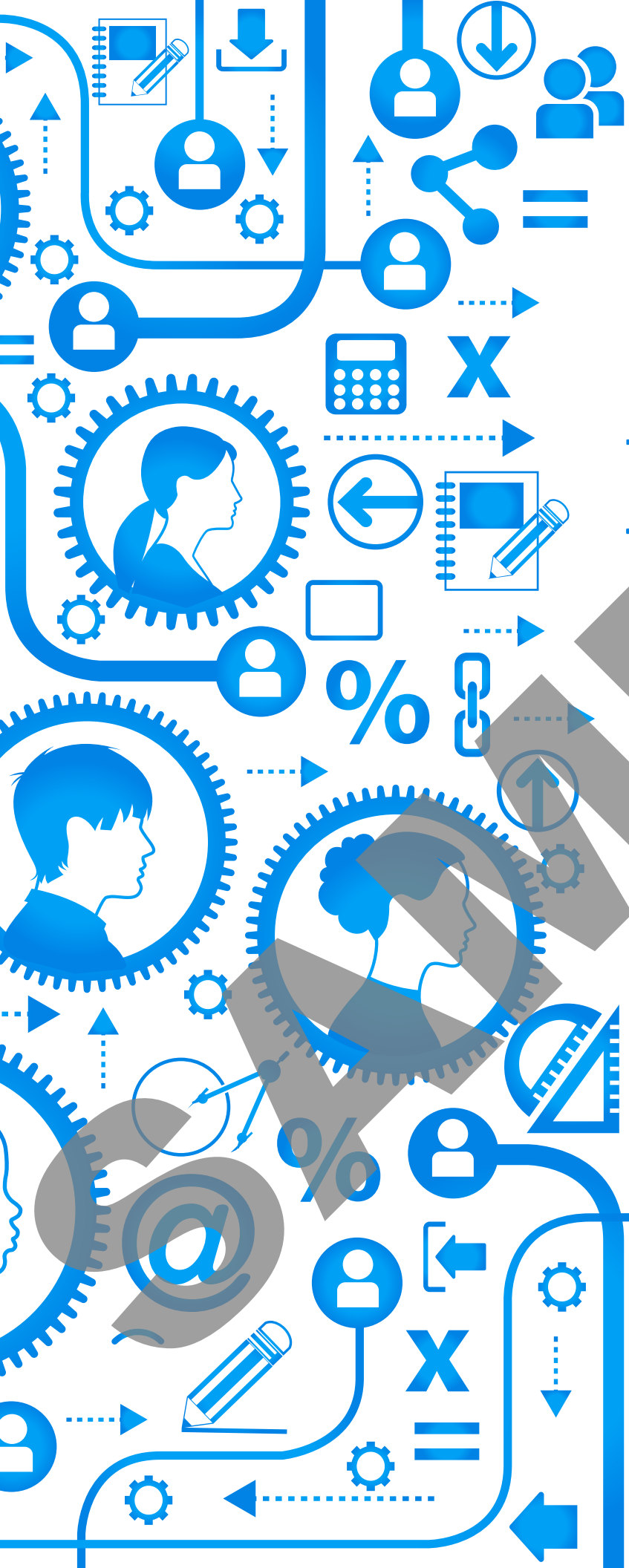

Engaging Mathematics,

Volume I: Algebra 2

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Engaging Mathematics, Volume I: Algebra II

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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Writing Team
Sana Brennan
Yvette Henry
Patti Nicodemo
Kim Seymour
Shelley Bolen-Abbott
Sharon Benson, Ed.D.

Design Team
Dave Martinez

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

1 An instructional resource featuring 77 Texas Essential Knowledge and Skills (TEKS)-based, classroom-ready mathematics activities that each take approximately 10 to 15 minutes to complete. We took the best activities of the original series, refreshed and revised them, and then added new activities where needed to create a collection of activities that can be used throughout the year.

2 A TEKS-based resource that addresses all of the Algebra II TEKS. *Engaging Mathematics, Volume I* complements teachers existing resources and provides—

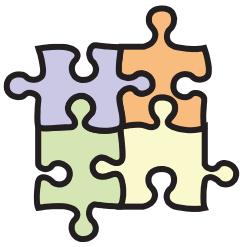
- Rigorous problem-solving tasks;
- Manipulative-based tasks;
- Vocabulary development tasks; and
- Sorting and classifying tasks.

3 A resource that supports high-quality, research-based practices 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 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; and
- Supplemental tasks to support intervention strategies.

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

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



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

Each activity addresses a specific student expectation that is reflected in the content objective.

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

Students should have continuous access to graphing technology.

Facilitation questions are provided for teacher use when supporting student thinking and discourse.

Attributes of Functions, Activity 2
2A(2)(A)

Activity Objective
The student will determine attributes of given functions.

Materials
- **Changing Graphs**

Facilitation Questions
- **What is an asymptote?**
  An asymptote is a vertical or horizontal line that the function values approach.
- **Which values correspond to the domain? the range?**
  The x-values correspond to the domain. The y-values correspond to the range.
- **How can you determine the minimum function value on a given interval?**
  Possible answer: I can examine the graph over the interval for the lowest point and determine its y-value.
- **How can you determine if the graph of a function is symmetric about an axis?**
  Possible answer: I can trace the graph and the axes onto patty paper and then fold the patty paper along an axis. If both sides of the graph match when folded then the graph is symmetric about that axis.

Answers

1. *False* a. The graph is symmetric about the ~~x-axis~~ *y-axis*.
   True b. The function graphed has a minimum value of 0.
   False c. The range for the function graphed is ~~all real numbers~~ $y \geq 0$.
2. *False* a. The maximum value on the interval [1, 4] of the function graphed is ~~4~~ 2.
   False b. The domain for the function graphed is ~~all real numbers~~. $x \geq 0$.
   True c. The function graphed does not have an asymptote.
3. *False* a. The graph is symmetric about the ~~y-axis~~ *origin*.
   True b. The minimum value on the interval [0, 1] of the function graphed is 1.
   True c. The function graphed has an asymptote at $y = 0$.

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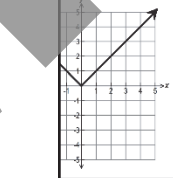
An answer key is included for each activity.

Each activity includes an opportunity for students to articulate and summarize aspects of their learning.

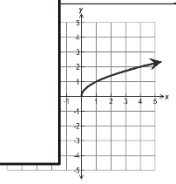
Name: _____ Date: _____

Changing Graphs

statements are true or false for the given graph. If a statement is false, correct ortion to make a true statement.

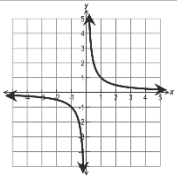


a. The graph is symmetric about the x-axis.
b. The function graphed has a minimum value of 0.
c. The range for the function graphed is all real numbers.



a. The maximum value on the interval [1, 4] of the function graphed is 4.
b. The domain for the function graphed is all real numbers.
c. The function graphed does not have an asymptote.

3.



a. The graph is symmetric about the y-axis.
b. The minimum value on the interval [0, 1] of the function graphed is 1.
c. The function graphed has an asymptote at $y = 0$.

Communicating about Mathematics
How can you determine if a function has an asymptote?

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# Solving Systems of Linear and Quadratic Equations, Activity 3
2A(3)(C)

Activity Objective
The student will determine solution sets for systems of two equations.

Materials

- **Systems of Equations: Loop**
- **Systems of Equations Cards**
- Scissors
- Tape or glue

Facilitation Questions

- **What strategies can you use to help you determine the solution set for the system?**
  I can solve both equations for y *and then set the resulting expressions equal to each other. I can use elimination to remove one of the variables and solve the resulting equation.*

- **How can you verify that the ordered pair is a solution?**
  I can substitute the x *and* y *values into the equations that represent the system and see if they create true statements.*

Answers

Systems of Equations	Solution
$x+y=6$ $y=x^2$	(*2, 4*) (*–3, 9*)
$y=3x-2$ $y=x^2+8$	*No real solutions*
$y-7x=-12$ $y=x^2-3x+13$	(*5, 23*)
$y=4x-10$ $y+2x=\frac{1}{2}x^2$	(*2, –2*) (*10, 30*)
$y=3$ $y=2x^2+6x-5$	(*1, 3*) (*–4, 3*)

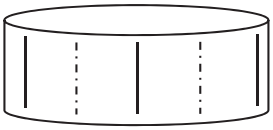
Systems of Equations	Solution
$x+y=12$ $2x^2-y=-6$	(*1.5, 10.5*) (*–2, 14*)
$x=2y^2$ $y=2x$	(*0, 0*) (*0.125, 0.25*)
$2x^2+5x=y+3$ $x=3$	*(3, 30)*
$x-y=4$ $x+y^2=10$	(*1, –3*) (*6, 2*)

SAMPLE

Student Name: _____ Date: _____

Systems of Equations: Loop

1. Determine a solution to one of the systems of two equations.
2. Tape the top of the card that contains the system of two equations to the bottom of the card with the solution.
3. Continue this process for the remaining systems of two equations.
4. When complete, the taped cards should form a loop.



Work Space:

Communicating about Mathematics

Compare algebraically solving a system of two linear equations to algebracially solving a system of a linear equation and a quadratic equation.

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Systems of Equations Cards

Cut along the dashed lines. Do not cut along the solid lines.

$x+y=6$ $y=x^2$ (1, –3) (6, 2)	$x=2y^2$ $y=2x$ (1.5, 10.5) (–2, 14)	$y=3$ $y=2x^2+6x-5$ (2, –2) (10, 30)
$x-y=4$ $x+y^2=10$ (3, 30)	$2x^2+5x=y+3$ $x=3$ (0, 0) (0.125, 0.25)	$y=3x-2$ $y=x^2+8$ (2, 4) (–3, 9)
$y-7x=-12$ $y=x^2-3x+13$ No real solutions	$x+y=12$ $2x^2-y=-6$ (1, 3) (–4, 3)	$y=4x-10$ $y+2x=\frac{1}{2}x^2$ (5, 23)

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# Writing Quadratic Functions
2A(4)(A)

Activity Objective
The student will write a quadratic function given three points in the plane.

Materials
- **What Happened?**

Facilitation Question
- **How can you determine if it is necessary to multiply by a scalar before combining the two equations within a system of equations?**
  If the coefficients of the variables we are trying to cancel out are not opposites then we multiply the equation by a value that would create opposites.

Answers

Error:

When Amanda combined the second two equations, she did not distribute the –2 to the –8. The rewritten equation should have been $-2a-2b-2c=16$.

My work:

$$-2(a+b+c=-8) \longrightarrow -2a-2b-2c=16$$
$$+(4a+2b+c=-9) \qquad +(4a+2b+c=-9)$$
$$2a-c=7$$

Combine these two equations:

$$2(2a-c=7) \longrightarrow 4a-2c=14$$
$$+2a+2c=-8 \qquad +(2a+2c=-8) \quad \text{so, } a=1$$
$$6a=6$$

Using substitution of $a=1$:

$$2(1)-c=7, \text{ so } c=-5$$

$$(1)+b+(-5)=-8, \text{ so } b=-4$$

Quadratic Function: $y=x^2-4x-5$

SAMPLE

Student Name: _____ Date: _____

What Happened?

Amanda made an error when she started to determine the equation of the quadratic function that passes through the points $(-1,0)$, $(1,-8)$, and $(2,-9)$.

- Determine and correct the error.
- Complete the work to determine the quadratic function.

Amanda's work:

From the point $(-1,0)$:

$$ax^2+bx+c=y$$
$$a(-1)^2+b(-1)+c=0$$
$$a-b+c=0$$

From the point $(1,-8)$:

$$ax^2+bx+c=y$$
$$a(1)^2+b(1)+c=-8$$
$$a+b+c=-8$$

From the point $(2,-9)$:

$$ax^2+bx+c=y$$
$$a(2)^2+b(2)+c=-9$$
$$4a+2b+c=-9$$

System of equations:

$$a-b+c=0$$
$$a+b+c=-8$$
$$4a+2b+c=-9$$

Combine the first two equations:

$$\begin{array}{r} a-b+c=0 \\ +(a+b+c=-8) \\ \hline 2a+2c=-8 \end{array}$$

Combine the last two equations:

$$-2(a+b+c=-8) \longrightarrow -2a-2b-2c=-8$$
$$\begin{array}{r} +(4a+2b+c=-9) \\ \hline \end{array} \qquad \begin{array}{r} +(4a+2b+c=-9) \\ \hline 2a-c=-17 \end{array}$$

Error:	My work: Quadratic Function:

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Can you have mulitple equations that represent one quadratic function? Explain your reasoning.

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