Engaging Mathematics, Volume II: Algebra I

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Teacher Edition

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Region 4 Education Service Center supports student achievement by providing educational products and services that focus on excellence in service for children.

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What is *Engaging Mathematics, Volume II: Algebra I*

1 An instructional resource featuring over 100 Texas Essential Knowledge and Skills (TEKS)-based, classroom-ready mathematics activities that each take approximately 10 to 15 minutes to complete.

2 A TEKS-based resource that addresses all algebra I mathematics TEKS and provides—

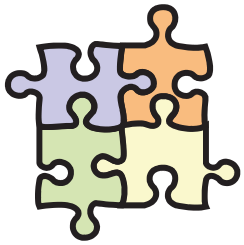
- Rigorous problem-solving tasks
- Manipulative-based tasks
- Vocabulary development tasks
- Sorting and classifying tasks

3 A resource that supports high-quality, research-based instruction by providing activities that can be used for various purposes, including—

- Engaging warm-ups and opening tasks that draw students into relevant and challenging mathematics
- Instructional support for all students, from at-risk to gifted and talented, to help learners articulate, refine, and retain important mathematical concepts, processes, and skills
- Short-cycle, formative assessments that provide immediate and ongoing feedback to guide instruction for the teacher and learning for the student
- Supplemental tasks to support intervention strategies

4 A resource that incorporates the mathematics process standards by promoting—

- Reasoning, generalizing, and problem solving in mathematical and real-world contexts
- Modeling, using tools, and connecting representations
- Analysis
- Communication

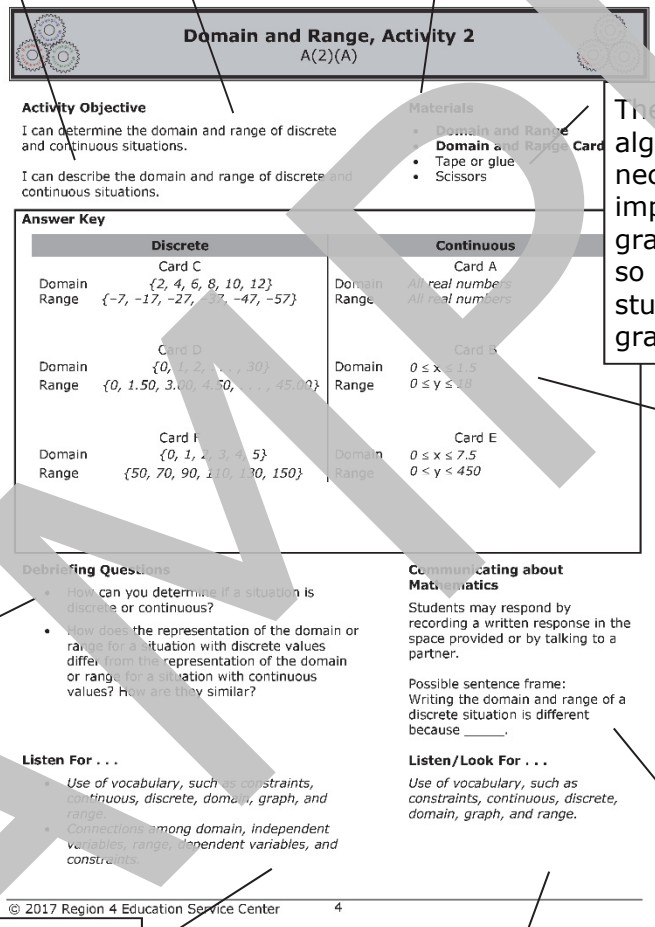


What is found in an Engaging Mathematics TEKS-based activity?

TEKS have been phrased in student-friendly language so that students may gauge their learning.

Common classroom materials are used for ease of preparation. Materials are listed 1-per-student unless otherwise noted. Page titles for student handouts are bolded.

ELPS have been included in the form of a student-friendly language objective.



Domain and Range, Activity 2
A(2)(A)

Activity Objective

I can determine the domain and range of discrete and continuous situations.

I can describe the domain and range of discrete and continuous situations.

Materials

- Domain and Range
- **Domain and Range Card**
- Tape or glue
- Scissors

Answer Key

	Discrete	Continuous
	Card C	Card A
Domain	{2, 4, 6, 8, 10, 12}	All real numbers
Range	{−7, −17, −27, −37, −47, −57}	All real numbers
	Card D	Card B
Domain	{0, 1, 2, 3, ..., 30}	$0 \le x \le 1.5$
Range	{0, 1.50, 3.00, 4.50, ..., 45.00}	$0 \le y \le 18$
	Card F	Card E
Domain	{0, 1, 2, 3, 4, 5}	$0 \le x \le 7.5$
Range	{50, 70, 90, 110, 130, 150}	$0 < y < 450$

Debriefing Questions

- How can you determine if a situation is discrete or continuous?
- How does the representation of the domain or range for a situation with discrete values differ from the representation of the domain or range for a situation with continuous values? How are they similar?

Communicating about Mathematics

Students may respond by recording a written response in the space provided or by talking to a partner.

Possible sentence frame:
Writing the domain and range of a discrete situation is different because _____.

Listen For . . .

- *Use of vocabulary, such as constraints, continuous, discrete, domain, graph, and range.*
- *Connections among domain, independent variables, range, dependent variables, and constraints.*

Listen/Look For . . .

Use of vocabulary, such as constraints, continuous, discrete, domain, graph, and range.

The emphasis on algebra readiness skills necessitates the implementation of graphing calculators, so it is assumed all student have access to graphing calculators.

An answer key is included for each activity.

Debriefing questions are included to assist the teacher with facilitating a post-activity student discussion.

Each activity includes an opportunity for students to articulate and summarize their own learning.
A sentence frame is provided for students who may need language support.

Key learning outcomes from the debriefing discussion are summarized here.

Key learning outcomes from the Communicating about Mathematics section are included here.

Texas Essential Knowledge and Skills (TEKS) Alignment Chart

Linear Functions, Equations, and Inequalities

Linear Functions, Equations, and Inequalities

Quadratic Functions and Equations

Quadratic Functions and Equations

Exponential Functions and Equations

Number and Algebraic Methods

Equations of Parallel and Perpendicular Lines, Activity 2 A(2)(E), A(2)(F)

Activity Objective

I can write the equation of a line that passes through a point and is parallel or perpendicular to a given line.

I can describe how to write the equations for a pair of perpendicular lines.

Materials

- **Equations of Parallel and Perpendicular Lines**

Answer Key

	Partner A	Partner B
1.	Write the equation of the line perpendicular to $5y + 3x = 1$ that passes through the point $(2, -3)$ in point-slope form. $y + 3 = \frac{5}{3}(x - 2)$	Write the equation of the line perpendicular to $2y = 3x + 4$ that passes through the point $(6, 0)$ in point-slope form. $y = -\frac{2}{3}(x - 6)$
2.	Write the equation of the line perpendicular to $x = 4y + 1$ that passes through the point $(-2, 2)$ in standard form. $4x + y = -6$	Write the equation of the line perpendicular to $x = 2y$ that passes through the point $(4, -2)$ in standard form. $2x + y = 6$
3.	Write the equation of the line parallel to $3x = -y$ that passes through $\left(-\frac{2}{3}, 7\right)$ in slope-intercept form. $y = -3x + 5$	Write the equation of the line parallel to $5x = y - 2$ that passes through $\left(-\frac{2}{5}, 9\right)$ in slope-intercept form. $y = 5x + 11$
4.	Write the equation of the line perpendicular to $3x + 2y = 6$ that passes through the point $(-1, 1.5)$ in point-slope form. $y - 1.5 = \frac{2}{3}(x + 1)$	Write the equation of the line perpendicular to $5x - 2y = 10$ that passes through the point $(-2.5, -5)$ in point-slope form. $y + 5 = -\frac{2}{5}(x + 2.5)$

Debriefing Questions

- How can you use other representations to verify that the equation of the line is perpendicular to the given line?
- When given a line and a point, how does determining the equation of a perpendicular line compare to determining the equation of a parallel line?

Listen For . . .

- *Use of vocabulary, such as negative reciprocal, perpendicular, point-slope form, slope, and y-intercept.*
- *Connections between the equations of parallel lines and the equations of perpendicular lines.*
- *Use of multiple representations to verify parallel lines and perpendicular lines.*

Communicating about Mathematics

Students may respond by recording a written response in the space provided or by talking to a partner.

Possible sentence frame:
To write the equations for a pair of perpendicular lines, I _____ .

Listen/Look For . . .

Understanding that the slopes of perpendicular lines must be negative reciprocals.

Student Name: _____ Date: _____

Equations of Parallel and Perpendicular Lines

- Determine who will be Partner A and who will be Partner B. Each partner should determine the equation of the line described in question 1 in the corresponding column.
- After you have finished, trade papers, and check your partner's work.
- Repeat the process for the remaining questions.

	Partner A	Partner B
1.	Write the equation of the line perpendicular to $5y + 3x = 1$ that passes through the point $(2, -3)$ in point-slope form.	Write the equation of the line perpendicular to $2y = 3x + 4$ that passes through the point $(6, 0)$ in point-slope form.
2.	Write the equation of the line perpendicular to $x = 4y + 1$ that passes through the point $(-2, 2)$ in standard form.	Write the equation of the line perpendicular to $x = 2y$ that passes through the point $(4, -2)$ in standard form.
3.	Write the equation of the line parallel to $3x = -y$ that passes through $\left(-\frac{2}{3}, 7\right)$ in slope-intercept form.	Write the equation of the line parallel to $5x = y - 2$ that passes through $\left(-\frac{2}{5}, 9\right)$ in slope-intercept form.
4.	Write the equation of the line perpendicular to $3x + 2y = 6$ that passes through the point $(-1, 1.5)$ in point-slope form.	Write the equation of the line perpendicular to $5x - 2y = 10$ that passes through the point $(-2.5, 5)$ in point-slope form.

Communicating about Mathematics

Describe the process you used to write the equations for a pair of perpendicular lines.

_____

_____

_____

_____

_____

_____

Domain and Range of Quadratic Functions, Activity 2 A(6)(A)

Activity Objective

I can determine the range of a quadratic function.

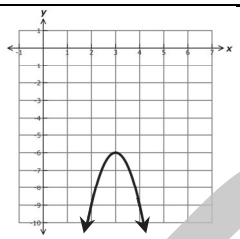
I can explain the connection between the vertex and the range of a quadratic function.

Materials

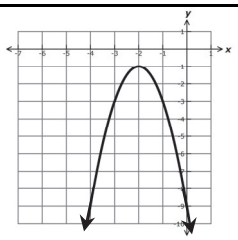
- **Range of a Quadratic Function: Odd One Out**

Answer Key

$g(x) = 2x^2 - 12x + 22$



The quadratic function with a vertex at (−3, −6) that passes through the point (0, −42).

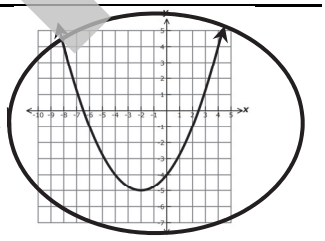


x	$f(x)$
−8	−13
−6	−1
−5	2
−4	3
−3	2
−2	−1

$g(x) = -5x^2 + 10x - 6$

The quadratic function with a minimum value at (8, −7) that passes through the point (4, −5).

$f(x) = \frac{1}{3}x^2 + 2x - 4$



Debriefing Questions

- How can you determine if the range has a maximum or minimum value?
- How could you verify if quadratic functions have the same range?
- How can you determine the vertex of a quadratic function written in standard form?

Listen For . . .

- *Use of vocabulary, such as domain, range, maximum, minimum, standard form, vertex, and vertex form.*
- *Use of representations to determine the range of a quadratic function.*

Communicating about Mathematics

Students may respond by recording a written response in the space provided or by talking to a partner.

Possible sentence frame:
The vertex of a quadratic function tells me _____.

Listen/Look For . . .

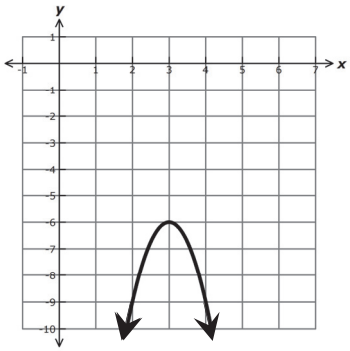
Understanding that the vertex, if a maximum, provides the maximum value of the range of the quadratic function. If the vertex is a minimum, it provides the minimum value of the range of the quadratic function.

Student Name: _____ Date: _____

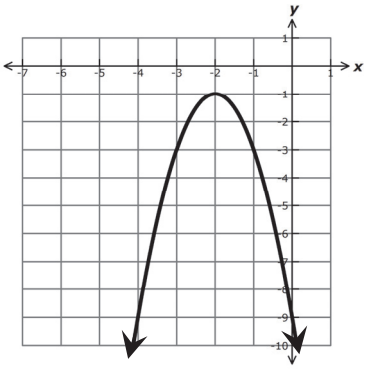
Range of a Quadratic Function: Odd One Out

Compare the ranges within each group of quadratic functions. Circle the "odd one out."

$g(x) = 2x^2 - 12x + 22$



The quadratic function with a vertex at (−3, −6) that passes through the point (0, −42).



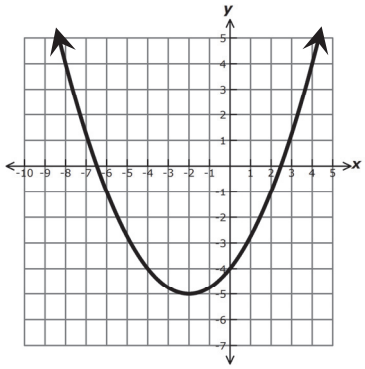
The table shows some ordered pairs that belong to a quadratic function, h.

x	$f(x)$
−8	−13
−6	−1
−5	2
−4	3
−3	2
−2	−1

$g(x) = -5x^2 + 10x - 6$

The quadratic function with a minimum value at (8, −7) that passes through the point (4, −5).

$f(x) = \frac{1}{3}x^2 + 2x - 4$



Communicating about Mathematics

What is the relationship between the vertex and the range of a quadratic function?

_____

_____

_____

_____

_____

_____