SSE.A.1.a, A-SSE.A.1.b, A-SSE.B.3.c, A-REI.B.3	1, 2, 4, 7	Database Architects	3-6
2. Solving Equations							7-11
	A-2.1	Solving One- and Two-Step Equations	Exploration	A-REI.A.1, A-REI.B.3	1, 2, 7	Multiple	1
	A-2.2	Writing Linear Equations	Application	A-CED.A.1, A-REI.A.1, A-REI.B.3, F-BF.A.1.a, F-LE.A.2	1, 2, 4	Credit Counselors	1-2
	A-2.3	Solving Multi-Step Equations	Exploration	A-REI.A.1, A-REI.B.3	1, 2, 7	Multiple	1
	A-2.4	Solving Linear Equations with a Variable on One Side	Application	A-CED.A.1, A-REI.A.1, A-REI.B.3	1, 2, 4	Veterinarians	1-2
	A-2.5	Solving Linear Equations with a Variable on Both Sides	Application	A-CED.A.1, A-REI.A.1, A-REI.B.3	1, 4, 5	Bookkeeping, Accounting, and Auditing Clerks	1-2
	A-2.6	Introduction to Literal Equations and Formulas	Exploration	A-CED.A.4, A-REI.A.1	2, 7, 8	Multiple	1

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
A-2.7	Solving Literal Equations and Formulas	Application	N-Q.A.1, A-CED.A.4, A-REI.A.1	4, 6, 7	Electricians	1-2
3. Solving Inequalities						**9-13**
A-3.1	Inequalities in One Variable	Exploration	A-CED.A.1, A-REI.B.3	4, 5, 7	Multiple	1
A-3.2	Writing Linear Inequalities in One Variable	Exploration	A-CED.A.1, A-REI.B.3, F-BF.A.1.a	1, 2, 7	Multiple	1
A-3.3	Solving Linear Inequalities in One Variable	Application	A-CED.A.1, A-REI.B.3	1, 2, 5	Property, Real Estate, and Community Association Managers	1-2
A-3.4	Solving and Graphing Compound Inequalities–And	Exploration	A-CED.A.1, A-REI.B.3	1, 2, 7	Multiple	1
A-3.5	Solving and Graphing Compound Inequalities–Or	Exploration	A-CED.A.1, A-REI.B.3	1, 2, 7	Multiple	1
A-3.6	Using Compound Inequalities	Application	A-CED.A.1, A-CED.A.3, A-REI.B.3, F-BF.A.1.a	1, 2, 4	Billing and Posting Clerks	1-2
A-3.7	Absolute Value Equations and Inequalities	Exploration	A-CED.A.1, A-REI.B.3, A-REI.D.11	1, 2, 7	Multiple	1
A-3.8	Writing and Solving Absolute Value Inequalities	Application	A-CED.A.1, A-CED.A.3, A-REI.B.3, A-REI.D.11, F-BF.A.1.a	1, 2, 4	Exercise Physiologists	1-2
A-3.9	Solving Inequalities Graphically	Application	A-CED.A.1, A-CED.A.3, A-REI.B.3, F-BF.A.1.a	1, 2, 4	Business Operations Specialists, All Other	1-2
4. Functions and Linear Functions						**14-21**
A-4.1	Relations and Functions	Exploration	F-IF.A.1, F-IF.A.2, F-IF.B.5	1, 4, 8	Multiple	1
A-4.2	Features of Functions	Exploration	F-IF.B.4, F-IF.B.5	2, 3, 7	Multiple	1
A-4.3	Identifying Linear Functions	Exploration	F-IF.B.5, F-IF.C.7.a, F-LE.A.1.a, F-LE.A.1.b, F-LE.A.2	2, 7, 8	Multiple	1
A-4.4	Rate of Change	Exploration	A-CED.A.2, F-IF.B.6, F-LE.A.1.b, F-LE.A.2, F-LE.B.5	1, 2, 7	Multiple	1
A-4.5	Standard Form and Slope-Intercept Form	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.C.7.a, F-LE.A.2	1, 2, 7	Multiple	1
A-4.6	Using the Point-Slope Form of a Line	Application	A-CED.A.2, A-REI.D.10, F-IF.B.4, G-GPE.B.5	1, 2, 4, 7	Social and Community Service Managers	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A-4.7	Equations of Parallel and Perpendicular Lines	Exploration	A-CED.A.2, F-IF.B.4, G-GPE.B.5	2, 3, 7	Multiple	1-2
	A-4.8	Graphs of Linear Functions	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.B.6, F-IF.C.7.a, F-BF.A.1.b, F-LE.A.2, F-LE.B.5	1, 4, 7	Multiple	1
	A-4.9	Rate of Change of Linear Functions	Application	F-IF.B.6, F-LE.B.5	1, 2, 4	Fitness Trainers and Aerobics Instructors	1-2
	A-4.10	Representations of Linear Functions	Application	A-CED.A.2, A-CED.A.3, F-IF.C.7.a, F-IF.C.9, F-BF.A.1.a, F-LE.A.1.b, F-LE.A.2	1, 2, 4	Geological and Petroleum Technicians	1-2
	A-4.11	Using Graphs of Linear Functions	Application	A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-IF.B.6, F-IF.C.7.a, F-LE.A.1.a, F-LE.A.2	5, 6, 8	Hydrologists	1-2
	A-4.12	Scatter Plots and Lines of Fit	Exploration	S-ID.B.6.a, S-ID.B.6.b, S-ID.B.6.c, S-ID.C.7, S-ID.C.8, S-ID.C.9	2, 5, 7	Multiple	1
	A-4.13	Applying Scatter Plots and Lines of Fit	Application	S-ID.B.6.a, S-ID.B.6.c, S-ID.C.7	1, 2, 4, 5	Cost Estimators	1-2
	A-4.14	Analyzing Lines of Fit	Application	F-IF.B.6, S-ID.B.6.a, S-ID.B.6.b, S-ID.B.6.c, S-ID.C.7, S-ID.C.8, S-ID.C.9	1, 2, 4, 7	Financial Managers	1-2
P	A-4-P	Creating Equations	Project (Information Technology)	A-SSE.A.1.a, A-SSE.A.1.b, A-SSE.A.2, A-CED.A.1, A-CED.A.3, A-CED.A.4, F-BF.A.1.a, F-LE.A.2	3, 5, 6, 7	Software Developers	3-6
5. Systems of Equations and Inequalities							**11-16**
	A-5.1	Solving Systems of Linear Equations by Graphing	Exploration	A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.C.6, A-REI.D.10, F-IF.B.4	1, 2, 7	Multiple	1
	A-5.2	Applying Systems of Linear Equations	Application	A-CED.A.2, A-CED.A.3, A-REI.C.5, A-REI.C.6, A-REI.D.10	2, 4, 5	Chefs and Head Cooks	1-2
	A-5.3	Solving Linear Equations in One Variable by Graphing	Exploration	A-CED.A.3, A-REI.A.1, A-REI.C.6, A-REI.D.11	1, 2, 7	Multiple	1
	A-5.4	Solving Systems of Linear Equations by Substitution	Exploration	A-CED.A.3, A-REI.C.6	1, 2, 7	Multiple	1

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
A-6.6	Applying Exponential Growth	Application	A-SSE.A.1.b, A-CED.A.3, F-IF.C.8.b, F-LE.A.1.a, F-LE.A.1.c, F-LE.A.2	1, 7, 8	Animal Scientists	1-2
A-6.7	Applying Exponential Decay	Application	A-SSE.A.1.b, A-CED.A.3, F-IF.C.8.b, F-LE.A.1.a, F-LE.A.1.c, F-LE.A.2	1, 2, 4	Forensic Science Technicians	1-2
A-6.8	Solving Exponential Equations	Exploration	A-CED.A.1, A-REI.A.1, A-REI.D.11	1, 5, 7	Multiple	1
A-6.9	Applying Exponential Equations	Application	A-SSE.B.3.c, A-CED.A.1, A-REI.A.1, F-IF.C.8.b, F-BF.A.1.a, F-LE.A.1.c	1, 4, 5	Epidemiologists	1-2
A-6.10	Comparing Exponential Functions	Application	A-SSE.B.3.c, A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-IF.C.8.b, F-IF.C.9, F-LE.A.1.a, F-LE.A.1.c, F-LE.A.2, F-LE.A.4	2, 4, 7	Insurance Sales Agents	1-2
7. SEQUENCES						**8-12**
A-7.1	Understanding Sequences	Application	F-IF.A.2, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 4, 8	Biological Science Teachers, Postsecondary	1-2
A-7.2	Explicitly-Defined Arithmetic Sequences	Exploration	A-CED.A.2, F-IF.A.1, F-IF.A.2, F-IF.A.3, F-IF.B.5, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 2, 7	Multiple	1
A-7.3	Recursively-Defined Arithmetic Sequences	Exploration	A-CED.A.2, F-IF.A.1, F-IF.A.2, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 2, 7	Multiple	1
A-7.4	Applying Arithmetic Sequences	Application	A-CED.A.3, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 2, 4	General and Operations Managers	1-2
A-7.5	Explicitly-Defined Geometric Sequences	Exploration	A-CED.A.2, F-IF.A.1, F-IF.A.2, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	2, 7, 8	Multiple	1
A-7.6	Recursively-Defined Geometric Sequences	Exploration	A-CED.A.2, F-IF.A.1, F-IF.A.2, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	2, 7, 8	Multiple	1
A-7.7	Applying Geometric Sequences	Application	A-CED.A.3, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 2, 4	Actuaries	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A-7.8	Applying Recursively-Defined Sequences	Application	A-CED.A.2, A-CED.A.3, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	6, 7, 8	Sociologists	1-2
8. Polynomials and Factoring							**12-16**
	A-8.1	Modeling with Polynomials	Application	A-SSE.A.1.a	1, 2, 4	Astronomers	1-2
	A-8.2	Adding and Subtracting Polynomials	Exploration	A-SSE.A.1.a, A-APR.A.1	1, 7, 8	Multiple	1
	A-8.3	Multiplying Monomials and Binomials	Exploration	A-SSE.A.1.a, A-APR.A.1	1, 2, 7	Multiple	1
	A-8.4	Multiplying Polynomials	Exploration	A-SSE.A.1.a, A-APR.A.1	1, 2, 7	Multiple	1
	A-8.5	Special Products of Polynomials	Exploration	A-SSE.A.1.a, A-SSE.A.2, A-APR.A.1, A-APR.C.5	1, 7, 8	Multiple	1
	A-8.6	Operations with Polynomials	Application	A-SSE.A.2, A-APR.A.1	1, 2, 8	Operations Research Analysts	1-2
	A-8.7	Factoring Using the Greatest Common Factor	Exploration	A-SSE.A.2	1, 2, 7	Multiple	1
	A-8.8	Factoring the Difference of Squares	Exploration	A-SSE.A.2	1, 2, 7	Multiple	1
	A-8.9	Factoring Using Grouping	Exploration	A-SSE.A.2	2, 7, 8	Multiple	1
	A-8.10	Factoring Quadratic Expressions in the Form $x^2 + bx + c$	Exploration	A-SSE.A.2	1, 2, 7	Multiple	1
	A-8.11	Factoring Quadratic Expressions in the Form $ax^2 + bx + c$	Exploration	A-SSE.A.2	1, 2, 7	Multiple	1-2
	A-8.12	Solving Polynomial Equations	Exploration	A-SSE.A.2, A-SSE.B.3.a, A-APR.B.3, A-REI.A.1, A-REI.B.4.b, A-REI.D.11, F-IF.C.8.a	1, 7, 8	Multiple	1-2
P	A-8-P	Arithmetic with Polynomials and Rational Expressions	Project (Information Technology)	A-SSE.A.1.a, A-SSE.A.1.b, A-SSE.A.2, A-APR.A.1, A-APR.D.6	1, 2, 4, 7, 8	Video Game Designers	3-6
9. Quadratic Functions and Equations							**13-19**
	A-9.1	Graphing Quadratic Functions in Standard Form	Exploration	A-SSE.B.3.b, A-CED.A.2, A-REI.B.4.a, F-IF.B.4, F-IF.B.5, F-IF.C.7.a, F-BF.B.3	2, 4, 7	Multiple	1

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
A-9.2	Graphing Quadratic Functions in Vertex Form and Intercept Form	Exploration	A-SSE.B.3.a, A-SSE.B.3.b, A-CED.A.2, A-REI.B.4.a, F-IF.B.4, F-IF.B.5, F-IF.C.7.a, F-BF.B.3	1, 2, 4, 7	Multiple	1
A-9.3	Applying the Vertex Form of Quadratic Functions	Application	A-SSE.B.3.b, A-CED.A.2, A-CED.A.3, A-REI.B.4.a, F-IF.C.7.a, F-BF.A.1.a	1, 2, 4	Atmospheric and Space Scientists	1-2
A-9.4	Applying Graphs of Quadratic Functions	Application	A-SSE.B.3.a, A-SSE.B.3.b, A-CED.A.2, A-CED.A.3, F-IF.C.7.a, F-BF.A.1.a	4, 6, 7	Aerospace Engineers	1-2
A-9.5	Solving Quadratic Equations by Graphing and Taking the Square Root	Exploration	A-CED.A.2, A-REI.B.4.b, F-IF.C.7.a	1, 2, 5, 7	Multiple	1
A-9.6	Solving Quadratic Equations by Factoring	Exploration	A-SSE.B.3.a, A-REI.B.4.b, F-IF.C.8.a	1, 2, 4, 8	Multiple	1
A-9.7	Solving Quadratic Equations by Completing the Square	Exploration	A-REI.B.4.a, A-REI.B.4.b, F-IF.C.8.a	1, 2, 7	Multiple	1
A-9.8	Solving Quadratic Equations by Quadratic Formula	Exploration	A-REI.B.4.b	1, 2, 4, 5	Multiple	1
A-9.9	Using Quadratic Equations to Solve Problems	Application	A-REI.B.4.a, A-REI.B.4.b, F-IF.C.7.a, F-IF.C.8.a	1, 4, 6	Physicists	1-2
A-9.10	Comparing Quadratic Functions	Application	A-CED.A.2, A-CED.A.3, F-IF.B.4, F-IF.B.5, F-IF.C.7.a, F-IF.C.9, F-BF.B.3	1, 2, 4	Industrial Production Managers	1-2
A-9.11	Solving Linear-Quadratic Systems Graphically	Exploration	A-REI.C.7, A-REI.D.11	1, 2, 4, 5	Multiple	1
A-9.12	Solving Linear-Quadratic Systems Algebraically	Exploration	A-REI.C.7, A-REI.D.11	2, 6, 7	Multiple	1-2
A-9.13	Applying Linear-Quadratic Systems	Application	A-REI.C.7, A-REI.D.11	1, 2, 4	Economists	1-2
10. Graphing and Modeling with Functions						**11-15**
A-10.1	Graphing Absolute Value Functions	Exploration	A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-IF.C.7.b, F-BF.B.3	1, 2, 7	Multiple	1
A-10.2	Graphing Step Functions	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.C.7.b	1, 2, 7	Multiple	1

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A-10.3	Applying Step Functions	Application	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.C.7.b	1, 2, 4	Cargo and Freight Agents	1-2
	A-10.4	Graphing Piecewise-Defined Functions	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.C.7.b	1, 2, 6, 7	Multiple	1
	A-10.5	Applying Piecewise-Defined Functions	Application	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.C.7.b	1, 2, 4	Tax Preparers	1-2
	A-10.6	Translations of Graphs of Functions	Exploration	A-CED.A.2, F-BF.A.1.b, F-BF.B.3, G-CO.A.2, G-CO.A.4, G-CO.A.5	1, 2, 7	Multiple	1
	A-10.7	Stretches and Shrinks of Graphs of Functions	Exploration	F-BF.B.3, G-CO.A.2	1, 2, 7	Multiple	1
	A-10.8	Reflections of Graphs of Functions	Exploration	F-BF.B.3, G-CO.A.2, G-CO.A.4, G-CO.A.5	1, 6, 7, 8	Multiple	1
	A-10.9	Operations on Functions	Application	F-BF.B.3	4, 7, 8	Film and Video Editors	1-2
	A-10.10	Comparing Linear, Exponential, and Quadratic Models	Exploration	F-IF.B.4, F-IF.B.5, F-IF.B.6, F-IF.C.7.e, F-IF.C.9, F-LE.A.1.a, F-LE.A.1.b, F-LE.A.1.c, F-LE.A.3, F-LE.B.5	6, 7, 8	Multiple	1
	A-10.11	Applying Comparisons of Linear, Exponential, and Quadratic Models	Application	A-CED.A.2, F-IF.B.4, F-IF.B.6, F-IF.C.7.a, F-IF.C.7.e, F-IF.C.9, F-LE.A.2, F-LE.A.3, F-LE.B.5	1, 2, 4	Appraisers and Assessors of Real Estate	1-2
P	A-10-P	Linear, Quadratic, and Exponential Models	Project (Information Technology)	A-SSE.B.3.c, A-CED.A.2, F-IF.C.7.a, F-IF.C.7.e, F-IF.C.8.b, F-LE.A.1.a, F-LE.A.1.b, F-LE.A.1.c, F-LE.A.2, F-LE.A.3, F-LE.B.5, S-ID.B.6.a	4, 5, 8	Business Intelligence Analysts	3-6
11. Radical Expressions and Inverse Functions							**12-17**
	A-11.1	Radical Expressions	Exploration	N-RN.A.2, N-RN.B.3, A-SSE.A.2	2, 6, 7	Multiple	1
	A-11.2	Describing and Graphing Square Root Functions	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.B.5, F-IF.C.7.b, F-BF.B.3	1, 6, 7	Multiple	1
	A-11.3	Writing Square Root Functions	Application	A-CED.A.2, F-IF.B.4	1, 2, 4	Radiologic Technologists	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A-11.4	Applying Square Root Functions	Application	A-CED.A.1, A-REI.A.2	1, 2, 4	Registered Nurses	1-2
	A-11.5	Applying Graphs of Square Root Functions	Application	A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-IF.B.5, F-IF.C.7.b, F-BF.B.3	1, 2, 4	Mechanical Engineers	1-2
	A-11.6	Describing and Graphing Cube Root Functions	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.B.5, F-IF.C.7.b, F-BF.B.3	1, 2, 7	Multiple	1
	A-11.7	Solving Radical Equations	Exploration	A-REI.A.2, F-IF.C.7.b	1, 2, 5, 7	Multiple	1
	A-11.8	Inverses of Functions	Exploration	F-BF.B.4.c	1, 2, 4	Multiple	1
	A-11.9	Inverses of Linear Functions	Exploration	F-BF.B.4.c	1, 2, 4	Multiple	1
	A-11.10	Inverses of Radical Functions	Exploration	F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.c, F-BF.B.4.d	1, 2, 4	Multiple	1
	A-11.11	Inverses of Quadratic Functions	Exploration	F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.c, F-BF.B.4.d	1, 2, 4	Multiple	1-2
	A-11.12	Applying Inverse Functions	Application	F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.c, F-BF.B.4.d	1, 2, 6	Wind Turbine Service Technicians	1-2
P	A-11-P	Interpreting Functions	Project (Information Technology)	A-CED.A.2, F-IF.B.6, F-IF.C.7.a, F-IF.C.7.e, F-LE.A.2, F-LE.A.3, F-LE.B.5	2, 4, 7	Health Informatics Specialists	3-6
12. Statistics							**11-16**
	A-12.1	Measures of Center	Exploration	S-ID.A.3, S-IC.A.1, S-IC.B.4	1, 3, 5	Multiple	1
	A-12.2	Measures of Spread	Exploration	S-ID.A.3	1, 3, 5	Multiple	1
	A-12.3	Applying Measures of Center and Spread	Application	S-ID.A.3, S-IC.A.1, S-IC.B.4	1, 2, 4	Statisticians	1-2
	A-12.4	Representing Data with Box Plots	Exploration	S-ID.A.1, S-ID.A.3	1, 2, 7	Multiple	1
	A-12.5	Distributions of Data	Exploration	S-ID.A.1, S-ID.A.2, S-ID.A.3	2, 4, 7	Multiple	1
	A-12.6	Applying Box Plots	Application	S-ID.A.1, S-ID.A.3	2, 4, 5	Computer and Information Systems Managers	1-2
	A-12.7	Representing Data with Histograms	Exploration	S-ID.A.1, S-ID.A.2, S-ID.A.3	3, 6, 7	Multiple	1
	A-12.8	Applying Histograms	Application	S-ID.A.1, S-ID.A.2, S-ID.A.3	2, 4, 5	Financial Examiners	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A-12.9	Analyzing Data	Application	S-ID.A.1, S-ID.A.2, S-ID.A.3	2, 3, 4	Market Research Analysts and Marketing Specialists	1-2
	A-12.10	Two-Way Frequency Tables	Exploration	S-ID.B.5, S-CP.A.1, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6	1, 2, 7	Multiple	1
	A-12.11	Applying Two-Way Frequency Tables	Application	S-ID.B.5, S-CP.A.1, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6	1, 3, 5	Social Science Research Assistants	1-2
P	A-12-P	Interpreting Categorical and Quantitative Data	Project (Information Technology)	S-ID.A.1, S-ID.A.2, S-ID.A.3, S-IC.B.5	3, 4, 6, 8	Search Marketing Analysts	3-6

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P2C Math

Sample Lesson: Student Edition

LESSON 4.10

Representations of Linear Functions

CAREER SPOTLIGHT: Geological Technician

Occupation Description

Geological technicians provide support to scientists and engineers in exploring and extracting natural resources, such as oil and natural gas.

Geological technicians tend to specialize either in fieldwork and laboratory work or in office work analyzing data. However, many technicians have duties that overlap into multiple areas.

Education

Although some entry-level positions require only a high school diploma, most employers prefer applicants who have at least an associate's degree or 2 years of postsecondary training in applied science or a science-related technology. Geological technician jobs that are data intensive or otherwise highly technical may require a bachelor's degree.

Potential Employers

The largest employers of geological technicians are as follows:

Support activities for mining	23%
Oil and gas extraction	19%
Engineering services	13%
Management, scientific, and technical consulting services	5%
Management of companies and enterprises	3%

Watch a video about geological technicians: https://cdn.careeronestop.org/OccVids/OccupationVideos/19-4041.00.mp4

Career Cluster

Agriculture, Food & Natural Resources

Career Pathway

Natural Resource Systems

Career Outlook

- Salary Projections:
  Low-End Salary, $28,530
  Median Salary, $51,130
  High-End Salary, $104,660
- Jobs in 2018: 16,300
- Job Projections for 2028: 17,400 (increase of 7%)

Algebra Concepts

- Compare properties of two functions represented in different ways.
- Solve problems by comparing two functions represented in different ways.

Is this a good career for me?

Geological technicians:

- Install and maintain laboratory and field equipment.
- Gather samples such as rock, mud, and soil in the field and prepare samples for laboratory analysis.
- Conduct scientific tests on samples to determine their content and characteristics.

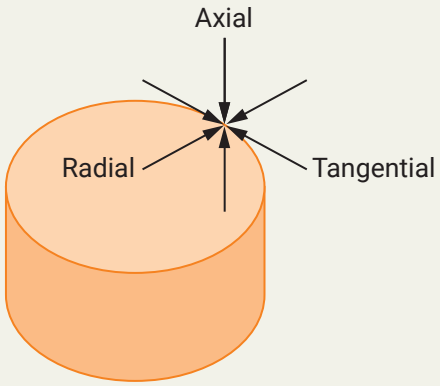
Photo credit: anatoliy_gleb/Shutterstock.com

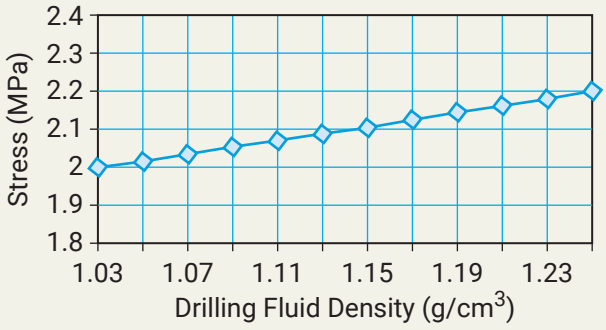
Lesson Objective

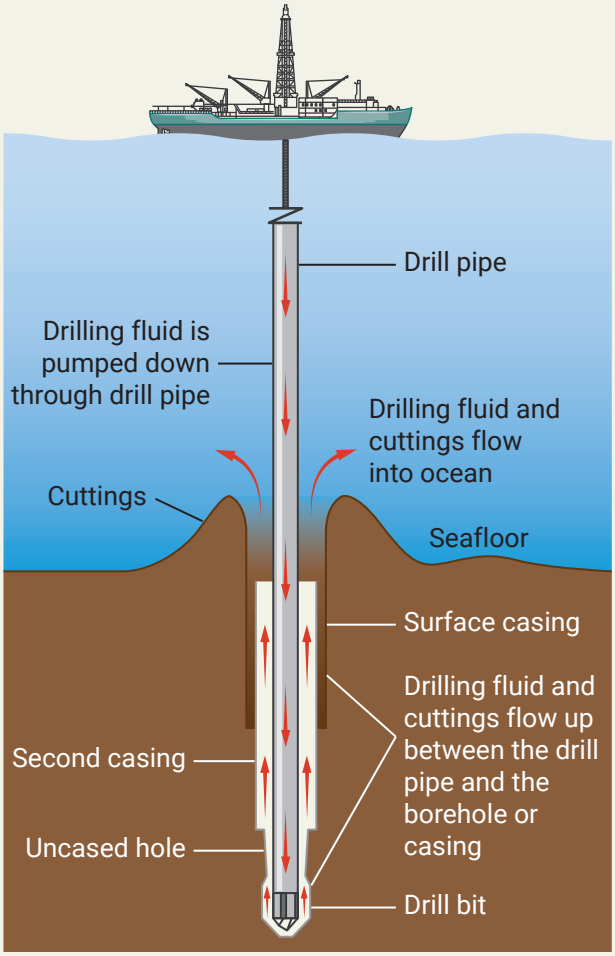
In this lesson, you will look at how a geological technician uses different representations of linear functions to analyze collected data.

1 Step Into the Career: Comparison of Linear Equations

When boring a hole, it is important to understand the stresses the borehole experiences so that it does not fail. A geological technician is compiling the functions for the effective stresses of a borehole 500 meters below the seafloor. The function r for effective radial stress is graphed below. The effective tangential stress in megapascals is modeled by the function $t(d) = -36d + 43$ for $1.03 \leq d \leq 1.25$, where d is the drilling fluid density in grams per cubic centimeter. Compare the functions.







Devise a Plan

Step 1: Determine which representation makes sense for both functions.

Step 2: Represent both functions the same way.

Step 3: Find the slope and y-intercept of both functions.

Step 4: Use the slopes and y-intercepts to compare the functions.

Walk Through the Solution

Step 1: Determine which representation makes sense for both functions.

Because the graph does not show the y-axis, graphing the y-intercept might be challenging. Instead, use points on the graph to write an equation for the effective radial stress.

Step 2: Represent both functions the same way.

Two points on the graph representing effective radial stress appear to be (1.03, 2) and (1.25, 2.2). Find the slope of the line.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{2.2 - 2}{1.25 - 1.03} = \frac{0.2}{0.22} \approx 0.91$$

Use either point and the slope to write an equation for the line.

$y - y_1 = m(x - x_1)$	Use the point-slope form of a line.
$y - 2 = 0.91(x - 1.03)$	Substitute 0.91 for m and (1.03, 2) for (x_1, y_1).
$y - 2 = 0.91x - 0.94$	Use the Distributive Property. Round to the nearest hundredth.
$y = 0.91x + 1.06$	Use the Addition Property of Equality.
$r(d) = 0.91d + 1.06$	Substitute d for the independent variable and $r(d)$ to represent the function.

So, the equation for effective tangential stress is $t(d) = -36d + 43$ for $1.03 \leq d \leq 1.25$, and the equation for effective radial stress is $r(d) = 0.91d + 1.06$ for $1.03 \leq d \leq 1.25$.

Step 3: Find the slope and y-intercept of both functions.

The slope of the effective tangential stress function is –36, and the y-intercept is 43. The slope of the effective radial stress function is 0.91, and the y-intercept is 1.06.

Step 4: Use the slopes and y-intercepts to compare the functions.

The slopes have opposite signs, so the functions are moving in different directions. The effective tangential stress function is decreasing while the effective radial stress function is increasing. Because the effective tangential stress function decreases from 43 while the effective radial stress function increases from 1.06, the graphs intersect, and there is a point where the effective tangential stress equals the effective radial stress.

On the Job: Apply Comparison of Linear Equations

1. A geological technician is helping a researcher examine the effects of explosive charges inside a borehole. When an air column is above a stack of spherical charges, the pressures appear as approximated in the table. When an air column is between two stacks of spherical charges, the pressure is approximated by the function $P = 180n$, where P is the initial pressure in megapascals and n is the number of charges in each stack. Compare the functions.

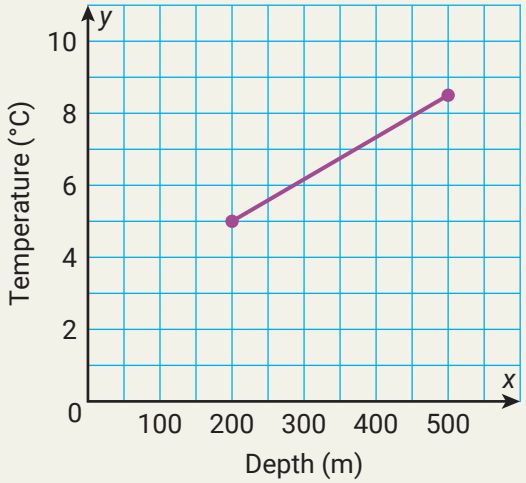
Air Column Above One Stack of Charges

Number of Charges in Each Stack	Initial Pressure (megapascals)
1	18
2	62
3	106
4	150

2 Step Into the Career: Problem Solving with Linear Equations

A geological technician is analyzing temperatures of boreholes in eastern Canada. At Location A, the temperatures are related to the depth of the borehole as shown in the graph. At Location B, the temperatures are related as shown in the table. At which location do you expect the greater surface temperature?

Location A



Location B

Depth (m)	Temperature (°C)
200	5.2
300	6.8
400	8.4
500	10.0

Devise a Plan

Step 1: Determine the characteristic of the functions that will help you answer the question.

Step 2: Represent both functions graphically.

Step 3: Make an educated guess about the answer to the question.

Step 4: Write an equation for Location A to determine its surface temperature.

Step 5: Write an equation for Location B to determine its surface temperature.

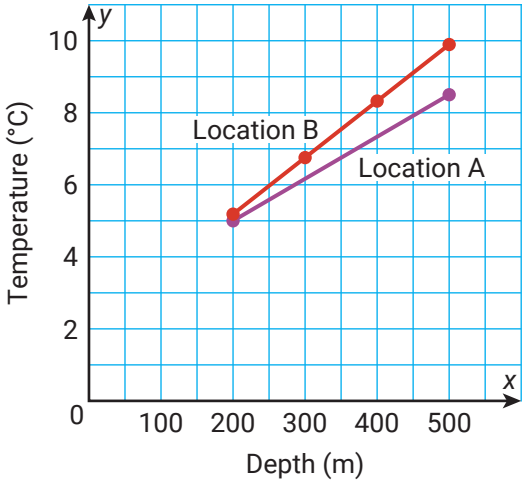
Walk Through the Solution

Step 1: Determine the characteristic of the functions that will help you answer the question.

The surface corresponds to a depth of 0 meters, so the *y*-intercepts will help you answer the question.

Step 2: Represent both functions graphically.

Because you need to find the *y*-intercepts, you want to use the graphs of the functions or the equations of the functions. The function for Location A is already graphed, so it makes sense to graph the function for Location B as well. To graph the function for Location B, plot the points (200, 5.2), (300, 6.8), (400, 8.4), and (500, 10). Then draw the line segments connecting the points.



Step 3: Make an educated guess about the answer to the question.

The graph shows that the functions are distanced from each other at $x = 500$ but close at $x = 200$. If you extend the lines to the left, they will intersect. After intersecting, the line for Location A will be above the line for Location B, which means the function for Location A has the greater *y*-intercept.

Step 4: Write an equation for Location A to determine its surface temperature.

One way to find the *y*-intercept is to write the slope-intercept form of a linear equation. That means you need to find the slope. Use points (200, 5) and (500, 8.5) to find the slope of the line for Location A.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{8.5 - 5}{500 - 200} = \frac{3.5}{300} \approx 0.012$$

Then substitute what you know into the slope-intercept form of a linear equation.

$y = mx + b$	Use the slope-intercept form of a line.
$5 = 0.012(200) + b$	Substitute 0.012 for m and (200, 5) for (x, y).
$5 = 2.4 + b$	Simplify.
$2.6 = b$	Use the Subtraction Property of Equality.

The *y*-intercept for Location A is 2.6.

Step 5: Write an equation for Location B to determine its surface temperature.

Another way to find the y-intercept is to write the point-slope form of a linear equation and then rewrite it in slope-intercept form. Use points (200, 5.2) and (500, 10) to find the slope of the line for Location B.

$$m = \frac{\text{rise}}{\text{run}} = \frac{\text{change in } y}{\text{change in } x} = \frac{10 - 5.2}{500 - 200} = \frac{4.8}{300} = 0.016$$

Then substitute what you know into the point-slope form of a linear equation.

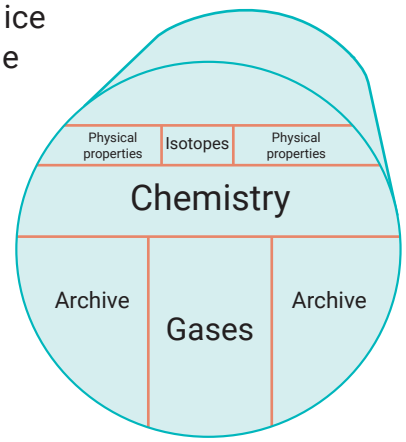
$y - y_1 = m(x - x_1)$	Use the point-slope form of a line.
$y - 10 = 0.016(x - 500)$	Substitute 0.016 for m and (500, 10) for (x_1, y_1).
$y - 10 = 0.016x - 8$	Use the Distributive Property.
$y = 0.016x + 2$	Use the Addition Property of Equality.

The y-intercept for Location B is 2.

Because the y-intercept for Location A is greater than the y-intercept for Location B, Location A is expected to have the greater surface temperature.

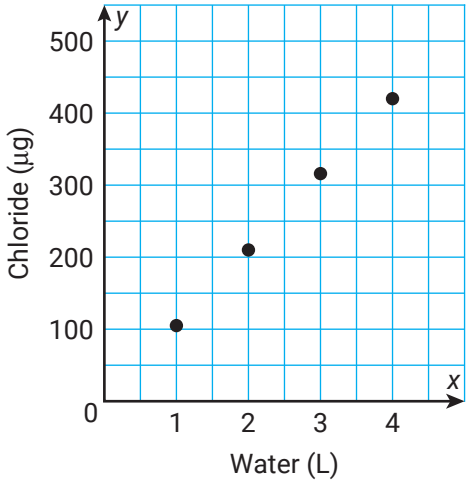
On the Job: Apply Problem Solving with Linear Equations

2. Ice core samples are taken in the shape of a cylinder. Analyzing ice core samples requires melting them. To avoid destroying a whole sample, a sample can be sectioned as shown in the diagram. Sections are analyzed for different purposes or archived.



A geological technician is analyzing data from an ice core samples from different depths. These depths represent time periods ten years apart. The sample that was 0.33 to 0.36 meters deep suggests that a liter of water at that time would have contained 111 micrograms of chloride.

1.17 to 1.2 Meters Deep



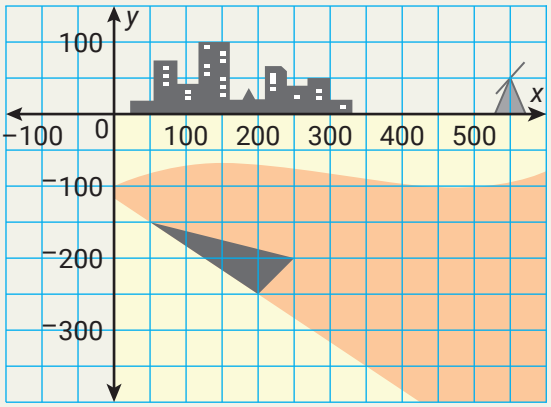
1.98 to 2.01 Meters Deep

Water (liters)	Chloride (micrograms)
2	118
4	236
6	354

Over these twenty years, did the concentration of chloride increase, decrease, or stay the same? Explain.

3 Step Into the Career: Intersecting Lines

An oil company has determined there is enough oil under a city to justify drilling a well. Because they cannot build a well in the city, they will drill at an angle from outside the city. The oil reservoir is modeled on the coordinate plane. A geological technician proposes the path of the drill follow the line $y = 0.6x - 350$ for $200 \leq x \leq 500$. Does the proposed path of the drill intersect the lines that define the reservoir? Explain what your answer means for the oil company.



Devise a Plan

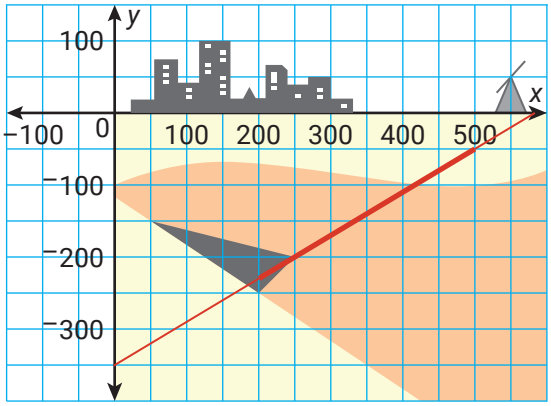
Step 1: Graph the proposed path of the drill.

Step 2: Determine whether any lines intersect.

Step 3: Reason about the needs of the oil company and whether the result of Step 2 is good or bad for the company.

Walk Through the Solution

Step 1: Graph the proposed path of the drill. Then highlight the portion of the line that falls within the boundary values of x.



Step 2: Determine whether any lines intersect.

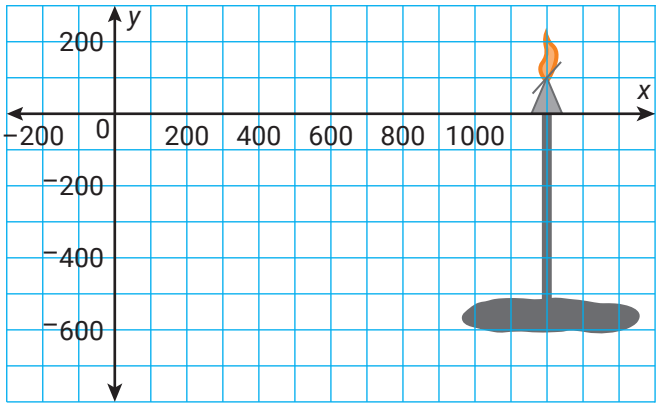
From examining the graph, the path of the drill appears to intersect one border of the oil reservoir at about (250, –200).

Step 3: Reason about the needs of the oil company and whether the result of Step 2 is good or bad for the company.

The path of the drill intersects one border of the reservoir and ends before it intersects another, so the company will reach the oil.

On the Job: Apply Intersecting Lines

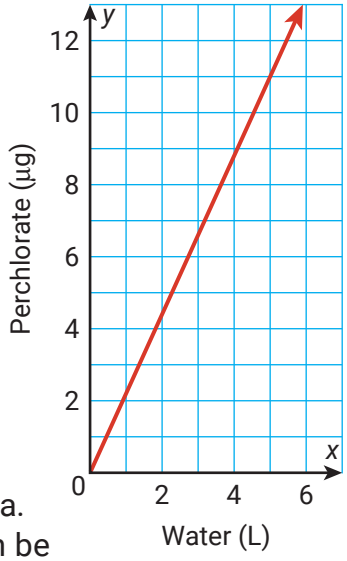
3. An oil well that was drilled vertically has blown, meaning it is flowing uncontrollably. The only way to stop the blowout is to drill a relief well at another location at an angle that will intersect the original well above the oil deposit. The original well extends 600 meters down from ground level, as modeled on the coordinate plane.



A geological technician suggests the diagonal portion of the relief well should follow the line $y = -\frac{1}{2}x + 200$ for $600 \le x \le 1200$. Will drilling this path result in a successful relief well? Explain.

Career Spotlight: Practice

4. A geological technician who works for the Environmental Protection Agency (EPA) tested groundwater in a particular location. The graph shows the amount of perchlorate in various amounts water five years ago. In each liter of water now the amount of perchlorate is 92 micrograms. Compare the functions.



Devise a Plan

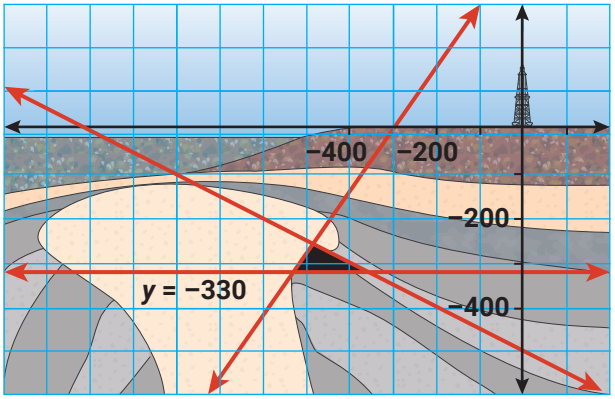
Step 1: Represent both functions the same way.

Step 2: ____?____

Step 3: ____?____

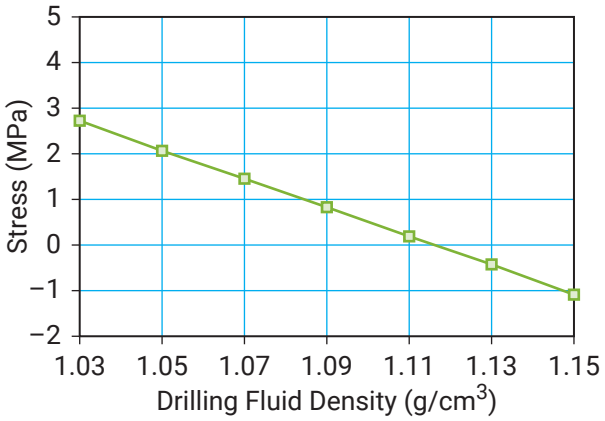
5. A geological technician is checking the temperature of a well in Nevada. For the first 1126 meters below ground surface, the temperature can be found using the equation $T = 0.0036d$, where T is in °C and d is in meters. After 1126 meters, the temperature rises 0.0376 °C with each meter of descent. Does the temperature increase faster at 1000 meters below ground surface or at 2000 meters below ground surface? Explain.

6. A petroleum company wants to extract oil from beneath a salt dome. To do so, they must drill around it. The oil is bordered by the lines shown on the graph. A geological technician suggests drilling along the line $y = \frac{1}{4}x - 200$ for $-450 \leq x \leq -100$. How many of the oil's borders does this line intersect? What does that mean for the petroleum company?



Career Spotlight: Check

7. A geological technician is comparing the functions for the effective tangential stresses of a borehole 200 meters below the seafloor and 500 meters below the seafloor. The function for effective tangential stress at 200 meters is graphed. The effective tangential stress at 500 meters follows the function $t(d) = -36d + 43$ for $1.03 \leq d \leq 1.15$, where d is the drilling fluid density. How do the functions compare?



Select all the statements that are true.

a. Both functions are increasing.

b. Both functions are decreasing.

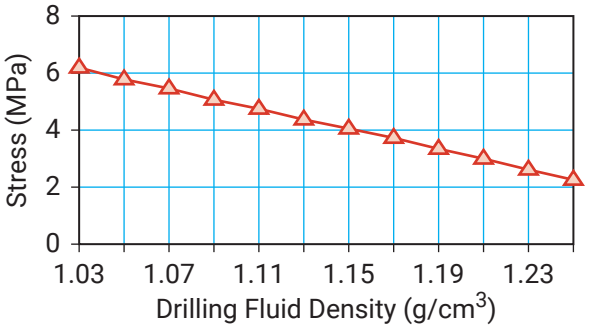
c. The tangential stress at 500 meters increases faster than the tangential stress at 200 meters.

d. The tangential stress at 500 meters decreases faster than the tangential stress at 200 meters.

e. The tangential stresses at 500 meters and at 200 meters increase at the same rate.

f. The tangential stresses at 500 meters and at 200 meters decrease at the same rate.

8. A geological technician is compiling the functions for the effective stresses of a borehole 500 meters below the seafloor. The function for effective axial stress is graphed. The effective tangential stress follows the function $t(d) = -36d + 43$ for $1.03 \leq d \leq 1.25$, where d is the drilling fluid density. Compare the functions.



A. Both functions are increasing, but the tangential stress is increasing faster than the axial stress.

B. Both functions are increasing, but the axial stress is increasing faster than the tangential stress.

C. Both functions are decreasing, but the tangential stress is decreasing faster than the axial stress.

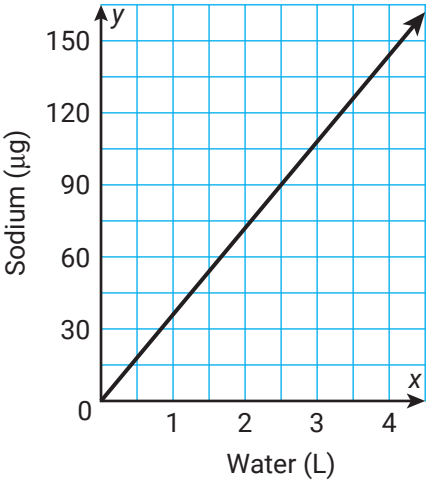
D. Both functions are decreasing, but the axial stress is decreasing faster than the tangential stress.

9. A geological technician is analyzing data from an ice core samples from different depths. These depths represent time periods ten years apart, with each deeper sample being ten years older. The sample that was 0.33 to 0.36 meters deep suggests that a liter of water at that time would have contained 56 micrograms of sodium.

1.98 to 2.01 Meters Deep

Water (liters)	Sodium (micrograms)
2	36
4	72
6	108

1.17 to 1.2 Meters Deep



Over these twenty years, how did the concentration of sodium change?

Select all the statements that are true.

a. The concentration of sodium increased during the first ten years.

b. The concentration of sodium decreased during the first ten years.

c. The concentration of sodium stayed the same during the first ten years.

d. The concentration of sodium increased during the last ten years.

e. The concentration of sodium decreased during the last ten years.

f. The concentration of sodium stayed the same during the last ten years.

10. A geological technician is analyzing data from an ice core sample taken in Antarctica. Layer B is 5 years older than Layer A. The sample at Layer A suggests that a liter of water at that time would have contained 58 micrograms of sulfate and 65 micrograms of nitrate.

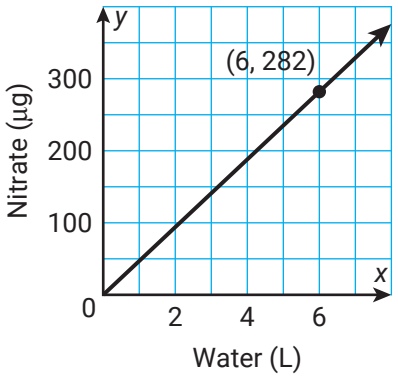
Layer A

Water (liters)	Sodium (micrograms)
2	66
4	132
6	198

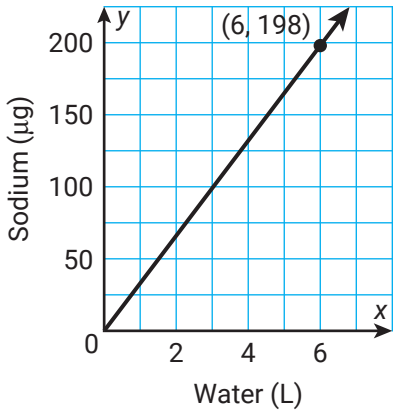
Layer B

Water (liters)	Sulfate (micrograms)
2	122
4	244
6	366

Layer B



Layer B



Select the answer from each box that makes the sentence true.

The concentration of

a. nitrate
b. sodium
c. sulfate
d. none of these

has increased over the 5 years between when the samples were taken.

The concentration of

a. nitrate
b. sodium
c. sulfate
d. none of these

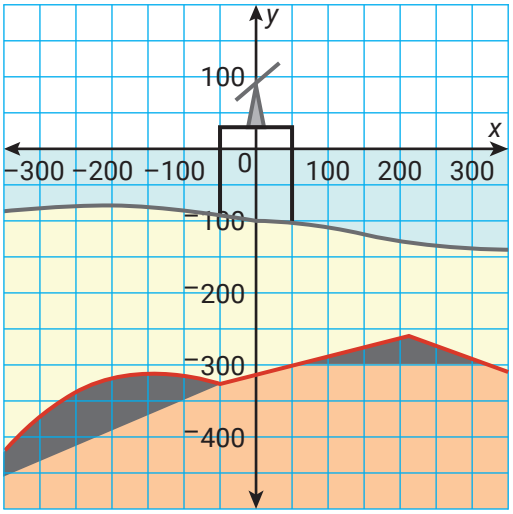
has decreased over the 5 years between when the samples were taken.

The concentration of

a. nitrate
b. sodium
c. sulfate
d. none of these

has stayed the same over the 5 years between when the samples were taken.

11. A petroleum company wants to drill toward two oil deposits from the same offshore platform. Which of these functions can the geological technician suggest?



Select all the functions that can be suggested by the geological technician.

a. $y = \frac{2}{5}x - 200$ for $-190 \le x \le -40$

b. $y = \frac{2}{5}x - 250$ for $-250 \le x \le -50$

c. $y = x - 150$ for $-190 \le x \le -40$

d. $y = -x - 150$ for $40 \le x \le 140$

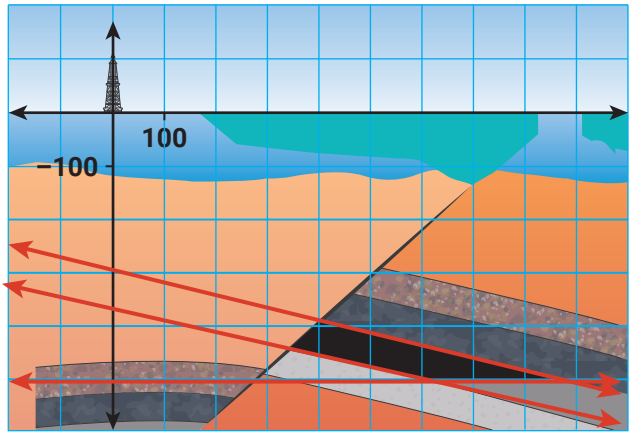
e.

x	*y*
50	−275
100	−275
150	−275
200	−275

f.

x	*y*
50	−200
100	−250
150	−300
200	−350

12. An oil company has determined there is enough oil under a bay to drill a well. However, it is cheaper to build an onshore oil rig and access the oil at an angle than to build an offshore oil rig and drill straight down. The oil reservoir is shown on the graph. A geological technician proposes the path of the drill follow the line $y = -0.4x - 300$ for $100 \le x \le 600$. Should the company drill along this path?



Select the answer from each box that makes the sentence true.

The path of the drill [**a.** intersects / **b.** does not intersect] the boundaries of the reservoir [**a.** at all / **b.** once / **c.** twice].

This means the company [**a.** will / **b.** will not] be able to harvest oil from this reservoir using this path.

PATHWAY 2 CAREERS

P2C Math: Geometry

Table of Contents & Pacing

Total # of Days 126-190

	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
1. Geometry Fundamentals						10-15
G-1.1	Points, Lines, and Planes	Exploration	G-CO.A.1, G-MG.A.1	3, 4, 5	Multiple	1
G-1.2	Measure and Construct Segments	Exploration	G-CO.A.1, G-CO.D.12	2, 5, 6	Multiple	1
G-1.3	Measure and Construct Angles	Exploration	G-CO.A.1, G-CO.D.12	1, 5, 6	Multiple	1
G-1.4	Describe Pairs of Angles	Exploration	G-CO.A.1	1, 5, 7	Multiple	1
G-1.5	Solve Problems Using Pairs of Angles	Application	G-CO.A.1	1, 2, 4	Occupational Therapists	1-2
G-1.6	Classify Polygons	Exploration	G-CO.A.1, G-MG.A.1	2, 4, 8	Multiple	1
G-1.7	Solve Design Problems Using Areas of Figures	Application	N-Q.A.1, G-MG.A.2, G-MG.A.3	1, 2, 4	Meeting, Convention, and Event Planners	1-2
G-1.8	Midpoint and Distance in the Coordinate Plane	Application	G-GPE.B.6, G-GPE.B.7	1, 2, 4	Emergency Medical Technicians & Paramedics	1-2
G-1.9	Perimeter in the Coordinate Plane	Application	G-GPE.B.6, G-GPE.B.7	1, 2, 4	Fence Erectors	1-2
G-1.10	Area in the Coordinate Plane	Application	G-GPE.B.7	1, 4, 6	Computer Specialists	1-2
2. Geometric Reasoning						9-12
G-2.1	Use Inductive Reasoning	Exploration	G-CO.C.9, G-CO.C.11	1, 3, 8	Multiple	1
G-2.2	Write Conditional Statements	Exploration	G-CO.C.9, G-CO.C.11	1, 3	Multiple	1
G-2.3	Use Deductive Reasoning	Exploration	G-CO.C.9, G-CO.C.11	1, 3	Multiple	1
G-2.4	Apply Deductive Reasoning	Application	G-CO.C.9, G-CO.C.11	1, 3	Child, Family, and School Social Workers	1-2
G-2.5	Biconditional Statements and Definitions	Exploration	G-CO.C.9, G-CO.C.11	1, 3	Multiple	1-2
G-2.6	Write Algebraic Proofs	Exploration	A-REI.A.1, G-CO.C.9, G-CO.C.11	1, 2, 3	Multiple	1
G-2.7	Write Proofs about Segments	Exploration	G-CO.A.1, G-CO.C.9	1, 2, 3	Multiple	1
G-2.8	Write Proofs about Angles	Exploration	G-CO.A.1, G-CO.C.9	1, 2, 3	Multiple	1
G-2.9	Use Theorems about Angles	Application	G-CO.A.1, G-CO.C.9	1, 2, 4	Carpenters	1-2

"P" denotes that the lesson is a Project and may be omitted or abbreviated at the discretion of the teacher/district. Pacing for these lessons is not included in the chapter or course totals.

960L

		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
3. Parallel and Perpendicular Lines							**10-15**
	G-3.1	Pairs of Lines and Angles	Exploration	G-CO.A.1, G-CO.C.9	2, 6, 7	Multiple	1
	G-3.2	Parallel Lines and Transversals	Exploration	G-CO.A.1, G-CO.C.9	1, 3, 7	Multiple	1
	G-3.3	Use Properties of Parallel Lines	Application	G-CO.A.1, G-CO.C.9	1, 2, 4	Tree Trimmers and Pruners	1-2
	G-3.4	Prove Lines are Parallel	Exploration	G-CO.A.1, G-CO.C.9, G-CO.D.12	3, 5, 8	Multiple	1
	G-3.5	Show Lines are Parallel	Application	G-CO.A.1, G-CO.C.9	1, 2, 4	Rail-Track Equipment Operators	1-2
	G-3.6	Prove Theorems about Perpendicular Lines	Exploration	G-CO.A.1, G-CO.C.9, G-CO.D.12	2, 3, 5	Multiple	1
	G-3.7	Use Properties of Perpendicular Lines	Application	G-CO.A.1, G-CO.C.9	1, 2, 4	Brickmasons and Blockmasons	1-2
	G-3.8	Find and Use Slopes of Lines	Exploration	A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-BF.A.1.a, F-LE.A.2, G-GPE.B.5, G-GPE.B.6	1, 2, 7	Multiple	1
	G-3.9	Use the Slope Criteria for Parallel and Perpendicular Lines	Application	A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-BF.A.1.a, F-LE.A.2, G-GPE.B.5	1, 2, 4	Civil Engineers	1-2
	G-3.10	Lines in the Coordinate Plane	Exploration	A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-BF.A.1.a, F-LE.A.2, G-GPE.B.5, G-GPE.B.6	1, 6, 8	Multiple	1-2
P	G-3-P	Expressing Geometric Properties with Equations	Project (Information Technology)	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.A.2, F-IF.B.4, F-IF.B.6, F-BF.A.1.a, F-LE.A.1.b, F-LE.A.2, F-LE.B.5, G-CO.A.1, G-GPE.B.4, G-GPE.B.5	1, 2, 4, 6	Health Informatics Specialists	3-6
4. Transformations							**12-20**
	G-4.1	Translations	Exploration	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 6, 7	Multiple	1-2
	G-4.2	Apply Translations	Application	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 4	Biological Technicians	1-2

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
G-4.3	Reflections	Exploration	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 6, 7	Multiple	1
G-4.4	Apply Reflections	Application	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 4	Marine Engineers and Naval Architects	1-2
G-4.5	Rotations	Exploration	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 6, 7	Multiple	1
G-4.6	Apply Rotations	Application	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 4	Air Traffic Controllers	1-2
G-4.7	Investigate Symmetry	Application	G-CO.A.3	1, 2, 4	Architecture Professors	1-2
G-4.8	Compositions of Transformations	Application	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6	1, 2, 4	Computer Numerically Controlled Machine Tool Programmers	1-2
G-4.9	Transformations and Congruence	Exploration	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6, G-CO.B.7	1, 2, 7	Multiple	1
G-4.10	Dilations	Exploration	G-CO.A.2, G-SRT.A.1.a, G-SRT.A.1.b, G-SRT.A.2	1, 2, 6	Multiple	1
G-4.11	Apply Dilations	Application	G-CO.A.2, G-SRT.A.1.a, G-SRT.A.1.b, G-SRT.A.2, G-MG.A.3	1, 2, 4	Advertising and Promotions Managers	1-2
G-4.12	Transformations and Similarity	Exploration	G-CO.A.2, G-CO.B.6, G-SRT.A.2	1, 2, 7	Multiple	1-2
5. Congruent Triangles						**11-16**
G-5.1	Classifying Triangles	Exploration	G-CO.C.10	2, 6, 7	Multiple	1
G-5.2	Angles in Triangles	Exploration	G-CO.C.9, G-CO.C.10	1, 3, 8	Multiple	1
G-5.3	Apply Angle Relationships in Triangles	Application	G-CO.C.9, G-CO.C.10	1, 2, 3	Physical Therapists	1-2
G-5.4	Triangle Congruence	Application	G-CO.B.6, G-CO.B.7	1, 2, 4	Graphic Designers	1-2
G-5.5	Prove Triangle Congruence by SAS and SSS	Exploration	G-CO.B.7, G-CO.B.8, G-CO.C.9, G-SRT.B.5	2, 3, 6	Multiple	1
G-5.6	Apply SSS and SAS Triangle Congruence	Application	G-CO.B.8, G-CO.C.9, G-SRT.B.5	1, 2, 4	Glaziers	1-2
G-5.7	Prove Triangle Congruence by ASA and AAS	Exploration	G-CO.B.7, G-CO.B.8, G-CO.C.9, G-SRT.B.5	1, 3, 5	Multiple	1
G-5.8	Prove Triangle Congruence by HL	Exploration	G-CO.B.7, G-CO.B.8, G-CO.C.9, G-SRT.B.5	3, 4, 7	Multiple	1

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	G-7.8	Identify Special Quadrilaterals in the Coordinate Plane	Application	G-CO.C.9, G-CO.C.11, G-GPE.B.4, G-GPE.B.5	1, 2, 4	Fashion Designers	1-2
P	G-7-P	Congruence	Project (Information Technology)	G-CO.A.2, G-CO.A.4, G-CO.A.5, G-CO.B.6, G-CO.B.7, G-CO.B.8, G-CO.C.9, G-CO.C.10, G-CO.C.11, G-SRT.B.5, G-MG.A.3	1, 6, 7	Computer Network Architects	3-6
8. Similarity							**6-9**
	G-8.1	Similar Polygons	Application	G-SRT.A.2	1, 2, 4	Set and Exhibit Designers	1-2
	G-8.2	Prove Triangles Similar by AA	Exploration	G-CO.C.9, G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5	1, 2, 7	Multiple	1
	G-8.3	Prove Triangles Similar by SSS and SAS	Exploration	G-CO.C.9, G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5, G-GPE.B.5	1, 2, 7	Multiple	1
	G-8.4	Use Similar Triangles	Application	G-CO.C.9, G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5	1, 2, 4	Foresters	1-2
	G-8.5	Use Proportionality Theorems	Exploration	G-CO.C.9, G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5	1, 4, 5	Multiple	1
	G-8.6	Apply Proportionality Theorems	Application	G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5, G-MG.A.3	1, 2, 4	Urban and Regional Planners	1-2
9. Right Triangles and Trigonometry							**10-17**
	G-9.1	The Pythagorean Theorem	Exploration	G-CO.C.10, G-SRT.C.8	2, 6, 8	Multiple	1
	G-9.2	Apply the Pythagorean Theorem	Application	G-CO.C.10, G-SRT.C.8	1, 2, 4	Construction and Building Inspectors	1-2
	G-9.3	Special Right Triangles	Exploration	G-SRT.C.8	1, 6, 7	Multiple	1-2
	G-9.4	Similar Right Triangles	Exploration	G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5	2, 3, 7	Multiple	1
	G-9.5	Use Similar Right Triangles	Application	G-SRT.A.2, G-SRT.A.3, G-SRT.B.4, G-SRT.B.5	1, 2, 4	Photographers	1-2
	G-9.6	The Tangent Ratio	Exploration	G-SRT.C.6, G-SRT.C.8	1, 5, 8	Multiple	1

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	G-9.7	The Sine and Cosine Ratios	Exploration	G-SRT.C.6, G-SRT.C.7, G-SRT.C.8	2, 4, 7	Multiple	1-2
	G-9.8	Apply Trigonometric Ratios in Right Triangles	Application	G-SRT.C.6, G-SRT.C.8	1, 2, 4	Solar Photovoltaic Installers	1-2
	G-9.9	Law of Sines and Law of Cosines	Exploration	G-SRT.C.6, G-SRT.C.8, G-SRT.D.9, G-SRT.D.10, G-SRT.D.11	1, 5, 7	Multiple	1-2
	G-9.10	Apply the Law of Sines and the Law of Cosines	Application	G-SRT.C.6, G-SRT.C.8, G-SRT.D.10, G-SRT.D.11, G-MG.A.3	1, 2, 4	Sound Engineering Technicians	1-2
10. Circles							**12-16**
	G-10.1	Lines and Segments that Intersect Circles	Exploration	G-CO.A.1, G-C.A.2, G-C.A.4	1, 5, 6	Multiple	1
	G-10.2	Finding Arc Measures	Exploration	G-C.A.1, G-C.A.2, G-C.B.5	1, 6, 7	Multiple	1
	G-10.3	Using Chords	Exploration	G-C.A.2	1, 6, 7	Multiple	1
	G-10.4	Inscribed Angles	Exploration	G-C.A.2	1, 6, 7	Multiple	1
	G-10.5	Inscribed Polygons	Exploration	G-C.A.2, G-C.A.3	1, 6, 7	Multiple	1
	G-10.6	Apply Central Angles and Inscribed Angles	Application	G-C.A.2, G-MG.A.3	1, 2, 4	Security and Fire Alarm Systems Installers	1-2
	G-10.7	Angle Relationships in Circles	Exploration	G-C.A.2	1, 2, 7	Multiple	1
	G-10.8	Segment Relationships in Circles	Exploration	G-C.A.2	1, 2, 7	Multiple	1
	G-10.9	Apply Segment Relationships in Circles	Application	G-C.A.2	1, 2, 4	Life, Physical and Social Science Technicians	1-2
	G-10.10	Circles in the Coordinate Plane	Exploration	G-GPE.A.1, G-GPE.B.4	1, 2, 7	Multiple	1
	G-10.11	Apply Circles in the Coordinate Plane	Application	G-GPE.A.1	4, 6, 7	Geoscientists	1-2
	G-10.12	Equation of a Parabola	Exploration	A-CED.A.2, F-IF.C.7.a, G-GPE.A.2, G-GPE.A.3	1, 2, 7	Multiple	1-2
P	G-10-P	Circles	Project (Information Technology)	A-CED.A.2, G-C.A.2, G-C.A.3, G-GPE.A.1, G-MG.A.3	2, 5, 6, 7, 8	Telecommunications Engineering Specialists	3-6

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
11. Circumference and Area						**7-12**
G-11.1	Find Areas of Triangles using Trigonometry	Application	N-Q.A.1, G-SRT.C.8, G-MG.A.2	1, 2, 4	Surveyors	1-2
G-11.2	Areas of Parallelograms, Trapezoids, and Regular Polygons	Application	N-Q.A.1, G-SRT.C.8, G-MG.A.2	1, 4, 6	Fish and Game Wardens	1-2
G-11.3	Areas of Composite Figures	Application	N-Q.A.1, G-MG.A.2	1, 2, 4	Appraisers and Assessors of Real Estate	1-2
G-11.4	Circumference and Arc Length	Exploration	N-Q.A.1, G-C.B.5, G-GMD.A.1	1, 2, 7	Multiple	1
G-11.5	Apply Circumference and Arc Length	Application	N-Q.A.1, G-C.B.5, G-GMD.A.1, G-MG.A.1	2, 4, 7	Mechanical Engineering Technicians	1-2
G-11.6	Areas of Circles and Sectors	Exploration	N-Q.A.1, G-C.B.5, G-GMD.A.1	1, 2, 7	Multiple	1
G-11.7	Apply Areas of Circles and Sectors	Application	N-Q.A.1, G-C.B.5, G-MG.A.1	1, 2, 4	Cardiovascular Technologists and Technicians	1-2
12. Surface Area and Volume						**13-20**
G-12.1	Cross Sections of Solids	Exploration	G-GMD.B.4	4, 5, 8	Multiple	1
G-12.2	Visualizing Solids	Application	G-GMD.B.4	1, 2, 4	Architectural and Civil Drafters	1-2
G-12.3	Surface Areas of Prisms and Pyramids	Exploration	N-Q.A.1, G-MG.A.1	2, 4, 7	Multiple	1
G-12.4	Apply Surface Areas of Prisms and Pyramids	Application	N-Q.A.1, G-MG.A.1	1, 2, 4	Anthropologists and Archeologists	1-2
G-12.5	Surface Areas of Cylinders and Cones	Exploration	N-Q.A.1, G-MG.A.1	1, 2, 4	Multiple	1-2
G-12.6	Surface Areas of Spheres	Exploration	N-Q.A.1, G-MG.A.1	3, 4, 7	Multiple	1
G-12.7	Apply Surface Areas of Cylinders, Cones, and Spheres	Application	N-Q.A.1, G-MG.A.1, G-MG.A.3	1, 2, 4	Industrial Production Managers	1-2
G-12.8	Volumes of Prisms and Pyramids	Exploration	N-Q.A.1, G-GMD.A.1, G-GMD.A.3	2, 6, 8	Multiple	1

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	G-13.9	Dependent Events	Exploration	S-CP.A.1, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6, S-CP.B.7, S-CP.B.8, S-CP.B.9	1, 4, 7	Multiple	1
	G-13.10	Apply Probabilities of Dependent Events	Application	S-CP.A.1, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6, S-CP.B.7, S-CP.B.8, S-CP.B.9, S-MD.B.7	1, 2, 4	Gaming Managers	1-2
P	G-13-P	Using Probability to Make Decisions	Project (Information Technology)	S-ID.B.5, S-IC.A.2, S-IC.B.5, S-CP.A.1, S-CP.A.2, S-CP.A.3, S-CP.A.4, S-CP.A.5, S-CP.B.6, S-CP.B.7, S-CP.B.8, S-CP.B.9, S-MD.B.6, S-MD.B.7	2, 3, 4	Computer Programmers	3-6

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P2C Math

Sample Lesson: Student Edition

LESSON 2.9

Use Theorems About Angles

CAREER SPOTLIGHT: Carpenter

Occupation Description

Carpenters construct, repair, and install building frameworks and structures made from wood and other materials.

Carpenters have many different tasks. Some carpenters insulate office buildings; others install drywall or kitchen cabinets in homes. Still others focus on production or commercial work to help construct tall buildings or bridges. These carpenters also erect shoring and scaffolding for buildings.

Education

Carpenters typically need a high school diploma and learn on the job or through apprenticeships. Certain high school courses, such as mathematics and mechanical drawing, may be useful. Some vocational-technical schools offer associate's degrees in carpentry. The programs vary in length and teach basics and specialties in carpentry.

Potential Employers

The largest employers of carpenters are as follows:

Self-employed workers	27%
Residential building construction	22%
Nonresidential building construction	13%
Building finishing contractors	12%
Foundation, structure, and building exterior contractors	10%

Watch a video about carpenters:
https://cdn.careeronestop.org/OccVids/OccupationVideos/47-2031.00.mp4

Career Cluster
Architecture & Construction

Career Pathway
Construction

Career Outlook

- Salary Projections:
  Low-End Salary, $30,170
  Median Salary, $48,330
  High-End Salary, $84,690
- Jobs in 2018: 1,006,500
- Job Projections for 2028: 1,086,600 (increase of 8%)

Geometry Concept

- Apply theorems about angles.

Is this a good career for me?

Carpenters:

- Follow blueprints and building plans to meet the needs of clients.
- Measure, cut, and shape wood, plastic, and other materials.
- Construct and install building frameworks, including walls, floors, and doorframes.
- Instruct and direct laborers and other construction helpers.
- Install structures and fixtures, such as windows and molding.
- Inspect and replace damaged framework or other structures and fixtures.

Photo credit: Pikselstock/Shutterstock.com

Lesson Objective

In this lesson, you will look at how a carpenter applies theorems about angles to carpentry tasks such as framing buildings and building furniture.

Definitions

Angles that have the same angle measure are **congruent angles**.

A **linear pair** are two adjacent angles formed by intersecting lines.

Vertical angles are opposite angles formed by intersecting lines.

A pair of angles are **complementary** if the sum of the angle measures is 90°.

A pair of angles are **supplementary** if the sum of the angle measures is 180°.

Theorems

Linear Pair Postulate: Two angles that form a linear pair are supplementary.

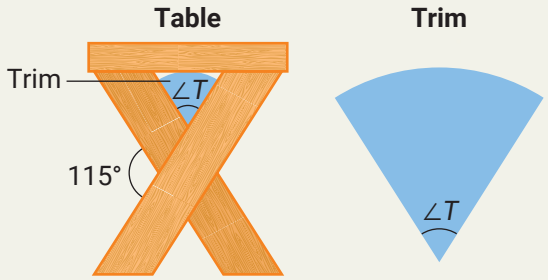
Vertical Angles Theorem: Vertical angles are congruent.

Congruent Complements Theorem: If two angles are complements to the same angle (or congruent angles), then the two angles are congruent.

Congruent Supplements Theorem: If two angles are supplements to the same angle (or congruent angles), then the two angles are congruent.

1 Step Into the Career: Linear Pair Postulate

A carpenter is building coffee tables with crossed legs and decorative trim. One version is shown. What is the angle measure that the carpenter should cut the bottom angle of the trim, $\angle T$, so that it fits with no gaps?



Devise a Plan

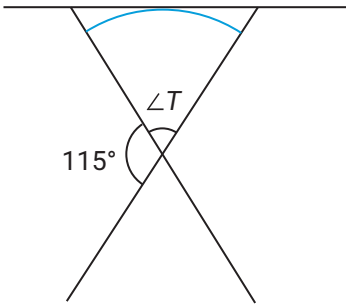
Step 1: Model the table legs with a pair of intersecting lines.

Step 2: Identify the type of angles formed by the 115° angle and $\angle T$.

Step 3: Write an equation to describe the connection between the 115° angle and $\angle T$.

Step 4: Solve for $m\angle T$.

Walk Through the Solution



Step 1: Model the table legs with a pair of intersecting lines, as shown.

Step 2: The 115° angle and $\angle T$ are adjacent angles formed by intersecting lines. They are a linear pair.

Step 3: By the Linear Pair Postulate, the angles are supplementary. The sum of the measures of the 115° angle and $\angle T$ is 180°.

$$115° + m\angle T = 180°$$

Step 4: Solve for $m\angle T$.

$$115° + m\angle T = 180°$$

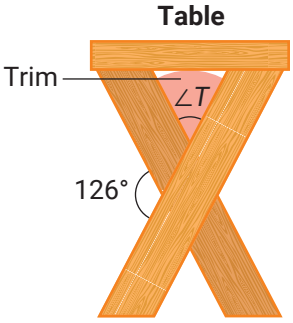
$$m\angle T = 180° - 115°$$

$$m\angle T = 65°$$

The carpenter should cut the trim piece so that $m\angle T$ is 65°.

On the Job: Apply The Linear Pair Postulate

1. A carpenter building coffee tables has decorative trim cut to various angles.



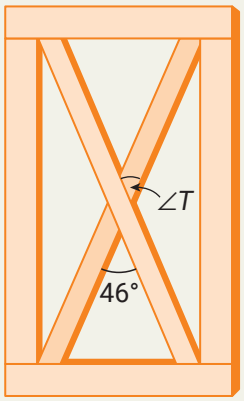
a. Will decorative trim cut with an angle of 57° fit the table shown?

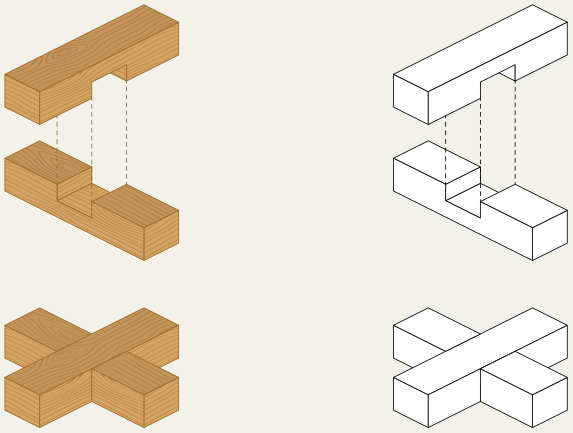
b. If the trim cut to an angle of 57° does not fit the table shown, what angle measure should the carpenter cut the angle of the trim, $\angle T$, so that it fits with no gaps?

2 Step Into the Career: Vertical Angles Theorem

A carpenter is building a shelving unit with additional support on each side provided by two boards that are connected with edge cross lap joints, as shown.

What is the measure of $\angle T$ that the carpenter should cut the notch in the board?





In edge cross lap joints, matching notches are cut in the two boards so that they fit together snugly.

Devise a Plan

Step 1: Model the two boards with a pair of intersecting lines.

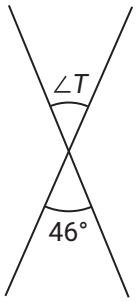
Step 2: Identify the type of angles formed by the 46° angle and $\angle T$.

Step 3: Identify the relationship between the 46° angle and $\angle T$.

Step 4: Find the measure of $\angle T$.

Walk Through the Solution

Step 1: Model the two boards with a pair of intersecting lines as shown.



Step 2: The 46° angle and $\angle T$ are opposite angles formed by intersecting lines. They are vertical angles.

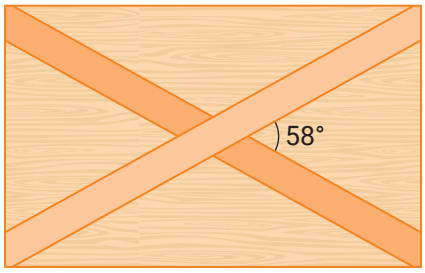
Step 3: By the Vertical Angles Theorem, vertical angles formed by intersecting lines are congruent.

Step 4: Since $\angle T$ and the 46° angle are congruent angles, $m\angle T = 46°$ by the definition of congruent angles.

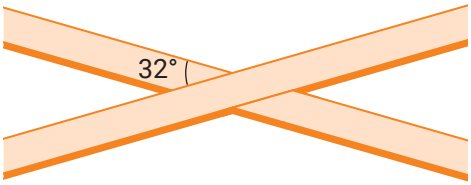
The carpenter should cut the notch with a 46° angle.

On the Job: Apply The Vertical Angles Theorem

2. A carpenter's apprentice has cut notches into several boards for edge cross lap joints to go on the sides of the box shown.



a. If the apprentice cut the boards using the angle shown at the right, do the boards work for the box?

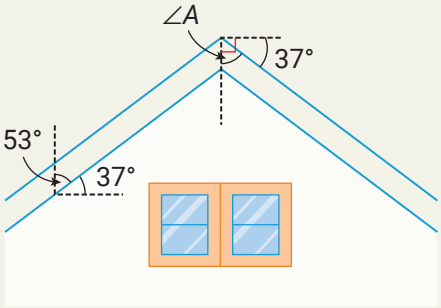


b. If the boards that the apprentice cut do not fit on sides of the box, what angle measure should have been used for the notches?

c. Can you identify the error that the apprentice made when calculating the angle that should be used?

3 Step Into the Career: Congruent Complements Theorem

A carpenter is framing the roof of a house where the pitch of the roof is 37°, as shown. What angle measure should be used for $\angle A$?



Devise a Plan

There are two 37° angles, a 53° angle, and $\angle A$ involved.

Step 1: Identify the relationship between the 37° angle and the 53° angle.

Step 2: Identify the relationship between the 37° angle and $\angle A$.

Step 3: Identify the relationship between the 53° angle and $\angle A$.

Step 4: Find $m\angle A$.

Walk Through the Solution

Step 1: Since 37 + 53 = 90, the 37° angle and the 53° angle form a right angle. They are complementary angles.

Step 2: The diagram shows that $\angle A$ and the 37° angle form a right angle, so they are complementary angles.

Step 3: From Steps 1 and 2, $\angle A$ and the 53° angle are both complements of 37° angles. By the Congruent Complements Theorem, two angles that are complements of the same angle (or congruent angles) are congruent.

Step 4: Since $\angle A$ is congruent to the 53° angle, $m\angle A$ is 53°.

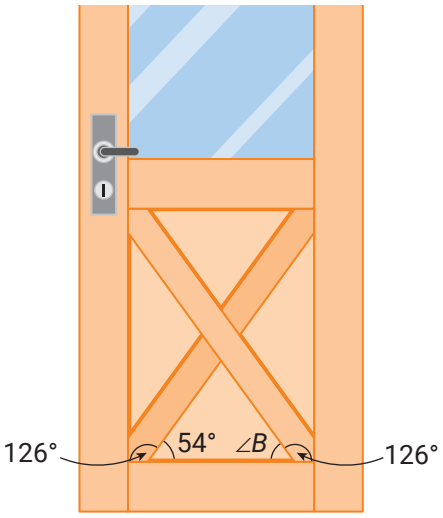
On the Job: Apply The Congruent Supplements Theorem

3. A carpenter is repairing a wooden door and needs to replace a triangular panel. What angle measure should be used for $\angle B$?

a. What is the relationship between a 54° angle and a 126° angle?

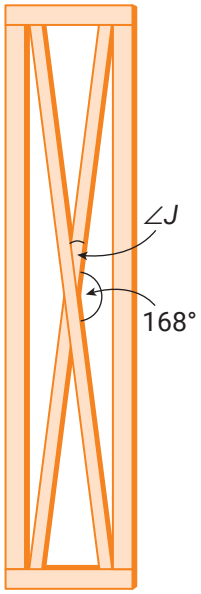
b. What is the relationship between $\angle B$ and the adjacent 126° angle?

c. What is $m\angle B$?



Career Spotlight: Practice

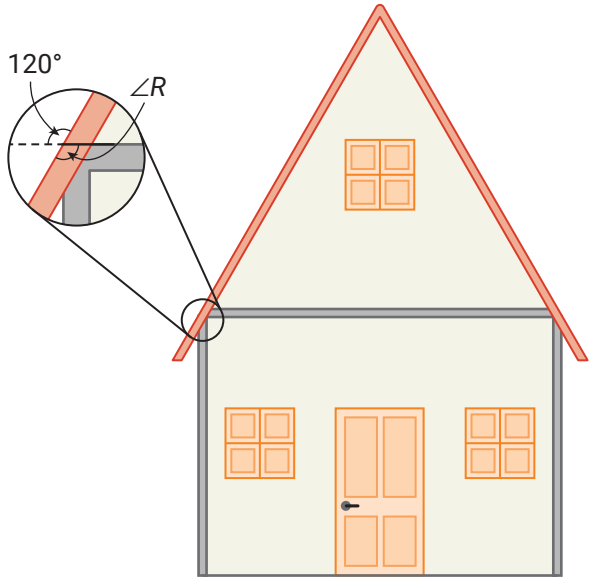
4. A carpenter is using an edge cross lap joint to create an X-shaped brace for the side of a bookcase. What angle measure should the carpenter use for $\angle J$ so that the boards fit together with no gaps?



5. A carpenter needs rafter ties to frame a very steep roof. The outside line of the roof makes a 120° angle with a horizontal line. What is the measure of $\angle R$?

QUICK TIP

Rafter ties are horizontal pieces that connect two sides of a roof.



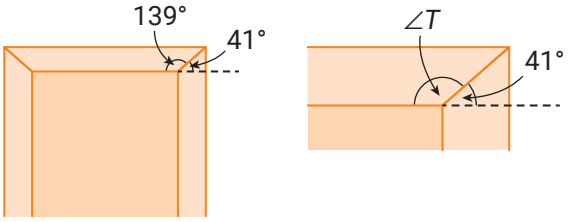
Devise a Plan

Step 1: Determine the relationship between the 120° angle and $\angle R$.

Step 2: _____?_____.

Step 3: _____?_____.

6. A carpenter needs to replace the trim above a doorway where the top trim and the side trim are different widths. The angles measured are shown.



a. What is the relationship between the 139° angle and the 41° angle shown on the left?

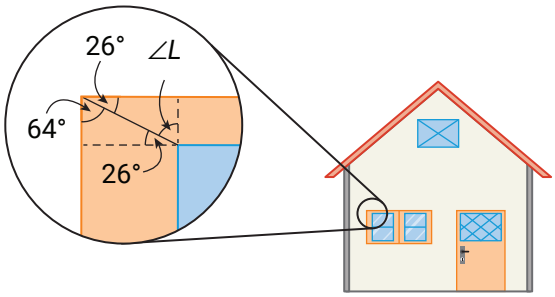
b. What is the relationship between the 41° angle and $\angle T$ shown on the right?

c. What relationship can you find between the 139° angle and $\angle T$?

d. What is $m\angle T$?

Career Spotlight: Check

7. A carpenter is working on a house. For the shutters on the lower window, the side frame needs to be wider than the top frame so that the shutters can be supported by the side frame.



Select the answer from each box that makes the sentence true.

The 26° angle and the 64° angle are

a. supplementary angles
b. complementary angles
c. a linear pair

. ∠*L* and the 26° angle are

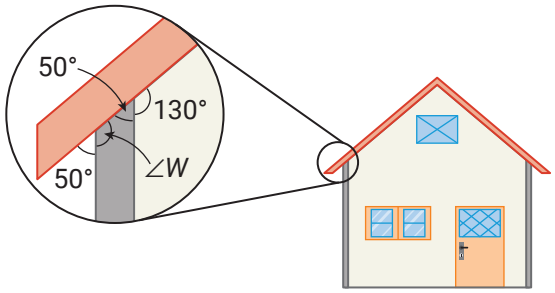
a. supplementary angles
b. complementary angles
c. a linear pair

. The measure of ∠*L* is

a. 26°
b. 64°
c. 116°

.

8. A carpenter is working on a house. The roof and the outer walls meet to form several angles.



What is $m\angle W$, and what theorem could you use to determine this?

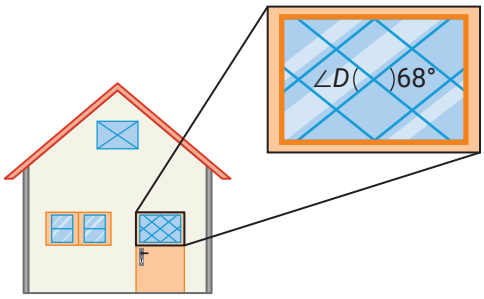
A. $m\angle W = 50°$, Congruent Supplements Theorem

B. $m\angle W = 130°$, Congruent Complements Theorem

C. $m\angle W = 50°$, Congruent Complements Theorem

D. $m\angle W = 130°$, Congruent Supplements Theorem

9. A carpenter is working on a house. The window in the door features framing that creates many angles.



Select all the statements that are true.

a. $m\angle D = 112°$

b. $\angle D$ and the angle labeled 68° are supplementary angles.

c. $m\angle D = 68°$

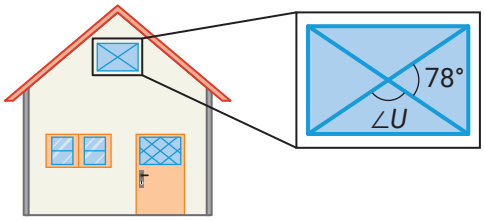
d. $\angle D$ and the angle labeled 68° are complementary angles.

e. $\angle D$ and the angle labeled 68° are vertical angles.

f. $m\angle D = 22°$

g. $\angle D$ and the angle labeled 68° are a linear pair of angles.

10. A carpenter is working on a house. The upper window has a frame that creates angles.



Select all the statements that are true.

a. $m\angle U = 102°$

b. $\angle U$ and the angle labeled 78° are supplementary angles.

c. $m\angle U = 78°$

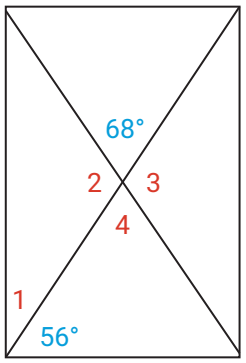
d. $\angle U$ and the angle labeled 78° are complementary angles.

e. $\angle U$ and the angle labeled 78° are vertical angles.

f. $m\angle U = 12°$

g. $\angle U$ and the angle labeled 78° are a linear pair of angles.

11. A carpenter is building a door with an X panel like the one shown. The panel is modeled by the diagram. The panel is a rectangle, so the corners are right angles. Use the diagram to find the measures of the numbered angles.



Match each angle with the correct angle measure.

	34°	56°	68°	112°
∠1	☐	☐	☐	☐
∠2	☐	☐	☐	☐
∠3	☐	☐	☐	☐
∠4	☐	☐	☐	☐

PATHWAY 2 CAREERS

P2C Math: Algebra II

Table of Contents & Pacing

Total # of Days 126-212

		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
1. Expressions and Equations							3-6
S	A2a-1.1	Solving Equations in One Variable	Exploration	A-CED.A.1, A-REI.A.1, A-REI.B.3	1, 6, 7, 8	Multiple	1
S	A2a-1.2	Isolating a Variable	Exploration	A-SSE.A.1.b, A-CED.A.4, A-REI.A.1	2, 3, 4	Multiple	1
S	A2a-1.3	Writing Equations	Exploration	A-CED.A.1, A-CED.A.2, A-REI.A.1, A-REI.B.3	1, 4, 5, 7	Multiple	1
S	A2a-1.4	Absolute Value	Exploration	A-CED.A.1	1, 4, 5, 8	Multiple	1
S	A2a-1.5	Applying Absolute Value	Application	A-CED.A.1, A-CED.A.2, A-CED.A.3, F-BF.A.1.a	1, 5, 7	Instructional Coordinators	1-2
	A2a-1.6	Exponents and Radicals	Exploration	N-RN.A.1, N-RN.A.2, N-CN.A.2, N-CN.B.5	1, 2, 7, 8	Multiple	1-2
	A2a-1.7	Applying Exponents and Radicals	Application	N-RN.A.1, N-RN.A.2	2, 5, 6	Environmental Scientists and Specialists	1-2
	A2a-1.8	Scientific Notation	Exploration	N-RN.A.1	1, 4, 7, 8	Multiple	1-2
2. Linear Functions and Graphs							4-6
	A2a-2.1	Function Notation	Exploration	F-IF.A.1, F-IF.A.2, F-BF.B.4.c	1, 3, 6, 7	Multiple	1-2
	A2a-2.2	Functions, Relations, and Inverses	Exploration	F-IF.A.1, F-IF.A.2, F-IF.B.4, F-IF.B.5, F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.d, F-LE.B.5	1, 7, 8	Multiple	1
S	A2a-2.3	Slope, Intercepts, and Linear Graphs	Exploration	A-CED.A.2, A-REI.D.10, F-IF.B.4, F-IF.B.6, F-LE.B.5	4, 6, 7	Multiple	1
S	A2a-2.4	Applying Slope, Intercepts, and Linear Graphs	Application	A-CED.A.2, A-REI.D.10, F-IF.A.2, F-IF.B.4, F-IF.B.5, F-IF.B.6, F-IF.C.7.a, F-LE.B.5	1, 2, 7	Secondary School Teachers	1-2
S	A2a-2.5	Writing Linear Equations	Exploration	A-CED.A.2, F-LE.A.2, F-LE.B.5	4, 6, 7	Multiple	1
S	A2a-2.6	Applying Writing Linear Equations	Application	A-CED.A.2, A-CED.A.3, F-IF.B.6, F-LE.A.2, F-LE.B.5	1, 2, 4	Civil Engineering Technicians	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
S	A2a-2.7	Parallel & Perpendicular Lines	Exploration	A-CED.A.2, F-IF.B.4, F-LE.A.2, F-LE.B.5, G-GPE.B.5	1, 6, 8	Multiple	1
S	A2a-2.8	Applying Parallel & Perpendicular Lines	Application	A-CED.A.2, A-CED.A.3, F-IF.B.4, F-IF.C.7.a, F-BF.A.1.a, F-LE.A.2, F-LE.B.5, G-GPE.B.5	1, 2, 5	Producers	1-2
	A2a-2.9	Inequalities and Their Graphs	Exploration	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.D.10, F-IF.B.4	3, 4, 7, 8	Multiple	1-2
	A2a-2.10	Compound Inequalities	Exploration	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.A.1	6, 7, 8	Multiple	1
3. Linear Systems of Equations							**5-9**
S	A2a-3.1	Solving Linear Systems of Two Equations	Exploration	A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.C.5, A-REI.C.6, A-REI.D.10, A-REI.D.11, F-IF.B.4, F-IF.C.7.a, F-LE.A.2	1, 5, 6	Multiple	1
	A2a-3.2	Solving Linear Systems of Three Equations	Exploration	A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.C.5, A-REI.C.6, A-REI.D.11, F-LE.A.2	1, 4, 8	Multiple	1-2
	A2a-3.3	Applying Solving Linear Systems of Three Equations	Application	A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.C.6, F-BF.A.1.a, F-LE.A.2	1, 2, 5	Information Security Analysts	1-2
	A2a-3.4	Using Systems of Linear Equations	Exploration	A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.C.6, F-IF.B.4, F-IF.C.7.a, F-BF.A.1.a, F-LE.A.2	1, 4, 6	Multiple	1
	A2a-3.5	Systems of Two Linear Inequalities	Exploration	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.D.10, A-REI.D.12, F-IF.B.4, F-IF.C.7.a, F-LE.A.2	1, 4, 5	Multiple	1-2
	A2a-3.6	Applying Systems of Two Linear Inequalities	Application	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.D.10, A-REI.D.12, F-IF.B.4, F-IF.C.7.a, F-BF.A.1.a	1, 4, 5	Interior Designers	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
E	A2a-3.7	Using Systems of Inequalities to Find the Feasible Region	Application	A-CED.A.2, A-CED.A.3, A-REI.D.10, A-REI.D.12, F-IF.B.4, F-IF.C.7.a, F-BF.A.1.a	1, 2, 4	Computer Network Specialists	2-3
4. MATRICES							**7-14**
	A2a-4.1	Matrices and Systems of Equations	Exploration	N-VM.C.6, A-CED.A.2, A-CED.A.3, A-REI.A.1, A-REI.C.8	1, 3, 4	Multiple	1-2
	A2a-4.2	Matrix Operations	Exploration	N-VM.C.7, N-VM.C.8, N-VM.C.10	1, 2, 4, 7	Multiple	1-2
	A2a-4.3	Matrix Multiplication	Exploration	N-VM.C.8, N-VM.C.9, N-VM.C.10, N-VM.C.11	1, 4, 5	Multiple	1-2
	A2a-4.4	Applying Matrix Multiplication	Application	N-VM.C.8, N-VM.C.9, N-VM.C.10, N-VM.C.11	1, 2, 7	Bioinformatics Scientists	1-2
	A2a-4.5	Determinants and Cramer's Rule	Exploration	N-VM.C.12	1, 4, 5	Multiple	1-2
	A2a-4.6	Inverse Matrices	Exploration	N-VM.C.8, N-VM.C.9, N-VM.C.10, N-VM.C.11, A-REI.C.9	1, 3, 4, 7	Multiple	1-2
	A2a-4.7	Applying Inverse Matrices	Application	N-VM.C.12, A-REI.C.9	1, 2, 5	Aircraft Mechanics and Service Technicians	1-2
P	A2a-4-P	Vector & Matrix Quantities	Project (Information Technology)	N-VM.B.5.a, N-VM.B.5.b, N-VM.C.6, N-VM.C.7, N-VM.C.8, N-VM.C.9, N-VM.C.10, N-VM.C.11, A-CED.A.3, A-REI.C.8, A-REI.C.9	3, 5, 7, 8	Web Administrators	3-6
5. QUADRATIC FUNCTIONS							**11-17**
	A2a-5.1	Graphing in Vertex Form	Exploration	A-SSE.A.1.a, A-SSE.A.1.b, A-SSE.B.3.b, A-CED.A.2, A-REI.B.4.a, F-IF.B.4, F-IF.C.7.a	3, 7, 8	Multiple	1
	A2a-5.2	Graphing in Standard Form	Exploration	A-SSE.A.1.a, A-SSE.A.1.b, F-IF.B.4, F-BF.B.3	2, 6, 7, 8	Multiple	1-2
	A2a-5.3	Applying Graphing in Standard Form	Application	A-SSE.B.3.a, A-SSE.B.3.b, A-CED.A.2, F-IF.C.7.a, F-BF.B.3	2, 4, 5	Tool and Die Makers	1-2

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A2a-5.4	Finding Zeros Using the Quadratic Formula	Exploration	A-APR.B.3, A-REI.B.4.b, F-IF.C.7.a	1, 7, 8	Multiple	1-2
A2a-5.5	Applying Properties of Quadratics	Application	A-SSE.B.3.b, A-APR.B.3, A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.B.4.a, A-REI.B.4.b, F-IF.C.7.a, F-BF.A.1.a	2, 4, 5	Structural Iron and Steel Workers	1-2
A2a-5.6	Solving Quadratic Functions by Factoring	Exploration	A-SSE.A.2, A-SSE.B.3.a, A-REI.A.1, A-REI.B.4.b, F-IF.C.8.a	2, 7	Multiple	1-2
A2a-5.7	Solving Quadratic Functions Using Square Roots	Exploration	N-CN.C.7, N-CN.C.9, A-REI.A.1, A-REI.B.4.b, F-IF.C.8.a	1, 6, 7	Multiple	1-2
A2a-5.8	Applying Solving Quadratic Functions Using Square Roots	Application	N-CN.C.9, A-REI.B.4.b, F-IF.C.8.a	1, 4, 5	Airfield Operations Specialists	2
A2a-5.9	Solving Quadratic Inequalities in Two Variables	Application	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.C.7, A-REI.D.10, A-REI.D.12, F-IF.B.4, F-IF.C.7.a, F-BF.A.1.a, F-LE.A.2	1, 2, 4	Sales Managers	2
6. Absolute Value and Piecewise Functions						**7-13**
A2a-6.1	Graphing Absolute Value Functions	Exploration	F-BF.B.3	1, 4, 6, 7	Multiple	1
A2a-6.2	Composite Functions	Exploration	F-IF.A.2, F-BF.A.1.b, F-BF.A.1.c, F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.d	1, 4, 8	Multiple	1-2
A2a-6.3	Applying Composite Functions	Application	F-IF.A.2, F-BF.A.1.b, F-BF.A.1.c	2, 3, 5	Audio and Video Technicians	1-2
A2a-6.4	Graphing Absolute Value Inequalities	Exploration	F-IF.C.7.b	1, 4, 6, 7	Multiple	1-2
A2a-6.5	Applying Graphing Absolute Value Inequalities	Application	A-CED.A.1, A-CED.A.2, A-CED.A.3, A-REI.D.10, A-REI.D.12, F-IF.B.5, F-IF.C.7.b	4, 5, 6	Power Plant Operators	1-2
A2a-6.6	Piecewise Functions	Exploration	A-CED.A.2, A-REI.D.10, F-IF.A.2, F-IF.B.4, F-IF.C.7.b, F-BF.B.3	1, 4, 6, 7	Multiple	1-2

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
A2a-6.7	Applying Piecewise Functions	Application	A-CED.A.2, A-REI.D.10, F-IF.A.2, F-IF.B.4, F-IF.C.7.b, F-IF.C.9	1, 3, 4	Film and Video Editors	1-2
7. Polynomial Functions						**9-12**
A2a-7.1	Intro to Polynomials	Exploration	A-APR.A.1, A-CED.A.2, F-IF.B.4	4, 5, 6	Multiple	1
A2a-7.2	Long Division, the Factor Theorem, and the Remainder Theorem	Exploration	A-SSE.A.2, A-APR.B.2, A-APR.C.4, A-APR.D.6	4, 7, 8	Multiple	1-2
A2a-7.3	Synthetic Division	Exploration	A-APR.B.2, A-APR.D.6	7, 8	Multiple	1-2
A2a-7.4	Applying Polynomial Division	Application	A-SSE.A.2, A-APR.B.2, A-APR.D.6	5, 6, 7	Chemical Engineers	2
A2a-7.5	Solving Polynomial Equations by Factoring	Exploration	N-CN.C.7, N-CN.C.8, A-SSE.B.3.a, A-APR.B.2, A-APR.B.3, A-APR.C.4, A-REI.B.4.b	1, 2, 3, 5, 7	Multiple	1
A2a-7.6	Graphs of Polynomial Functions	Exploration	F-IF.C.7.c, F-BF.B.3	1, 3, 4, 5	Multiple	1-2
A2a-7.7	Applying Graphs of Polynomial Functions	Application	A-APR.A.1, A-APR.B.3, A-CED.A.2, A-CED.A.3, A-REI.D.10, F-IF.B.4, F-IF.C.7.c	1, 4, 5	Electrical Engineers	2
8. Radical Functions and Rational Exponents						**8-12**
A2a-8.1	Roots	Exploration	N-RN.A.1, N-RN.A.2	2, 6, 8	Multiple	1
A2a-8.2	Properties of Rational Exponents	Exploration	N-RN.A.1, N-RN.A.2	1, 2, 6, 8	Multiple	1-2
A2a-8.3	Composite Functions	Exploration	A-CED.A.2, A-CED.A.3, F-IF.A.2, F-BF.A.1.b, F-BF.A.1.c, F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.c, F-BF.B.4.d	2, 6, 8	Multiple	1-2
A2a-8.4	Applying Composite Functions	Application	A-CED.A.2, A-CED.A.3, F-IF.A.2, F-BF.A.1.a, F-BF.A.1.b, F-BF.A.1.c, F-BF.B.4.c	2, 7, 8	Materials Engineer	1-2
A2a-8.5	Graphing Radical Functions	Exploration	F-BF.B.3	2, 7, 8	Multiple	1

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A2a-8.6	Solving Radical Equations	Exploration	A-CED.A.2, A-CED.A.3, A-REI.A.2	1, 2	Multiple	1-2
	A2a-8.7	Applying Radical Functions	Application	A-CED.A.2, A-CED.A.3, A-REI.A.2, A-REI.D.10, F-IF.B.4, F-IF.C.7.b, F-BF.A.1.a, F-BF.B.3	1, 2, 4, 5, 7	Electrical and Electronics Drafters	2
9. Discrete Math and Combinatorics							**4-8**
S	A2a-9.1	Counting, Permutations, and Combinations	Exploration	S-CP.B.8, S-CP.B.9	1, 2, 5	Multiple	1
	A2a-9.2	Probability and Compound Probability	Exploration	S-CP.A.1, S-CP.A.2, S-CP.B.7, S-CP.B.8, S-CP.B.9, S-MD.A.3, S-MD.A.4	1, 5, 7	Multiple	1-2
	A2a-9.3	Discrete Probability	Exploration	S-MD.A.1, S-MD.A.2, S-MD.A.3, S-MD.A.4, S-MD.B.5.a, S-MD.B.5.b, S-MD.B.6	1, 2, 8	Multiple	1-2
	A2a-9.4	Applying Discrete Probability	Application	S-MD.A.1, S-MD.A.2, S-MD.A.3, S-MD.A.4, S-MD.B.5.a, S-MD.B.5.b, S-MD.B.6, S-MD.B.7	1, 4, 6	Heavy and Tractor-Trailor Truck Drivers	1-2
	A2a-9.5	The Binomial Theorem	Exploration	A-SSE.A.1.a, A-APR.A.1, A-APR.C.4, A-APR.C.5	2, 6, 7	Multiple	1-2
E	A2a-9.6	The Traveling Salesperson Problem	Exploration	S-CP.B.9	1, 2, 4, 7	Multiple	2-3
E	A2a-9.7	Optimal Solutions	Exploration	F-IF.B.4, F-IF.C.9, S-IC.B.6	1, 2, 4	Multiple	2
10. Data							**5-8**
S	A2a-10.1	Measures of Central Tendency	Exploration	S-ID.A.2, S-ID.A.3, S-IC.B.4	3, 5, 6, 7	Multiple	1
S	A2a-10.2	Measures of Variation	Exploration	S-ID.A.2, S-ID.A.3, S-ID.A.4, S-IC.B.4	5, 6, 7	Multiple	1
	A2a-10.3	The Normal Distribution	Exploration	S-ID.A.4, S-IC.A.1, S-IC.B.4	1, 3, 5, 8	Multiple	1-2
	A2a-10.4	Applying the Normal Distribution	Application	S-ID.A.4, S-IC.A.1, S-IC.B.4	1, 2, 4, 5, 6	Nurse Practitioners	2
	A2a-10.5	Randomness and Bias	Exploration	S-IC.A.1, S-IC.A.2, S-IC.B.3, S-MD.B.7	1, 3, 8	Multiple	1-2

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	Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
A2b-2.7	Applying Translating Conics	Application	F-BF.B.3, G-GPE.A.2, G-GPE.A.3	2, 4, 7	Museum Technicians and Conservators	1-2
3. Complex Numbers						**9-17**
A2b-3.1	Properties of Complex Numbers	Exploration	N-CN.A.2, N-CN.B.5	6, 7, 8	Multiple	1-2
A2b-3.2	Operations with Complex Numbers	Exploration	N-CN.A.1, N-CN.A.2, N-CN.A.3, N-CN.B.5	1, 3, 8	Multiple	1-2
A2b-3.3	Applying Operations with Complex Numbers	Application	N-CN.A.1, N-CN.A.2, N-CN.A.3, N-CN.B.5	2, 4, 6	Mathematicians	1-2
A2b-3.4	Completing the Square Using Complex Numbers	Exploration	N-CN.C.7, N-CN.C.8, N-CN.C.9, A-REI.B.4.b, F-IF.C.8.a	2, 6, 8	Multiple	1-2
A2b-3.5	Graphing in the Complex Plane	Exploration	N-CN.A.1, N-CN.B.4, N-CN.B.6	1, 2, 5	Multiple	1-2
A2b-3.6	Applying Moduli and Arguments	Application	N-CN.B.5, N-CN.B.6	1, 4, 6, 7	Electricians	1
A2b-3.7	Distance and Midpoint	Exploration	N-CN.B.4, N-CN.B.5, N-CN.B.6, G-GPE.B.6	2, 8	Multiple	1-2
A2b-3.8	Using Notation with Complex Numbers	Exploration	N-CN.A.2, N-CN.A.3, N-CN.B.5, N-CN.C.7	1, 6, 8	Multiple	1-2
A2b-3.9	Applying Using Notation with Complex Numbers	Application	N-CN.A.2, N-CN.A.3, N-CN.B.5	2, 4, 5	Electronics Engineers	1-2
4. Exponential and Logarithmic Functions						**10-16**
A2b-4.1	Exponential Growth and Decay	Exploration	A-CED.A.3, F-IF.C.7.e, F-IF.C.8.b, F-BF.B.4.a, F-LE.A.2, F-LE.A.4, F-LE.B.5	2, 4, 7	Multiple	1-2
A2b-4.2	Applying Exponential Growth and Decay	Application	A-CED.A.3, F-IF.C.7.e, F-IF.C.8.b, F-LE.A.2, F-LE.A.4, F-LE.B.5	1, 2, 4, 7	Microbiologists	1-2
A2b-4.3	The Number e	Exploration	F-IF.C.7.e, F-IF.C.8.b, F-LE.A.2, F-LE.A.4	2, 4, 7	Multiple	1-2
A2b-4.4	Logarithms	Exploration	F-LE.A.4	1, 2, 4, 6	Multiple	1-2
A2b-4.5	Properties of Logarithmic Functions	Exploration	F-BF.B.4.a, F-BF.B.5, F-LE.A.4	2, 4, 6, 8	Multiple	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A2b-4.6	Applying Properties of Logarithmic Functions	Application	F-IF.A.2, F-IF.C.7.e, F-BF.B.4.c, F-BF.B.5, F-LE.A.4	2, 4, 6	Obstetricians	2
	A2b-4.7	Solving Exponential and Logarithmic Equations	Exploration	A-SSE.B.3.c, A-REI.D.11, F-IF.C.8.b, F-BF.B.4.c	2, 4, 6	Multiple	1-2
	A2b-4.8	Applying Solving Exponential and Logarithmic Equations	Application	A-SSE.B.3.c, F-IF.A.2, F-IF.C.8.b, F-BF.B.5, F-LE.A.1.a, F-LE.A.1.c, F-LE.A.4	1, 2, 4, 6	Environmental Scientists and Specialists, Including Health	2
P	A2b-4-P	Building Functions	Project (Information Technology)	F-IF.A.2, F-BF.A.1.c, F-BF.B.4.a, F-BF.B.4.b, F-BF.B.4.c, F-BF.B.4.d, F-LE.A.1.b, F-LE.A.1.c, F-LE.A.3, F-LE.B.5	1, 2, 4, 6	Software Quality Assurance Analysts and Testers	3-6
5. TRIGONOMETRY							**8-15**
S	A2b-5.1	Sine, Cosine, and Tangent in Right Triangles	Exploration	F-TF.A.3, G-SRT.C.6, G-SRT.C.7, G-SRT.C.8	2, 4, 6, 7	Multiple	1
	A2b-5.2	Inverse Sine, Cosine, and Tangent in Right Triangles	Exploration	G-SRT.C.6, G-SRT.C.7, G-SRT.C.8	2, 4, 6, 7	Multiple	1
S	A2b-5.3	The Law of Sines and the Law of Cosines	Exploration	G-SRT.C.6, G-SRT.C.8, G-SRT.D.10, G-SRT.D.11	1, 6, 7, 8	Multiple	1-2
	A2b-5.4	Solving Triangles	Exploration	G-SRT.C.6, G-SRT.C.8, G-SRT.D.9, G-SRT.D.10, G-SRT.D.11	1, 2, 4, 5, 6	Multiple	1-2
	A2b-5.5	Applying Solving Triangles	Application	G-SRT.C.6, G-SRT.C.8	2, 4, 5	Machinists	1-2
	A2b-5.6	More Applying Solving Triangles	Application	G-SRT.C.6, G-SRT.C.8	1, 3, 5	Welders, Cutters, Solderers, and Brazers	1-2
	A2b-5.7	Radians	Exploration	F-TF.A.1, G-C.B.5	2, 6, 8	Multiple	1-2
	A2b-5.8	The Unit Circle	Exploration	F-TF.A.2, F-TF.A.3, F-TF.A.4	4, 5, 6, 8	Multiple	1-2
	A2b-5.9	Using the Unit Circle	Exploration	F-TF.A.2, F-TF.A.3, F-TF.A.4	4, 5, 7	Multiple	1-2
	A2b-5.10	Applying the Unit Circle	Application	F-TF.A.2, F-TF.A.3, F-TF.A.4	1, 2, 5	Web and Digital Interface Designers	1-2

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6. Vectors						**6-11**
A2b-6.1	Magnitude and Direction of Vectors	Exploration	N-VM.A.1, N-VM.A.2, N-VM.A.3	1, 3, 6, 7	Multiple	1
A2b-6.2	Applying Magnitude and Direction of Vectors	Application	N-VM.A.1, N-VM.A.2, N-VM.A.3	1, 4, 5	Traffic Technicians	1-2
A2b-6.3	Vector Components	Exploration	N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.4.a, N-VM.B.4.b, N-VM.B.4.c	4, 6, 7	Multiple	1-2
A2b-6.4	Operations with Vectors	Exploration	N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.4.a, N-VM.B.4.b, N-VM.B.4.c	1, 4, 5	Multiple	1-2
A2b-6.5	Scalars	Exploration	N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.5.a, N-VM.B.5.b, N-VM.C.11	2, 6, 7	Multiple	1-2
A2b-6.6	Applying Scalars	Application	N-VM.A.1, N-VM.A.2, N-VM.A.3, N-VM.B.5.a, N-VM.B.5.b	2, 4, 6	Logisticians	1-2
7. Trig Identities and Trig Equations						**7-12**
A2b-7.1	Intro to Trigonometric Identities	Exploration	F-TF.A.3, F-TF.C.8	1, 2, 8	Multiple	1-2
A2b-7.2	Sum and Difference Identities	Exploration	F-TF.C.9	1, 2, 8	Multiple	1-2
A2b-7.3	Angle Identities	Exploration	F-TF.A.3	1, 2, 4, 6	Multiple	1-2
A2b-7.4	Proof of the Identities	Exploration	F-TF.C.8, F-TF.C.9	3, 6, 8	Multiple	1-2
A2b-7.5	Trigonometric Equations	Exploration	F-IF.B.5, F-IF.C.7.e, F-TF.B.5, F-TF.B.6, F-TF.B.7	6, 8	Multiple	1-2
A2b-7.6	Applying Trigonometric Equations	Application	F-IF.C.7.e, F-TF.B.5, F-TF.B.6, F-TF.B.7	1, 2, 5	Diagnostic Medical Sonographers	2
8. Series and Sequences						**6-9**
A2b-8.1	Defining Series and Sequences	Exploration	A-SSE.B.4, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 2, 3, 6, 8	Multiple	1
A2b-8.2	Arithmetic Series and Sequences	Exploration	A-CED.A.2, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 2, 3, 5, 7	Multiple	1

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
	A2b-8.3	Applying Arithmetic Series and Sequences	Application	A-SSE.B.4, A-CED.A.3, F-IF.A.3, F-BF.A.1.a, F-BF.A.2, F-LE.A.2	1, 7, 8	Library Technicians	1-2
	A2b-8.4	Geometric Series and Sequences	Exploration	A-SSE.B.4, F-IF.A.3, F-BF.A.1.a, F-BF.A.2	1, 2, 4, 7	Multiple	1
	A2b-8.5	Applying Geometric Series and Sequences	Application	A-SSE.B.4, A-CED.A.3, F-IF.A.3, F-BF.A.1.a, F-BF.A.2	3, 7, 8	Agricultural Technicians	1-2
	A2b-8.6	Infinite Geometric Series	Exploration	A-SSE.B.4, F-IF.A.3, F-BF.A.1.a	1, 2, 3, 5, 7	Multiple	1-2
EXTENSION OPPORTUNITIES:							**17-34**
9. BINARY AND HEXADECIMAL NUMBERS							**4-8**
E	A2b-9.1	Binary Codes	Exploration	NCTM PS: Communication, Connections	1, 2, 4, 8	Multiple	1-2
E	A2b-9.2	Binary Numbers	Exploration	NCTM PS: Connections, Representation	1, 2, 4, 8	Multiple	1-2
E	A2b-9.3	Bits, Bytes, and Hexadecimal Numbers	Exploration	NCTM PS: Connections, Representation	1, 2, 4, 8	Multiple	1-2
E	A2b-9.4	Applying Bits, Bytes, and Hexadecimal Numbers	Application	NCTM PS: Connections, Representation	1, 2, 4, 8	Data Administrators	1-2
10. TOPOLOGY							**5-10**
E	A2b-10.1	Topology and Topological Equivalence	Exploration	NCTM PS: Reasoning and Proof, Communication	2, 4, 7	Multiple	1-2
E	A2b-10.2	Mobius Strips	Exploration	NCTM PS: Connections, Representation	7, 8	Multiple	1-2
E	A2b-10.3	Properties of a Torus	Exploration	NCTM PS: Reasoning and Proof, Communication	7, 8	Multiple	1-2
E	A2b-10.4	Topological Properties	Exploration	NCTM PS: Communication, Connections, Representation	2, 7, 8	Multiple	1-2
E	A2b-10.5	Applying Topological Properties	Application	NCTM PS: Communication, Connections, Representation	3, 7, 8	Industrial Machinery Mechanics	1-2

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		Title	Type	Standard(s)	Mathematical Practices	Career(s)	Number of Days
11. Logic							**8-16**
E	A2b-11.1	Critical Thinking	Exploration	NCTM PS: Problem Solving, Reasoning and Proof	1, 2, 3, 7, 8	Multiple	1-2
E	A2b-11.2	An Introduction to Election Theory	Application	NCTM PS: Problem Solving, Reasoning and Proof	3, 4, 6, 7	Public Relations Specialists	1-2
E	A2b-11.3	Applying Critical Thinking	Application	NCTM PS: Problem Solving, Reasoning and Proof	1, 3, 8	Educational, Guidance and Career Counselors and Advisors	1-2
E	A2b-11.4	Sudoku and the Art of Deduction	Exploration	NCTM PS: Problem Solving, Connections	1, 3, 7, 8	Multiple	1-2
E	A2b-11.5	Logic Puzzles-Applying Deduction	Exploration	NCTM PS: Problem Solving, Reasoning and Proof	1, 3, 7, 8	Multiple	1-2
E	A2b-11.6	Cryptography	Exploration	NCTM PS: Problem Solving, Representation	1, 5, 7, 8	Multiple	1-2
E	A2b-11.7	Applying Cryptography	Application	NCTM PS: Problem Solving, Representation	2, 7, 8	Natural Sciences Managers	1-2
E	A2b-11.8	RSA Encryption	Exploration	NCTM PS: Problem Solving, Representation	2, 4, 7, 8	Multiple	1-2

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P2C Math

Sample Lesson: Student Edition

LESSON 3.7

Using Systems of Inequalities to Find the Feasible Region

CAREER SPOTLIGHT: Computer Network Support Specialists

Occupation Description

Computer network support specialists analyze, troubleshoot, and evaluate computer network problems. They play an important role in the routine maintenance of their organization's networks, such as performing file backups on the network. Maintenance can be performed daily, weekly, or monthly and is important to an organization's disaster recovery efforts. Network support specialists may assist computer users through phone, email, or in-person visits. They often work under network and computer systems administrators, who handle more complex tasks.

Education

For computer network support specialists, many employers accept applicants with an associate's degree, although some prefer applicants to have a bachelor's degree.

Positions that are more technical are likely to require a degree in a field such as computer science, engineering, or information science, but for others, the applicant's field of study is less important.

Potential Employers

The largest employers of computer network support specialists are as follows:

Computer systems design and related services	19%
Telecommunications	11%
Finance and insurance	7%
Management of companies and enterprises	6%
Data processing, hosting, and related services	4%

Watch a video about computer network support specialists: https://cdn.careeronestop.org/OccVids/OccupationVideos/15-1151.00.mp4

Career Cluster
Information Technology

Career Pathway
Network Systems

Career Outlook

- Salary Projections:
  Low-End Salary, $40,620
  Median Salary, $65,450
  High-End Salary, $110,450
- Jobs in 2019: 195,100
- Job Projections for 2028: 207,700 (Increase of 6%)

Algebra II Concepts

- Write and solve systems of inequalities from real-world situations.
- Demonstrate how computer network specialists might apply systems of inequalities.

Is this a good career for me?
Computer network specialists typically do the following:

- Create electronic data backup to prevent loss of information.
- Implement security measures for computer or information systems.
- Resolve computer network problems.
- Configure computer networks.
- Install computer software.

Lesson Objective

In this lesson, you will learn about using systems of linear inequalities to find the feasible region for the solutions to problems.

- You will write and solve systems of inequalities from real-world situations.
- You will demonstrate how computer network specialists might apply systems of inequalities.
- You will find the feasible region where solutions to problems may be found.

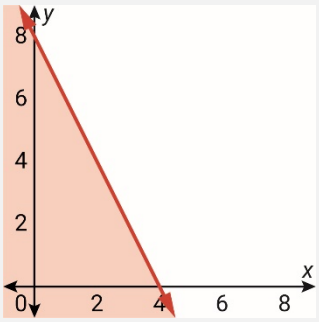
Systems of Linear Inequalities

A **system of linear inequalities** is a system of two or more linear inequalities in two variables. To solve a system of linear inequalities, graph each of the linear inequalities on the Cartesian Plane. The overlapping solution regions of the inequalities define the **feasible region**, or set of all ordered pairs for which all of the inequalities in the system are true.

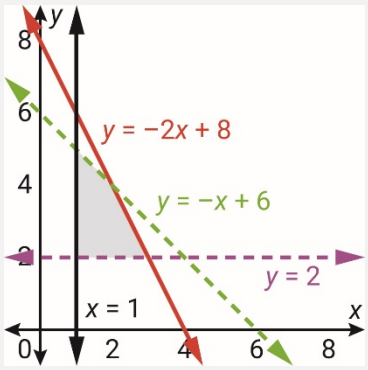
For example, consider the system of linear inequalities:

$$y \leq -2x + 8$$
$$y < -x + 6$$
$$x \geq 1$$
$$y > 2$$

To graph an inequality in two variables, begin by graphing its corresponding equation. Use a solid line for the ≤ or ≥ cases and a dashed line for the < or > cases. After graphing the line, shade the **half-plane** that corresponds to the solution region for that inequality. For the inequality $y \leq -2x + 8$, graph the solid line $y = -2x + 8$, then shade the half-plane below it.



Repeating this process for the other three inequalities results in the following graph. Only the feasible region is shaded to make the graph clearer.



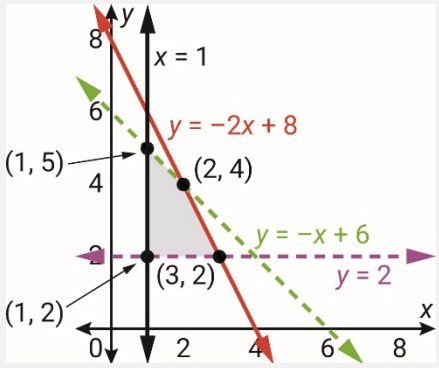
Many times, the boundary points of the feasible region are used to solve application problems. In order to find the coordinates of boundary points, set the equations equal to each other and solve.

$$\begin{aligned} -2x + 8 &= -x + 6 \\ 8 &= x + 6 \\ x &= 2 \end{aligned}$$

Substituting $x = 2$ into either equation results in the ordered pair (2, 4). For vertical or horizontal lines, substitute the known value into the second equation and solve. For instance, the boundary point of the lines $y = -2x + 8$ and $y = 2$ is:

$$\begin{aligned} -2x + 8 &= 2 \\ -2x &= -6 \\ x &= 3 \end{aligned}$$

This results in the boundary point at (3, 2). The other boundary points are labeled on the graph.



1 Step Into the Career: Applying Systems of Two Linear Inequalities

Regina is monitoring the bandwidth of a company's local computer network as part of her job as a computer network support specialist. Her company has tablets, x, and laptop computers, y, and a bandwidth maximum of 100 Megabits per second (Mbps).

During the day, the tablets require 4 Mbps and the laptops require 10 Mbps. At night, when software updates occur, the tablets require 8 Mbps and the laptops require 5 Mbps. In addition, the company has a maximum of 10 tablets and 8 laptops available.

Determine the system of linear inequalities that models this situation. Sketch this system of inequalities and sketch the feasible region of possibilities for the combinations of tablets and laptops that may be used at any one time.

Devise a Plan

Step 1: Define the system of linear inequalities that models the problem.

Step 2: Sketch the graph of the system of linear inequalities.

Step 3: Shade the feasible region of solution points for the system of inequalities.

Walk Through the Solution

Step 1: Given the definition of the x and y variables, the inequality describing the amount of bandwidth used during the day is:

$$4x + 10y \leq 100$$

The inequality describing the amount of bandwidth used during the night is:

$$8x + 5y \leq 100$$

The inequalities describing the number of tablets and laptops available are:

$$0 \leq x \leq 10$$

$$0 \leq y \leq 8$$

Notice, the variables each have a minimum value of 0 because a negative number of devices is not possible.

This completes the system of inequalities:

$$4x + 10y \leq 100$$

$$8x + 5y \leq 100$$

$$0 \leq x \leq 10$$

$$0 \leq y \leq 8$$

Step 2: Sketch the graphs of the inequalities. The first two inequalities are written in general form. So, you can use the x and y axes' intercepts. For example, when graphing the linear equation $4x + 10y = 100$, the intercepts may be found by setting each variable equal to 0.

y-intercept: $10y = 100$, therefore $y = 10$ and the y-intercept is (0, 10).

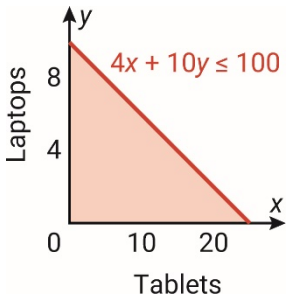
x-intercept: $4x = 100$, therefore $x = 25$ and the x-intercept is (25, 0).

The other option is to write each inequality in slope-intercept form by solving for y.

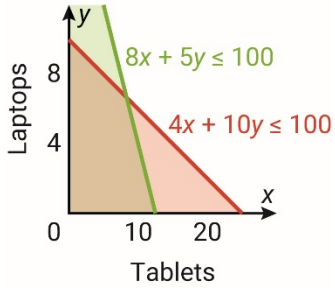
$$4x + 10y \leq 100$$

$$10y \leq -4x + 100$$

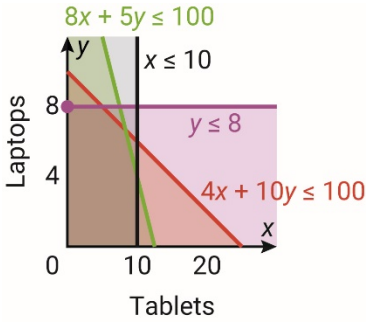
$$y \leq -0.4x + 10$$



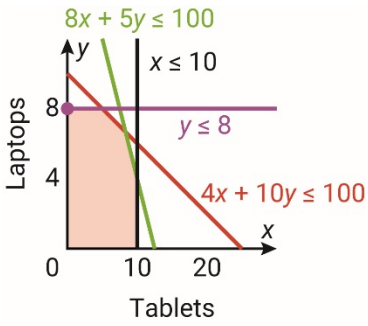
Next, graph the inequality $8x + 5y \leq 100$, which is equivalent to $y \leq -1.6x + 20$.



Sketch the graphs and shade the solution regions for the inequalities $0 \leq x \leq 8$ and $0 \leq y \leq 8$ as well. Only the regions in Quadrant I are shaded here because there will not be a negative number of tablets or laptops.



Step 3: Highlight the feasible region of the graph. This is the overlapping shaded region of the individual inequalities solution sets. Only the feasible region is shaded below.



Finally, the boundary points of the feasible region may be found by finding the appropriate intersection points of the lines. To find the intersection between the first two equations, solve the system of linear equations using the elimination method.

$$4x + 10y = 100$$

$$8x + 5y = 100$$

Multiply the first equation by 2. Then subtract the equations to eliminate the x-variable.

$$8x + 20y = 200$$

$$\underline{-\ (8x + 5y = 100)}$$

$$15y = 100$$

Solve for y, then back-substitute to find the value of x.

$$y = \frac{100}{15} = \frac{20}{3} \approx 6.67$$

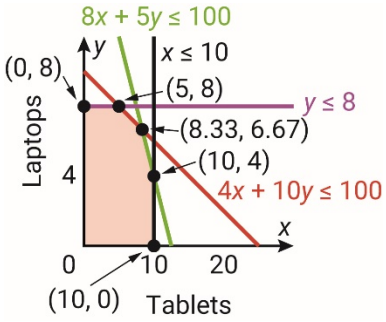
$$4x + 10\left(\frac{20}{3}\right) = 100$$

$$4x + \frac{200}{3} = \frac{300}{3}$$

$$4x = \frac{100}{3}$$

$$x = \frac{25}{3} \approx 8.33$$

The remainder of the boundary points are found by substituting the known values into the second equation. This results in five boundary points on the feasible region.



On the Job: Applying Systems of Two Linear Inequalities

1. Shasta, in her position as a computer network support specialist, is analyzing the bandwidth limitations for a client company. The client has tablets, x, and laptops, y, that use the internet bandwidth in the office.

   During the daytime, the company has a total of 71 Megabytes per second (Mbps) of available bandwidth. The tablets use 3 Mbps and the laptops 8 Mbps during this time.

   During the evening, the company leases additional bandwidth, to give them a total of 87 Mbps available. During this time, the tablets use 9 Mbps and the laptops use 6 Mbps as they upload information and receive updates.

   Write the system of linear inequalities that represents this problem. Sketch the system of inequalities and shade the feasible region. Label all boundary points of the feasible region. Remember, there cannot be a negative number of tablets or laptops.

2 Step Into the Career: Applying Systems of Two Linear Inequalities

Victor is helping configure the email server as part of his job as a computer network support specialist. A regular email has a maximum size of 30 megabytes (Mb). For this type of email, pictures have an average size of 4 Mb and data tables have an average size of 2 Mb. A multimedia email has a maximum size of 50 Mb. For this type of email, pictures have an average size of 5 Mb and data tables have an average size of 5 Mb.

Let *x* represent the number of pictures and *y* the number of data tables in each email. State the system of linear equations representing this problem. Graph the system, shade the feasible region, and identify the boundary points of the feasible region. Remember, the number of pictures and data tables in an email cannot be a negative number.

Devise a Plan

Step 1: Define the system of linear inequalities that models this problem.

Step 2: Graph the system of inequalities, shading the feasible region.

Step 3: Determine the boundary points of the feasible region.

Walk Through the Solution

Step 1: Given the definition of the x and y variables, the inequality for a regular email size is:

$$4x + 2y \leq 30$$

The inequality for a multimedia email is:

$$5x + 5y \leq 50$$

Since the number of pictures and data tables cannot be negative, the system of linear inequalities is:

$$4x + 2y \leq 30$$

$$5x + 5y \leq 50$$

$$x \geq 0$$

$$y \geq 0$$

In order to graph the system, the first two inequalities are written in slope-intercept form.

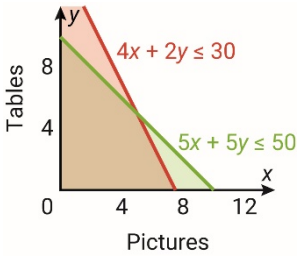
$$y \leq -2x + 15$$

$$y \leq -x + 10$$

$$x \geq 0$$

$$y \geq 0$$

Step 2: Graph the linear inequalities in quadrant I of the Cartesian plane.



Step 3: In order to find the boundary point of the first two inequalities, solve the resulting linear system. When the equations of the boundary lines are in slope-intercept form, the system may be solved by substitution.

$$y = -2x + 15$$

$$y = -x + 10$$

$$-2x + 15 = -x + 10$$

$$15 = x + 10$$

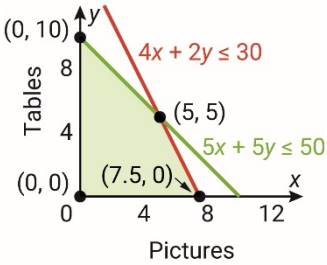
$$x = 5$$

Substitute $x = 5$ into one of the first two equations for the boundary lines:

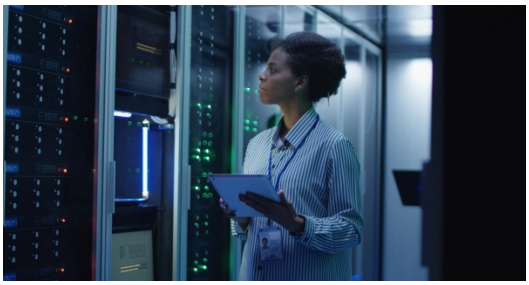
$$y = -5 + 10 = 5$$

The boundary point is (5, 5).

The remainder of the boundary points are found as *x* or *y* intercepts of the boundary lines. This results in the points (0, 10) and (7.5, 0).



On the Job: Applying Systems of Two Linear Inequalities



2. Joshua is managing the message limits for his company's email server as part of his job as a computer network support specialist. The messages being sent include audio attachments, x, and video attachments, y.

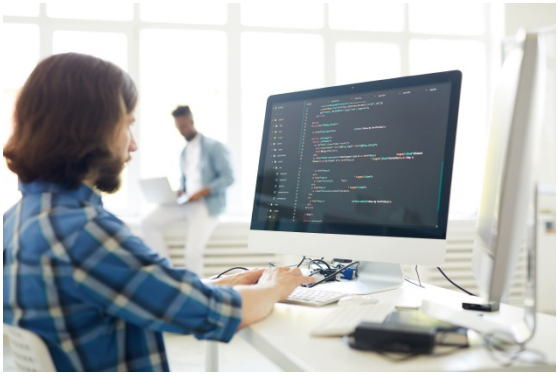
A regular email message has a size limit of 60 megabytes (Mb). An average audio attachment for a regular message is 7 Mb and an average video attachment is 6 Mb.

A zipped email message has a size limit of 27 Mb. An average zipped audio attachment is 4 Mb and an average zipped video attachment is 1 Mb.

Define the system of linear inequalities describing this problem. Sketch the graph of the system. Shade the feasible region and identify its boundary points.

Career Spotlight: Practice

3. Christian is analyzing the bandwidth usage of his network as part of his job as a computer network support specialist. He finds laptop computers use 6 megabytes per second (Mbps) and desktop computers use 4 Mbps. The bandwidth for the company is 120 Mbps.



State the linear inequality that represents this problem, given *x* is the number of laptops and *y* is the number of desktops. Sketch the graph of the system of inequalities on the plane, knowing the number of each type of computer cannot be negative.

4. Haadiya is managing the email server at her company as a computer network support specialist. The emails have a maximum size limit of 48 megabytes (Mb). Photos have an average size of 3 Mb and videos have an average size of 4 Mb.

Given x is the number of photos and y is the number of videos, state the inequality representing this problem. Given that the number of photos and videos must be at least 0, sketch the graph of the system of inequalities.

5. Tamara, in her job as a computer network support specialist, is purchasing software for her company. Software x has a cost of $8 per copy, software y has a cost of $12 per copy, and Tamara has $120 in the budget to purchase software this month. In addition, she needs at least 3 copies of software *x* and no more than 6 copies of software *y*.

State the system of linear inequalities modeling this problem. Sketch the system, shading the feasible region and labeling its boundary points.

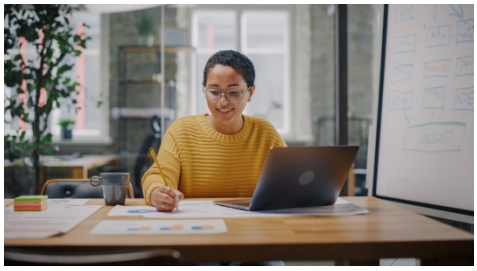
Devise a Plan

Step 1: Define the system of linear inequalities.

Step 2: ____?____

Step 3: ____?____

Step 4: ____?____



Career Spotlight: Check

6. Dara is trying to determine options for bandwidth usage at her office as its computer network support specialist. Provide her four points that are in the solution set to the following system of inequalities:

$$3x + 6y \leq 120$$

$$x > 5$$

$$y \geq 0$$

Point	Coordinates
P	
Q	
R	
S	

7. Nam is managing the cloud storage at his company as its computer network support technician. He determines that given *x* video and *y* audio files, the following system of inequalities reflects his company's current situation.

$$5x + 3y \leq 30$$

$$4x + 2y \leq 22$$

$$x \geq 0$$

$$y \geq 0$$

Select all the ordered pairs that are in the solution set to this system of inequalities.

a. (–1, 5)

b. (5, 4)

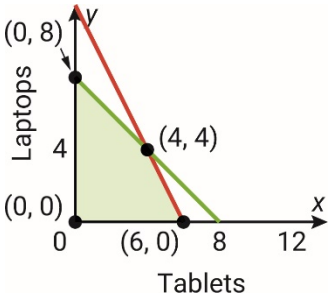
c. (3, 2)

d. (1, 7)

e. (0, 7)

f. (4, -1)

8. Sandra is analyzing the bandwidth usage of the tablets, x, and laptops, y, as part of her job as a computer network support technician. She is presented with the following graph that shows the possibilities given their current bandwidth.



State the system of equations represented by this graph.

9. Yaalini, in her position as a computer network support specialist, is analyzing the bandwidth limitations for a client company. The client has tablets, x, and laptops, y, that use the internet bandwidth in the office.

During the daytime, the company has a total of 84 Megabytes per second (Mbps) of available bandwidth. The tablets use 4 Mbps and the laptops 7 Mbps during this time.

During the evening, the company leases additional bandwidth, to give them a total of 100 Mbps. During this time, the tablets use 10 Mbps and the laptops use 5 Mbps as they upload information and receive updates.

Given that the number of tablets and laptops cannot be negative, select all the inequalities that make this system.

a. $y > 0$

b. $x \geq 0$

c. $10x + 5y \leq 100$

d. $4x + 7y \leq 84$

e. $7x + 4y \leq 100$

f. $5x + 10y \leq 100$

g. $y \geq 0$

10. Samuel, in his job as a computer network support specialist, is purchasing software for his company. Software *x* has a cost of $12 per copy, software *y* has a cost of $10 per copy, and Samuel has $240 in the budget to purchase software this month. In addition, he needs at least 3 copies of software *x* and no more than 18 copies of software *y*.

Select all the following that are boundary points of the feasible region of this system of linear inequalities.

a. (0, 24)

b. (20, 0)

c. (3, 18)

d. (0, 18)

e. (10, 12)

f. (5, 18)

g. (3, 0)