Skills Practice

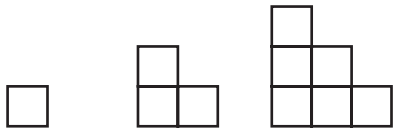
Name _____ Date _____

I. Observing Patterns

A. Draw the next three terms for each pattern shown.

1.

Pattern 1 **Pattern 2** **Pattern 3**



2.

Pattern 1 **Pattern 2** **Pattern 3**

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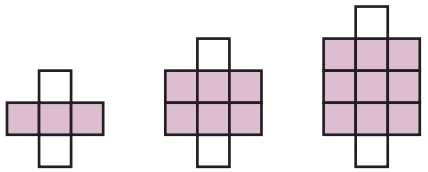
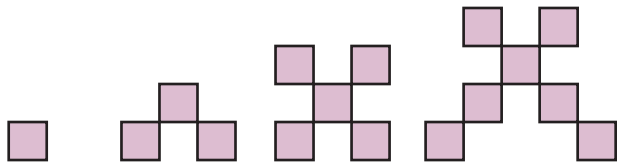
3. **Pattern 1** **Pattern 2** **Pattern 3**



4. **Pattern 1** **Pattern 2** **Pattern 3** **Pattern 4**



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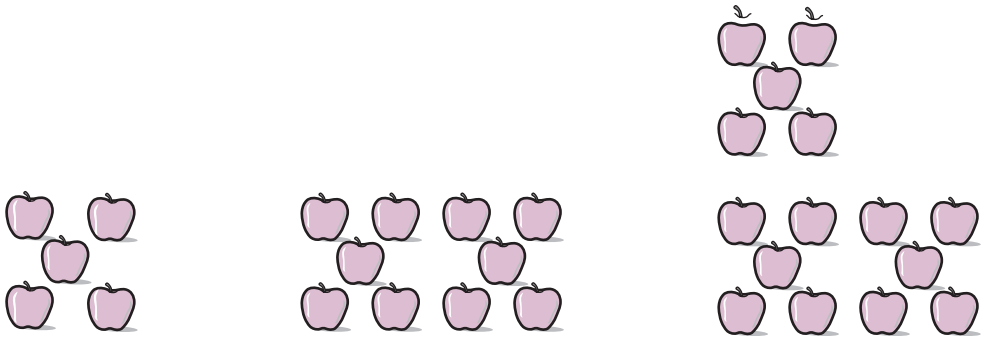
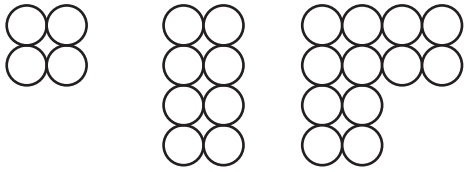
5.

Pattern 1 **Pattern 2** **Pattern 3**



6.

Pattern 1 **Pattern 2** **Pattern 3**



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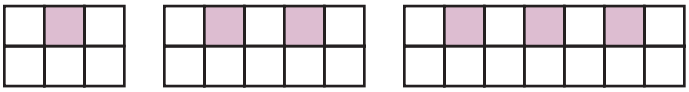
B. Analyze each pattern to answer the question.

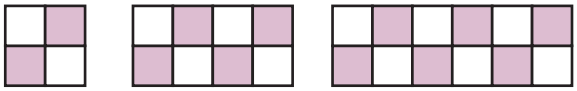
1. How many white tiles will be in Design 5 of the pattern? Explain your reasoning.

Design 1 **Design 2** **Design 3**



2. How many shaded tiles will be in Design 5 of the pattern? Explain your reasoning.

Design 1 **Design 2** **Design 3**



3. Gregory started a tomato plant garden and began giving away plants to his friends. The first year, he gave two tomato plants to friends. The following year he gave away four tomato plants. Gregory then decided the amount of tomato plants he gave away each year would be double the amount of plants he gave away the previous year. How many total tomato plants has Gregory given away by the end of year 5? Show your work.

Time (years)	Number of Tomato Plants Given Away Per Year	Cumulative Total Number of Plants Given Away
1		
2		
3		
4		
5		

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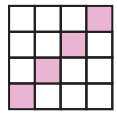
4. Charlene has a flourishing spider plant. She cuts three small pieces of the plant, called babies. She moves each baby into its own pot with soil. After one month, she is able to cut three babies off each of the original babies. She continues this pattern. How many baby plants will she have started after 5 months? Show your work.

Time (months)	Number of Baby Spider Plants
1	
2	
3	
4	
5	

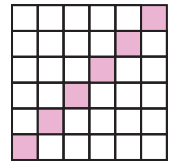
5. How many white squares will be in Design 6 of the pattern? Explain your reasoning.

Design 1

Design 2



Design 3



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6. Archie is playing an online game with friends. Each round of the game, he earns four times his current point total. The first three rounds are shown in the table. How many points does Archie have in round 6? Show your work.

Round	Number of Points
1	1
2	4
3	16

C. Determine the next number in each sequence. Explain your reasoning.

1. 6, 13, 27, 55, ...

2. 3, 5, 9, 17, ...

3. 1, 4, 7, 10, ...

4. 1, 5, 9, 13, ...

5. 3, 8, 18, 38, ...

6. 5, 8, 14, 26, ...

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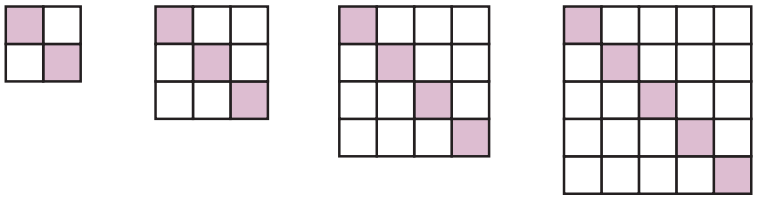
II. Generating Algebraic Expressions

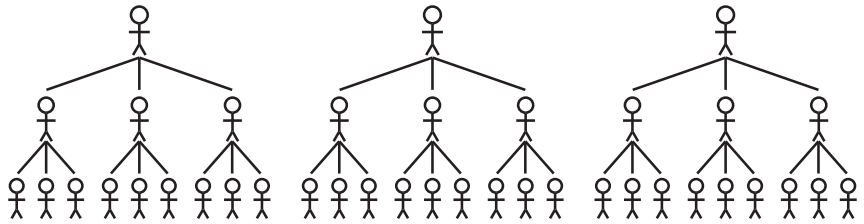
A. Write an expression to represent each pattern. Use your expression to determine an unknown value.

1. Renetta is creating a design for a craft project. Write an expression to represent the number of shaded squares in each piece of the design. Use your expression to determine the number of shaded squares in Design 37.

Design 1 **Design 2** **Design 3** **Design 4**



2. In Round 1, three candidates for the student government each tell three other people that the election will be held next Tuesday. In Round 2, all of the people who were told about the election from the three candidates go out and each tell three more people about the election. The pattern continues round after round. Write an expression to model the number of new people who hear about the election in any round. Use your expression to determine the number of new people who hear about the election in Round 7.

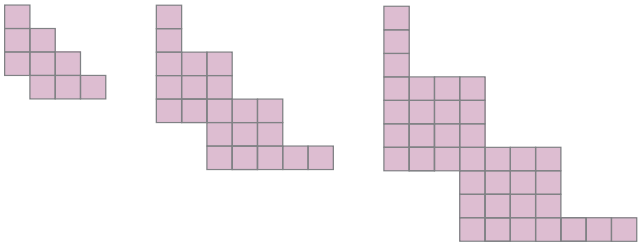


Round 1

Round 2

3. Sheila is drawing the pattern shown. Write an expression to represent the number of squares in each piece of her design. Use your expression to determine the number of squares in Design 10.

Design 1 **Design 2** **Design 3**



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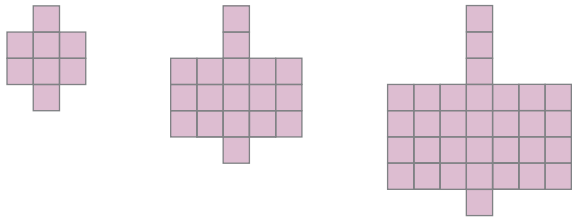
4. Luca is creating a design with blocks. Write an expression to represent the number of squares in each stage of his design. Use your expression to determine the number of squares in Design 15.

Design 1 **Design 2** **Design 3**



5. Charlie watches as a pattern develops. In month 1, he starts with 3 guppy fish in his fish tank. The next month, he finds 6 guppy fish in his tank. The following month, he finds 11 guppy fish in his fish tank. Write an expression to model the pattern of guppy fish in Charlie's fish tank. Use your expression to determine the number of guppy fish Charlie will observe in month 6.

6. After 1 minute, a video Portia is uploading is at 150 kilobytes uploaded. After 2 minutes, the video is at 600 kilobytes uploaded. After 3 minutes, the video is at 1350 kilobytes uploaded. After 4 minutes, the video is at 2400 kilobytes uploaded. Write an expression to model the amount of the video uploaded. Use your expression to determine the amount of the video uploaded after one hour.

7. A library receives book donations over the course of the year. The number of books received each month is listed in the table. Write an expression to model the number of books received by the library. Use your expression to determine the number of books the library should expect to receive in month 9.

Time (months)	Number of Books Received
1	2
2	11
3	26
4	47
5	74

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8. A website begins its first week with 3 subscribers. The number of subscribers each week is listed in the table. Write an expression to model the number of subscribers at the website each week. Use your expression to determine the number of subscribers in week 24.

Time (months)	Number of Subscribers
1	3
2	9
3	19
4	33
5	51

B. Determine whether the two expressions are equivalent. Explain your reasoning.

1. $6n + 8$ and $2(3n + 4)$

2. $(n^2 + 4n) - n^2$ and $4n$

3. $3x + 5$ and $2(x + 3)$

4. $15 - 6x$ and $15(1 - 6x)$

5. $(y + y + 2 + y) + 3y$ and $6y + 2$

6. $8y - 3 + 10y$ and $3(6y - 1)$

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C. Represent each pattern as an expression. Then identify whether the pattern is linear, exponential, or quadratic. Explain your reasoning.

1. The table lists the number of people who attended a museum (in thousands) over the course of several months.

Time (months)	Total Museum Attendance (thousands)
1	11
2	15
3	19
4	23
5	27

2. A local pet shelter tracks how many of their pets have been adopted. The table lists the number of pets that have been adopted over several weeks.

Time (weeks)	Number of Pets Adopted
1	8
2	11
3	16
4	23
5	32

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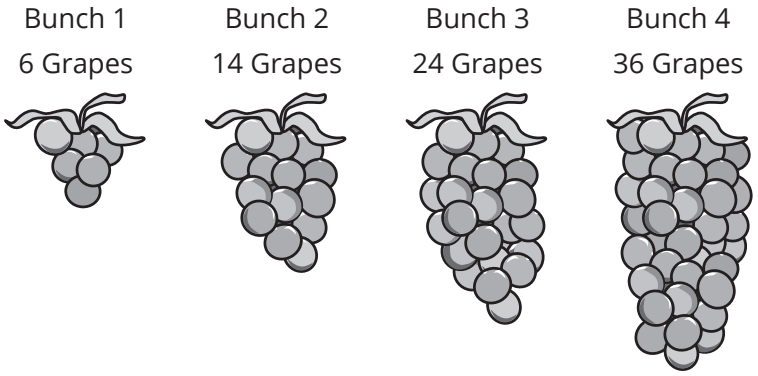
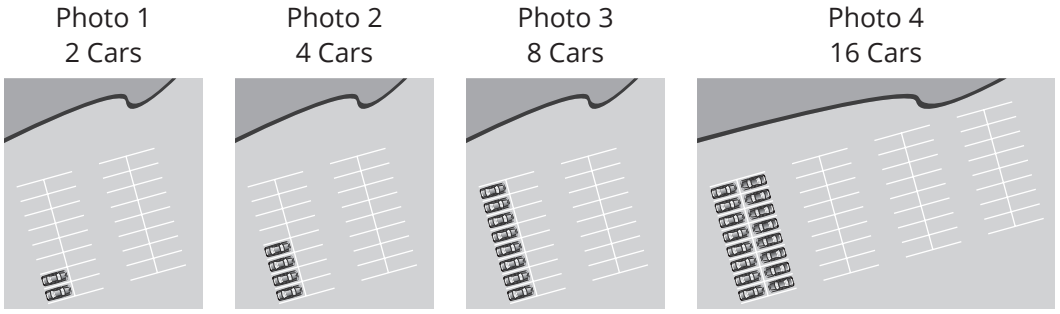
3. Emilio is looking at bunches of grapes at the market. He starts to notice a pattern in the number of grapes in each bunch. The diagram shows the number of grapes in each bunch.



4. Nolan takes a photo of a parking lot every two hours. He counts the number of cars in each photo. The diagram shows the number of cars in each photo.



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5. The school swim team holds a car wash to earn money for an upcoming trip. The table lists the number of hours that the car wash runs and the amount of money earned during the car wash.

Time (hours)	Amount of Money Earned (in dollars)
1	20
2	22
3	24
4	26
5	28

6. A store had a grand opening sale. During the sale, each person entering the store received a coupon for 10% off their entire purchase. The table lists the number of people who received a coupon.

Time Since Opening (hours)	Number of People Receiving a Coupon
1	3
2	12
3	27
4	48
5	75

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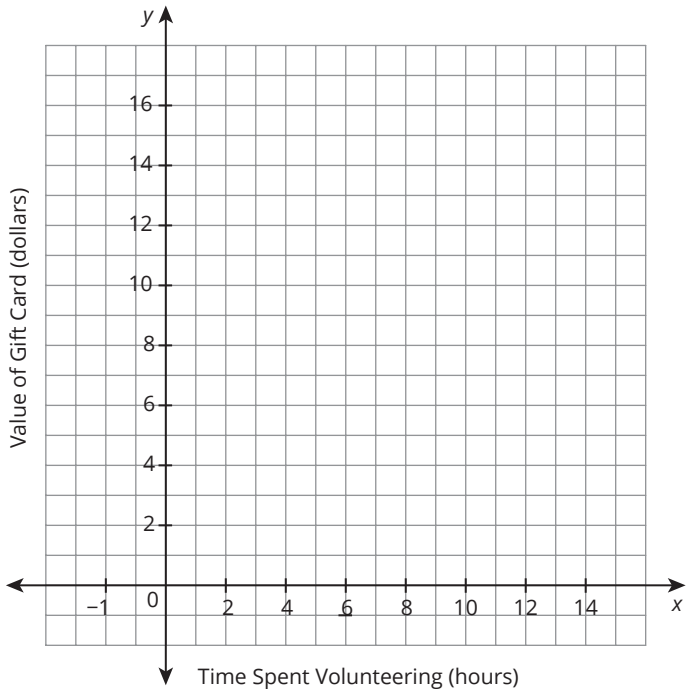
D. Model each scenario using a table, a graph, and an equation.

1. A local arts festival has 150 vendors and 75 volunteers. Each volunteer receives a T-shirt and earns $2 for each hour spent volunteering towards a gift card for the festival. Model the value of a gift card that a volunteer can earn.

Time Spent Volunteering (hours)	Value of Gift Card (dollars)



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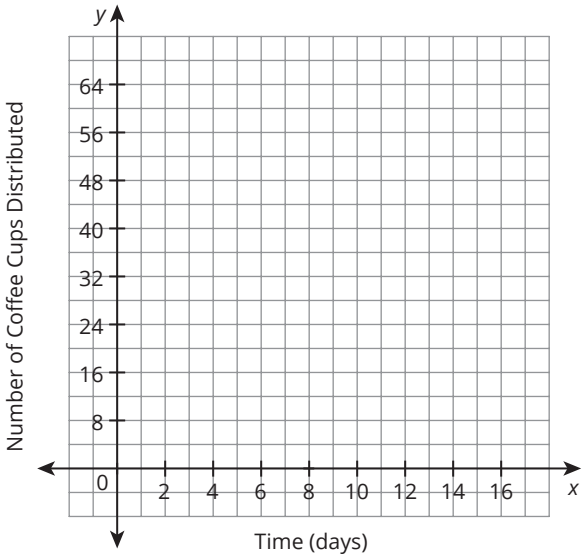
2. A public broadcasting station distributes 16 coffee cups each day of their fundraising drive to individuals who donate at least $75. During the fundraising drive, 12 people decline the coffee cup. Model the number of coffee cups that are distributed.

Time (days)	Number of Coffee Cups Distributed



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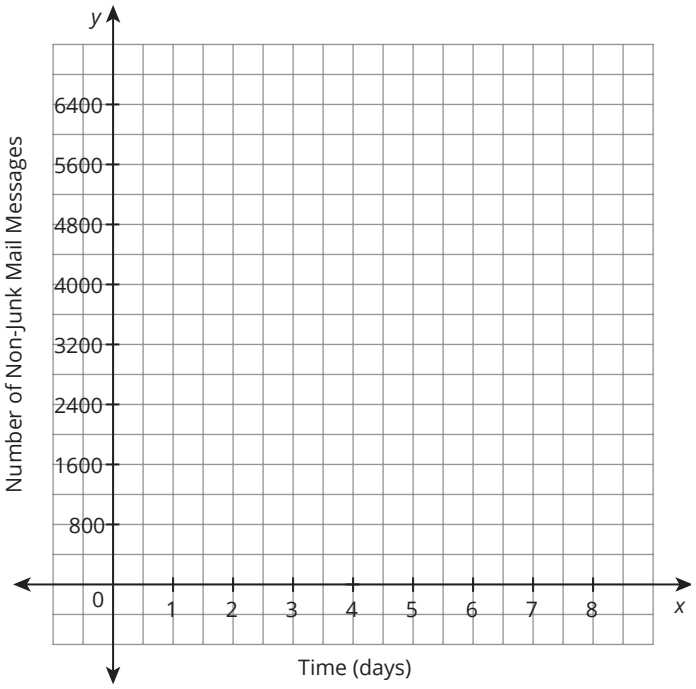
3. The school receives 2000 e-mail messages each day. Of those messages, 1250 are junk mail messages. Model the number of email messages received by the school that are not junk mail.

Time (days)	Number of Non-Junk Mail Messages Received



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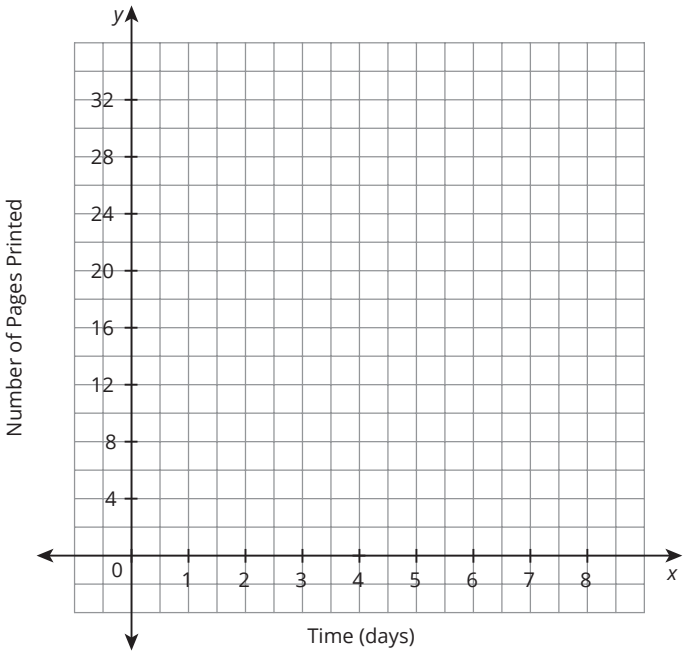
4. To cover the cost of paper, a computer lab institutes a new policy stating that students are only permitted to print 100 sheets of paper before incurring a cost. The policy is retroactive to the start of the current school year. After they have printed 100 sheets of paper, they must pay $0.50 per sheet of paper. Before the policy was created, one student had already printed a 5-page paper. He continues to print 4 pages per day. Model the number of pages this student prints.

Time (days)	Number of Pages Printed



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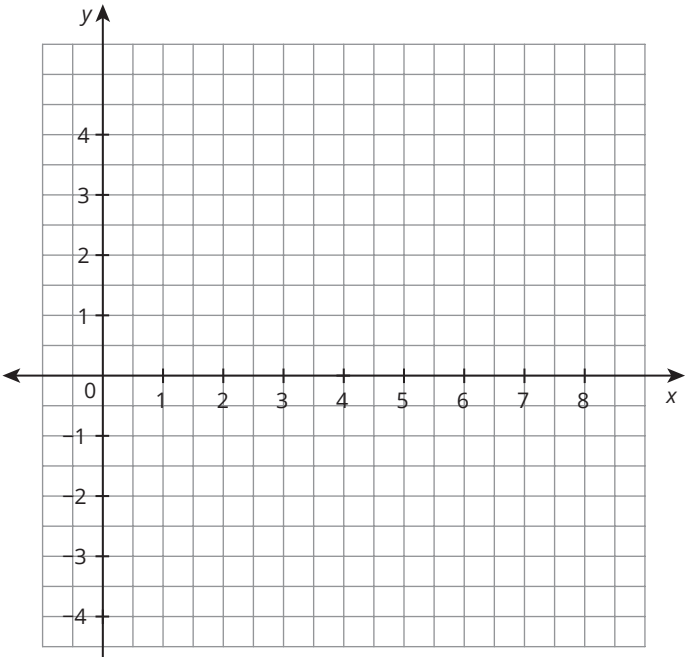
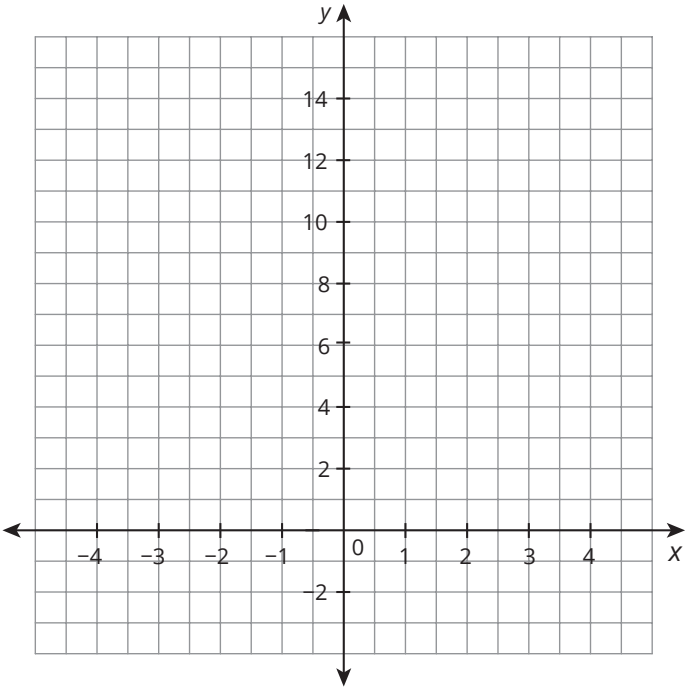
5. The opposite of x squared plus 5.

x	$f(x)$



6. The square of x plus 5.

x	$f(x)$



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E. Write an expression to model each scenario and use the expression to answer the question.

1. Tommy is purchasing items from an online store. The store charges $6 shipping and handling for each package. Write an expression to represent the total shipping costs. How much will Tommy pay in shipping and handling for 2 packages?

2. A library has 45 books in their young adult science fiction collection. During a collection drive, the library collects 9 new young adult science fiction books per day. How many total young adult science fiction books will the library have after 1 week?

3. A group of friends is planning a trip to the movie theater. The cost of one ticket for a movie is $8.50. The cost for each person to purchase snacks at the theater is $5. How much will a group of 8 friends pay to purchase movie tickets and snacks at the theater?

Number of Friends	Total Cost of Ticket and Snacks (dollars)
2	27
3	40.5
4	54
5	67.5
6	81

4. A bookstore advertises a book signing by calling each of the 12 members of their book club. Each member of the book club calls two additional people. The table lists the number of people who receive a call. How many people will receive a call in the 4th round of calls?

Round of Calls	Number of People Who Receive a Call
1	12
2	24
3	48

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5. A photographer takes 46 photos per hour during a soccer game. How many photos does the photographer take if the game lasts 3.5 hours?

6. The high school choir hosts a concert for the community. The members of the choir sell tickets for the concert. Each member of the choir sells 3 tickets. Tickets are also sold at the door before the concert. A total of 125 tickets are sold at the door. How many total tickets are sold if there are 18 members of the choir?

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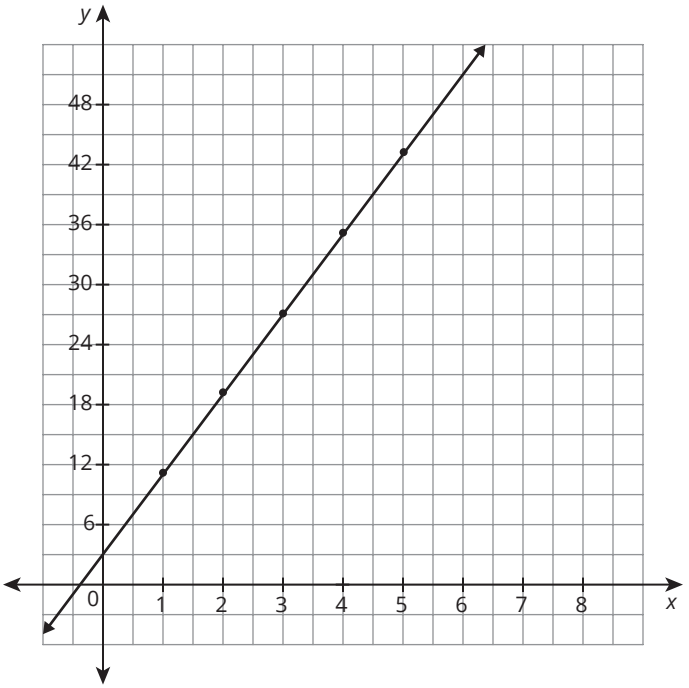
III. Comparing Multiple Representations of Functions

A. Determine whether the functions are equivalent.

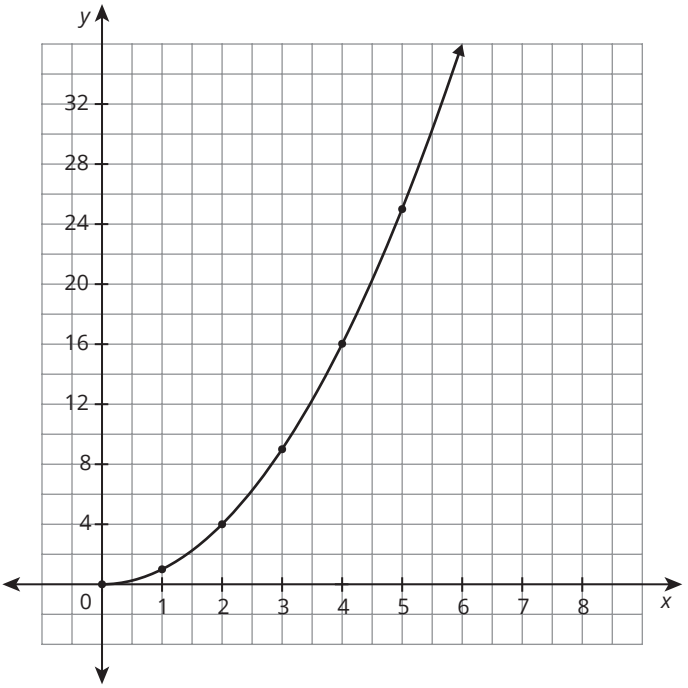
1.

Input	Output
1	11
2	19
3	27
4	35
5	43



2.

Input	Output
1	1
2	4
3	9
4	16
5	25



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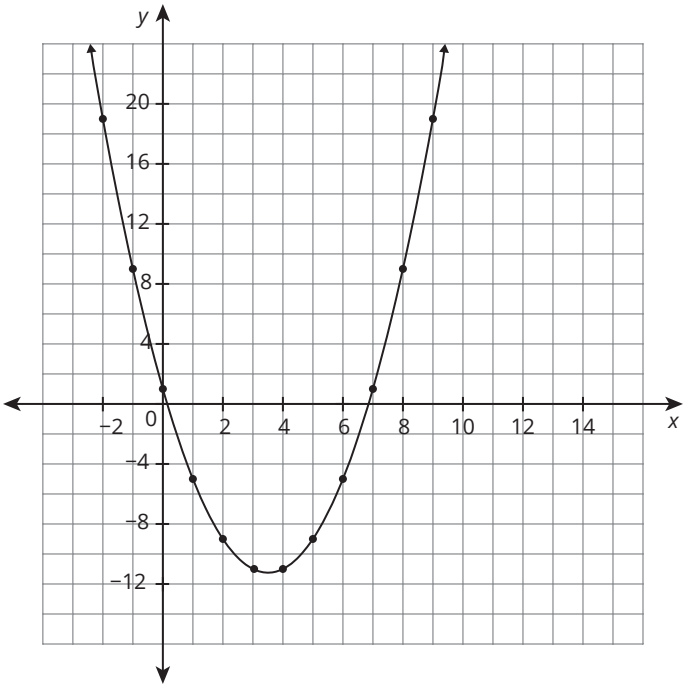
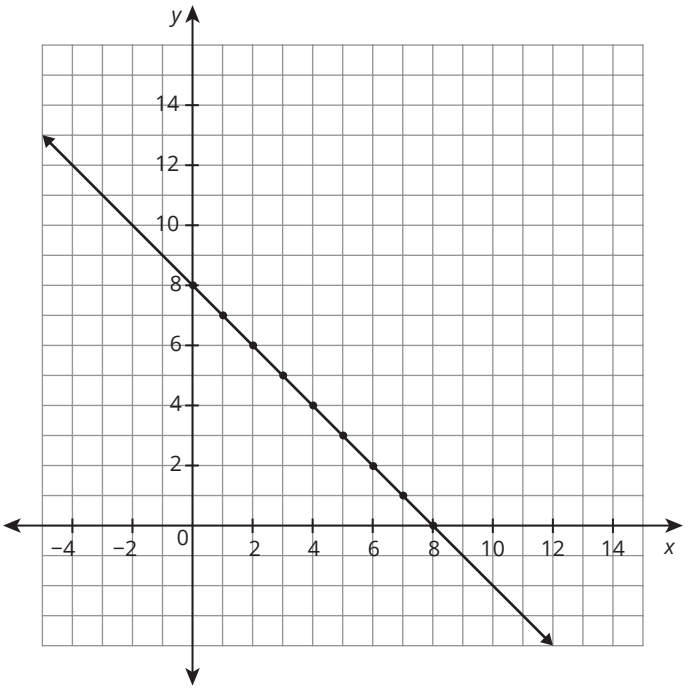
3. $y = x^2 - 7x + 1$



4. $y = 5(x - 1) + 4$



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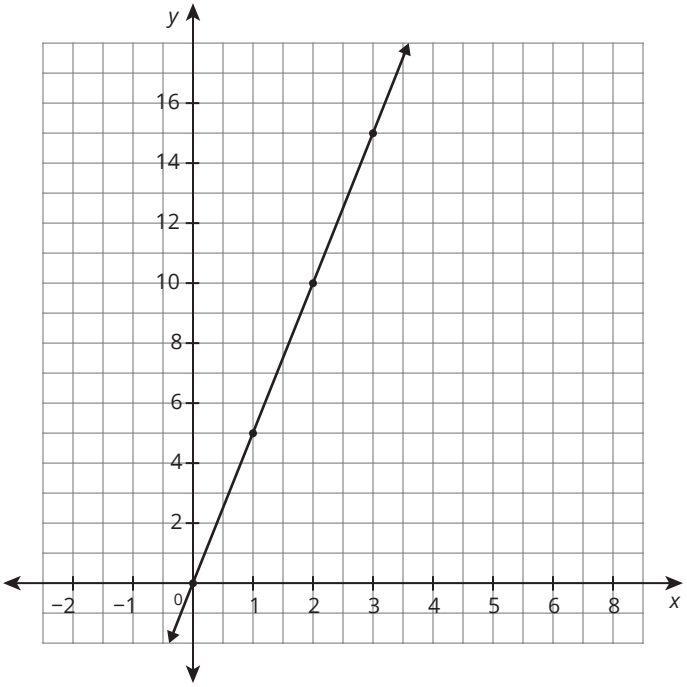
5. $f(x) = 3(x + 1)$

Input	Output
1	3
2	6
3	9
4	12
5	15

6. Alton is selling a few handmade toys at a community sale. After the first hour, Alton has earned \$5. After the second hour, he has earned \$10 and after the third hour, he has earned \$15.



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B. Determine whether the expressions are equivalent.

1. $(5x + 3) + 3x^2 - 2$ and $(5x + 1) + 3x^2$

2. $3x^2 + (x - 2)(x + 1)$ and $(2x - 2)(2x + 1)$

3. $(2x + 1)^2 - 2x(x - 3)$ and $6x^2 + 6x + 2 - (2x - 1)^2$

4. $(7x^2 + 1) - (3x - 1)(x + 4)$ and $2x(x - 3) + 2x^2 - 5x + 5$

5. $6x(x + 1)$ and $6x^2 + 6$

6. $8x(2x + 1) + 8x^2$ and $8x(3x + 1)$

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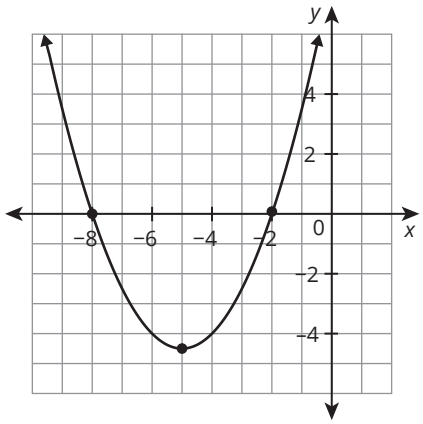
IV. Forms of Quadratic Equations

A. Select the function that matches each graph. Explain your reasoning.

1.



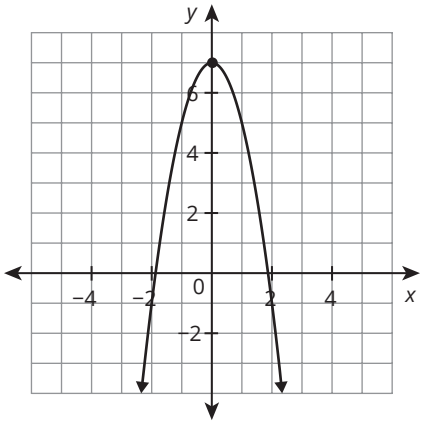
$f(x) = 6(x - 2)(x - 8)$

$f(x) = -\frac{1}{2}(x + 2)(x + 8)$

$f(x) = \frac{1}{2}(x + 2)(x + 8)$

$f(x) = \frac{1}{2}(x - 2)(x - 8)$

2.



$f(x) = 2x^2 - x + 7$

$f(x) = -2x^2 - x + 7$

$f(x) = -x^2 - 2x + 7$

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

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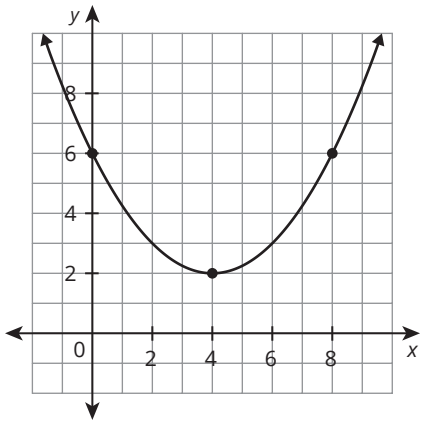
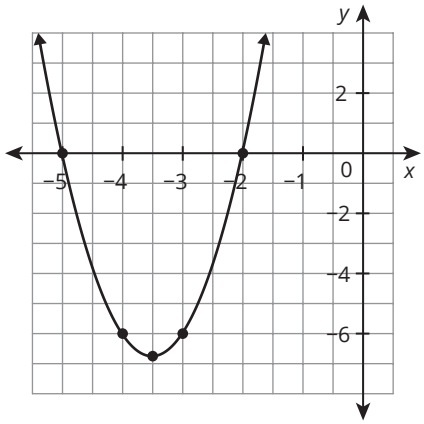
3.



$f(x) = 0.25(x - 4)^2 + 2$
$f(x) = -4(x - 2)^2 - 2$
$f(x) = 0.25(x + 4)^2 + 2$
$f(x) = 0.25(x - 2)^2 + 4$

4.



$f(x) = -3(x + 2)(x - 5)$
$f(x) = 3(x + 2)(x + 5)$
$f(x) = 3(x - 2)(x - 5)$
$f(x) = -3(x - 2)(x - 5)$

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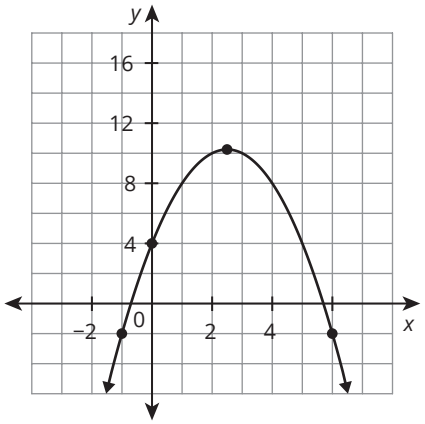
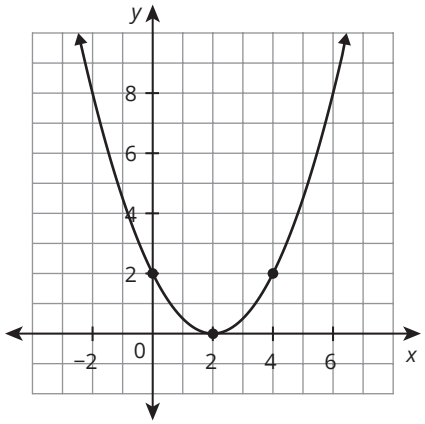
5.



$f(x) = x^2 + 5x - 4$
$f(x) = -x^2 + 5x + 10$
$f(x) = -x^2 + 5x + 4$
$f(x) = x^2 + 5x + 4$

6.



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

B. Use the given information to determine the most efficient form you could use to write the quadratic function. Write *general form*, *factored form*, or *vertex form*.

1. vertex (3, 7) and point (1, 10)

2. points (1, 0), (4, −3), and (7, 0)

3. *y*-intercept (0, 3) and axis of symmetry $-\frac{3}{8}$

4. points (−1, 12), (5, 12), and (−2, −2)

5. roots (−5, 0) and (13, 0) and point (−7, 40)

6. maximum point (−4, −8) and point (−3, −15)

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C. Complete the table by converting the given quadratic function into its other two forms.

	General Form	Vertex Form	Factored Form
1		$f(x) = 2(x - 3)^2 - 32$	
2			$f(x) = \frac{1}{2}(x + 2)(x - 4)$
3	$f(x) = 5x^2 - 70x + 225$		
4			$f(x) = -0.25(x - 4)(x + 6)$
5	$f(x) = -3x^2 + 36x - 81$		

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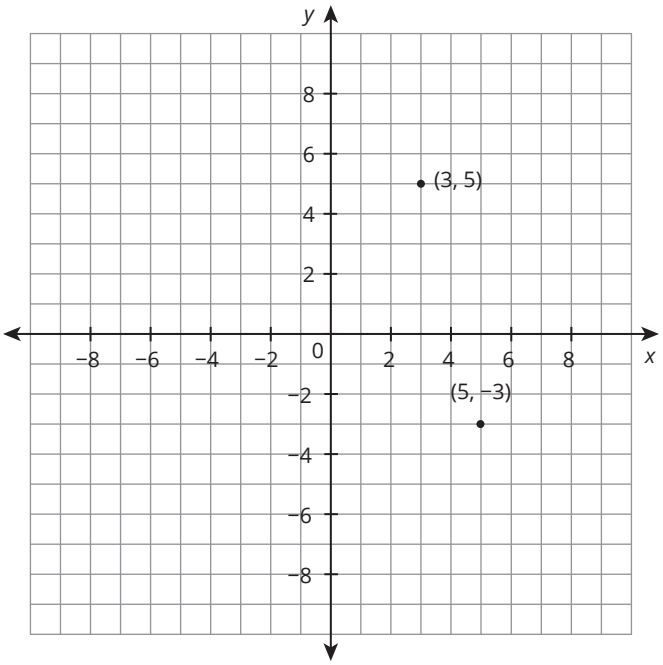
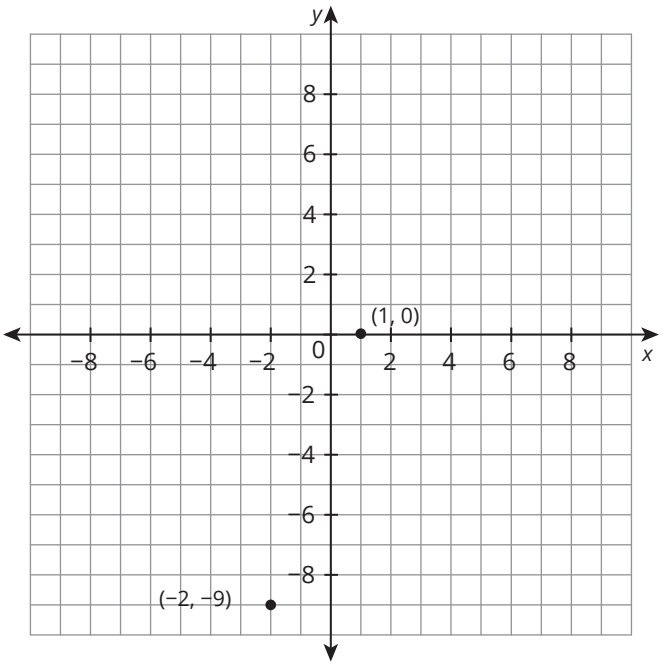
D. Use your knowledge of reference points to write an equation for the quadratic function that satisfies the given information. Use the graph to help solve each problem.

1. Given: vertex (3, 5) and point (5, –3)



2. Given: vertex (–2, –9) and one of two *x*-intercepts (1, 0)



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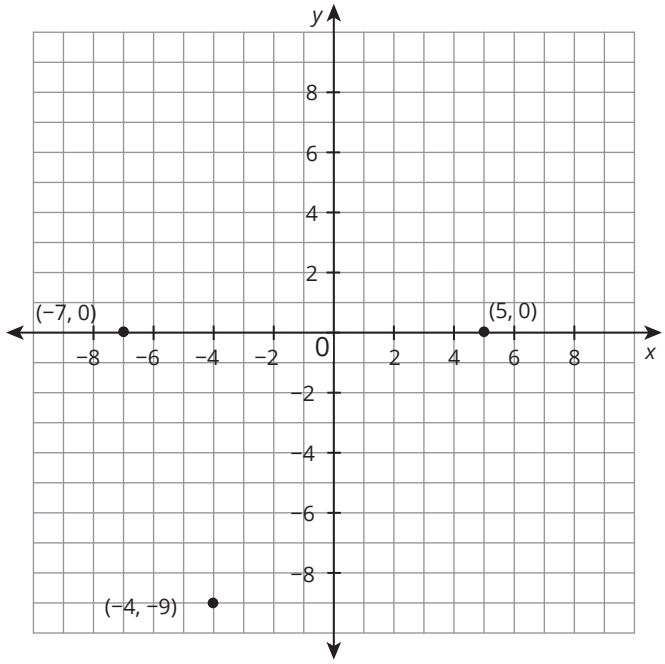
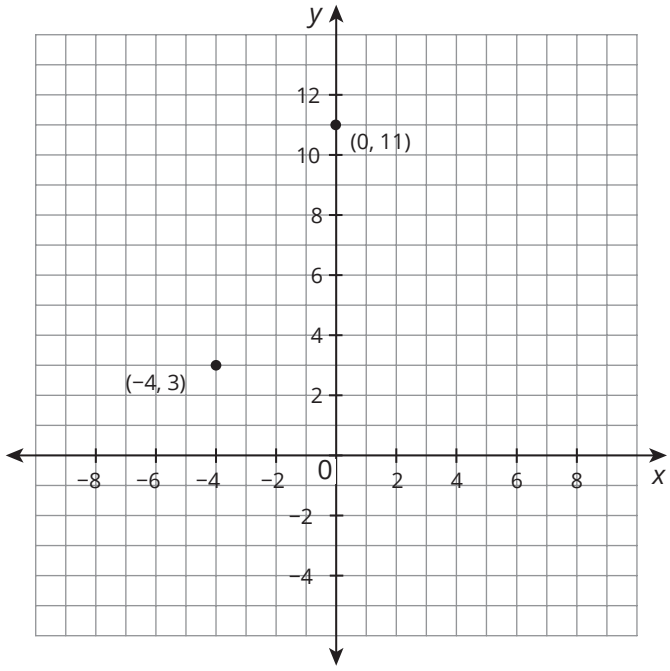
3. Given: two *x*-intercepts (–7, 0) and (5, 0) and one point (–4, –9)



4. Given: vertex (– 4, 3) and *y*-intercept (0, 11)



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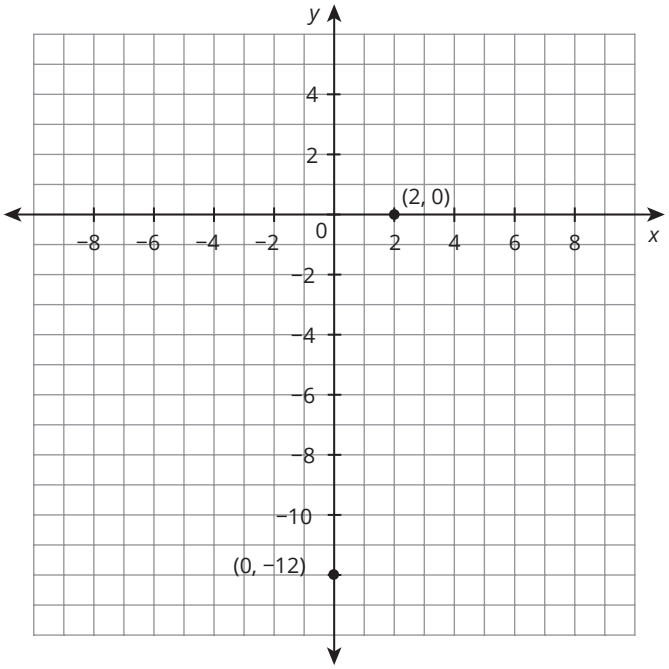
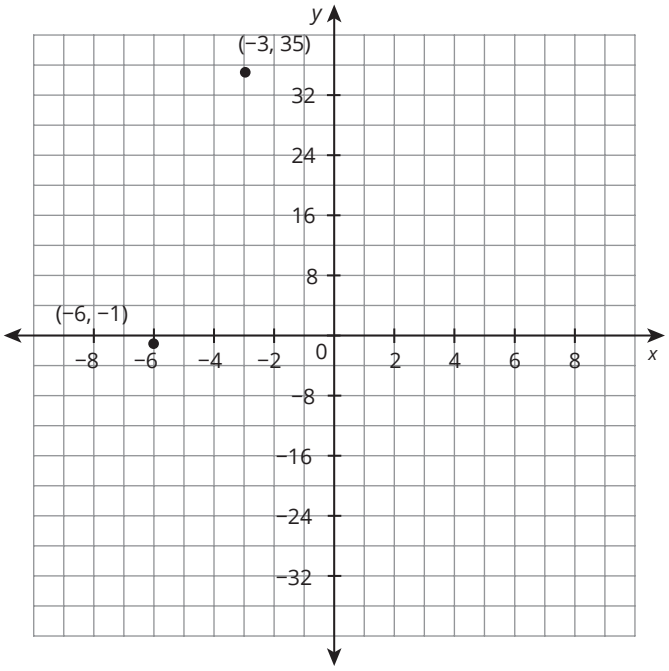
5. Given: exactly one *x*-intercept (2, 0) and *y*-intercept (0, −12)



6. Given: vertex (−6, −1) and point (−3, 35)



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E. Create a system of equations and use algebra to write a quadratic equation for each set of three points that lie on a parabola.

1. (–3, 12), (0, 9), (3, 24)

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2. (–2, –2), (1, –5), (2, –18)

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3. (2, 9), (0, –5), (–10, –15)

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4. (–1, 2), (4, 27), (–3, 20)

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5. (5, –6), (–2, 8), (3, 4)

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6. (1, 17), (–1, –9), (2, 105)

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V. Solving Quadratic Equations

A. Determine the roots of each quadratic equation by factoring.

1. $x^2 + 5x + 6 = 0$

2. $x^2 - 3x - 4 = 0$

3. $m^2 + 2m - 35 = 0$

4. $-x^2 - 4x + 12 = 0$

5. $x^2 + 8x = 0$

6. $w^2 + 50 = -15w$

7. $-t^2 + 12t = 32$

8. $x^2 + 2x + 2 = 0$

9. $2t\,2 + t - 3 = 0$

10. $w^2 + 5w - 32 = 2w - 4$

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B. Determine the roots of each quadratic equation by completing the square. Round your answer to the nearest hundredth. Check your answer.

1. $x^2 + 4x - 6 = 0$

2. $x^2 - 2x - 4 = 0$

3. $x^2 + 10x + 2 = 0$

4. $x^2 - 12x + 25 = 0$

5. $x^2 + 3x - 1 = 0$

6. $x^2 + x - 10 = 0$

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C. Determine the zeros or roots of each function or equation.

1. $f(x) = x^2 + 3x - 5$

2. $f(x) = -3x^2 - x + 7$

3. $2x^2 + 6x - 7 = 2$

4. $4x^2 - x - 1 = 5$

5. $f(x) = -8x^2 + 2x + 1$

6. $3x^2 + x + 3 = 5$

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7. $f(x) = -2x^2 - 8x + 1$

8. $5x^2 + 8x - 3 = 1$

9. $-3x^2 + 6x + 2 = -5$

10. $f(x) = x^2 + 6x + 5$

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

12. $-3x^2 + 8x - 2 = -6$

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13. $f(x) = -x^2 + 6x + 7$

14. $2x^2 + 8x + 3 = -5$

15. $f(x) = 9x^2 + 5x + 1$

16. $6x^2 + 3x - 5 = 2$

17. $f(x) = 5x^2 + 10x + 5$

18. $f(x) = 7x^2 + 9x + 5$

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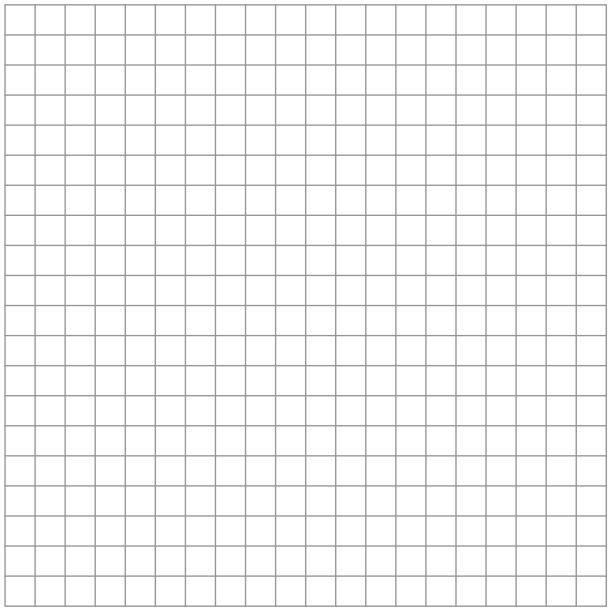
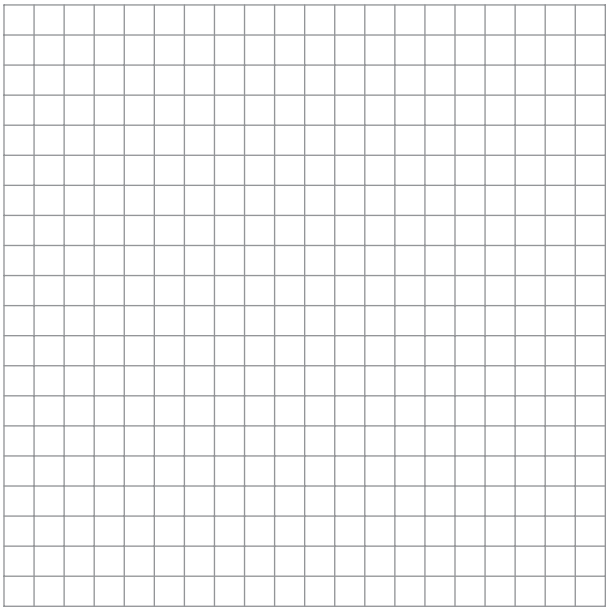
D. Solve each system of equations algebraically. Then verify each solution graphically.

1. $\begin{cases} y = x^2 - 6x + 7 \\ y = 2x \end{cases}$



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



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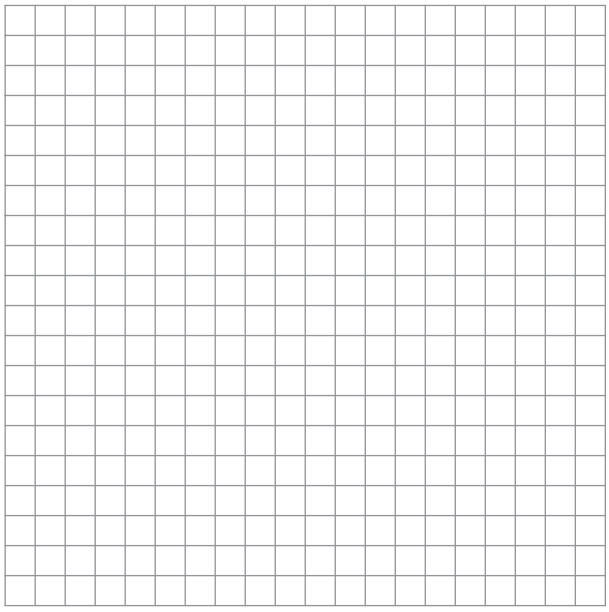
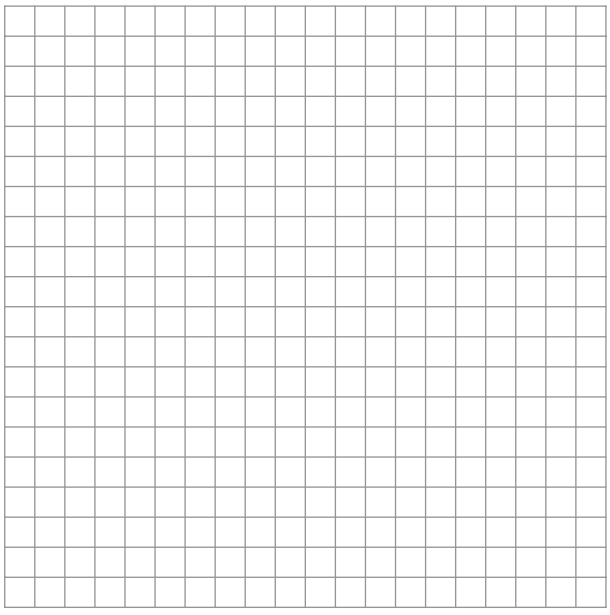
3. $\begin{cases} y = 2x^2 + 16x + 24 \\ y = -x - 2 \end{cases}$



4. $\begin{cases} y = -x^2 + 6x - 6 \\ y = 3x + 1 \end{cases}$



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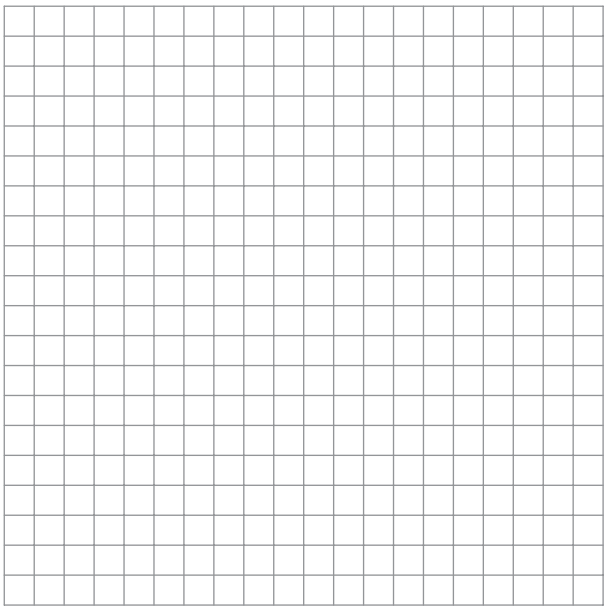
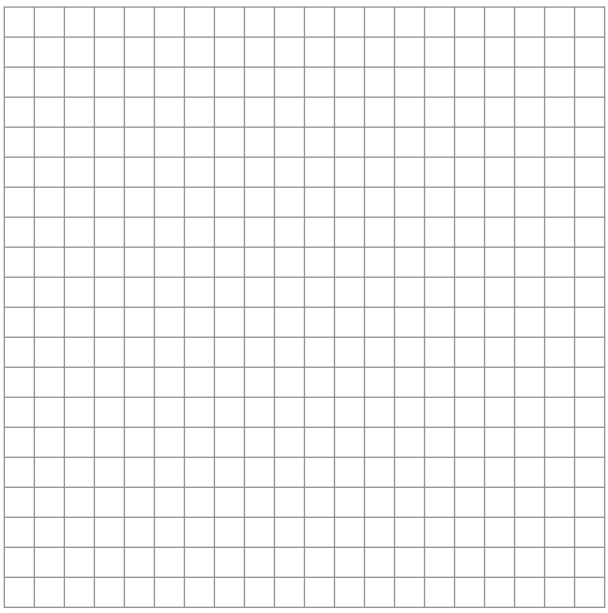
5. $\begin{cases} y = 4x^2 + 6x + 3 \\ y = -6x - 6 \end{cases}$



6. $\begin{cases} y = 3x^2 + 24x + 50 \\ y = 4x + 1 \end{cases}$



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VI. Imaginary and Complex Numbers

A. Rewrite each expression using *i*.

1. $\sqrt{-72}$

2. $\sqrt{-49} + \sqrt{-23}$

3. $38 - \sqrt{-200} + \sqrt{121}$

4. $\sqrt{-45} + 21$

5. $\frac{\sqrt{-48} - \sqrt{12}}{4}$

6. $\frac{1 + \sqrt{4} - \sqrt{15}}{3}$

7. $-\sqrt{-28} + \frac{\sqrt{21}}{3} - \frac{\sqrt{12}}{6}$

8. $\frac{\sqrt{-75} + \sqrt{80}}{10}$

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B. Simplify each expression.

1. $(2 + 5i) - (7 - 9i)$

2. $-6 + 8i - 1 - 11i + 13$

3. $-(4i - 1 + 3i) + (6i - 10 + 17)$

4. $22i + 13 - (7i + 3 + 12i) + 16i - 25$

5. $9 + 3i(7 - 2i)$

6. $(4 - 5i)(8 + i)$

7. $-0.5(14i - 6) - 4i(0.75 - 3i)$

8. $\left(\frac{1}{2}i - \frac{3}{4}\right)\left(\frac{1}{8} - \frac{3}{4}i\right)$

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C. Determine each product.

1. $(3 + i)(3 - i)$

2. $(4i - 5)(4i + 5)$

3. $(7 - 2i)(7 + 2i)$

4. $\left(\frac{1}{3} + 3i\right)\left(\frac{1}{3} - 3i\right)$

5. $(0.1 + 0.6i)(0.1 - 0.6i)$

6. $-2[(-i - 8)(-i + 8)]$

D. Use the discriminant to determine whether each function has real or imaginary zeros.

1. $f(x) = x^2 + 12x + 35$

2. $f(x) = -3x^2 + x - 9$

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3. $f(x) = x^2 - 4x + 7$

4. $f(x) = 9x^2 - 12x + 4$

5. $f(x) = -\frac{1}{4}x^2 + 3x - 8$

6. $f(x) = x^2 + 6x + 9$

E. Factor each function over the set of real or imaginary numbers. Then, identify the type of zeros.

1. $k(x) = x^2 - 25$

2. $n(x) = x^2 - 5x - 14$

3. $p(x) = x^2 - 8x - 17$

4. $g(x) = x^2 + 6x + 10$

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5. $h(x) = -x^2 + 8x - 7$

6. $m(x) = \frac{1}{2}x^2 + 8$

F. Determine the zeros of each given function.

1. $f(x) = 4x^2 + 1$

2. $f(x) = x^2 + 9$

3. $f(x) = x^2 + 2x + 5$

4. $f(x) = -x^2 + 4x - 6$

5. $f(x) = x^2 + 2x + 2$

6. $f(x) = -x^2 + 6x - 25$

7. $f(x) = x^2 - 4x + 9$

8. $f(x) = 2x^2 + 8x + 10$

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