Poorna Foundation

MATH

PRACTICE BOOK

Algebra 1

Paresh Chotaliya

Krishaa Jani

Mahi Patel

Welcome to the Poorna Foundation Algebra I Practice Book!

This book is designed to help students strengthen their Algebra I skills through meaningful practice and review of key concepts.

This practice book provides a variety of exercises that reinforce key Algebra I topics, including expressions, equations, inequalities, functions, graphing, systems of equations, exponents, polynomials, and quadratic relationships. Each activity is designed to help students apply what they have learned, identify areas for improvement, and develop mathematical fluency through consistent practice.

As you work through the exercises, you will build confidence in solving equations, working with functions, graphing relationships, and applying mathematical reasoning to a variety of problems. Consistent practice will help reinforce your understanding and prepare you for success in future math courses.

At Poorna Foundation, we believe every student can succeed through curiosity, perseverance, and a commitment to learning. We hope this practice book inspires you to challenge yourself, build confidence, and enjoy the journey of learning mathematics.

Happy Learning!

— Poorna Foundation

Website: https://poornafoundation.org
Email: contact@poornafoundation.org

Authors

Paresh Chotaliya is the founder of Poorna Foundation, an organization dedicated to its mission of "Complete Development Through Education." Recognizing the challenges students face in mastering mathematics, Paresh took the initiative to create hands-on resources that make learning engaging and effective. He led the effort to assemble a talented team and publish a comprehensive Algebra 1 practice book to empower students with the skills and confidence they need to succeed.

Krishaa Jani is a dedicated student volunteer and mentor at Poorna Foundation, committed to empowering students through education. She brings her expertise to the creation of this Algebra 1 practice book. Krishaa is deeply passionate about education and inspiring students to reach their full potential. Through her mentorship and contributions to Poorna Foundation, she continues to make a meaningful difference in the lives of young students, helping them build confidence and achieve academic success.

Mahi Patel is a student volunteer and mentor at Poorna Foundation. She attends Elkins High School. Mahi has contributed her expertise to this Algebra 1 math textbook, aiming to make learning more accessible and enjoyable for young learners. Mahi is passionate about education and inspiring students to achieve their best. Through her work with Poorna Foundation, she continues to make a meaningful impact in the lives of young students.

Reviewer

Tejal Parmar is a skilled Data Engineer with a strong background in mathematics and over six years of experience tutoring students. Her unique combination of technical expertise and teaching experience brings a practical perspective to the review process of the Algebra 1 practice book. Tejal’s passion for math education and her commitment to helping students succeed ensure that the book is both accurate and accessible. By leveraging her analytical skills and teaching insights, she has played a key role in shaping this resource to meet the needs of learners and aligns with the mission of the Poorna Foundation.

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Term 4

Unit 1: Exploring Functions

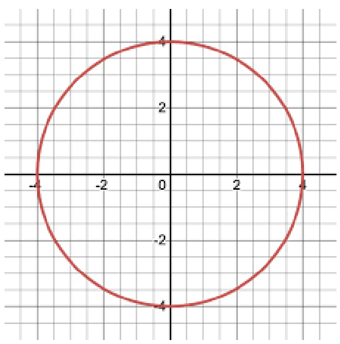
Lesson 1: Determining and Evaluating Functions

Determine if the following relations are a function or not. Explain why or why not.

1. (1, 2) (3, 4) (5,6) 2. (4.5, 8) (6.4, 4) (10.5,0) 3. (5.5, 0) (5.5, 6) (4.4, 6)

______________________ ________________________ _______________________

Identify whether the following graphs represent functions. Circle yes or no.

1.


YES/NO

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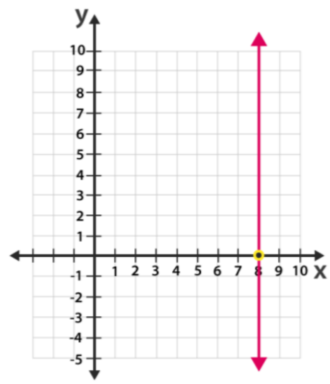
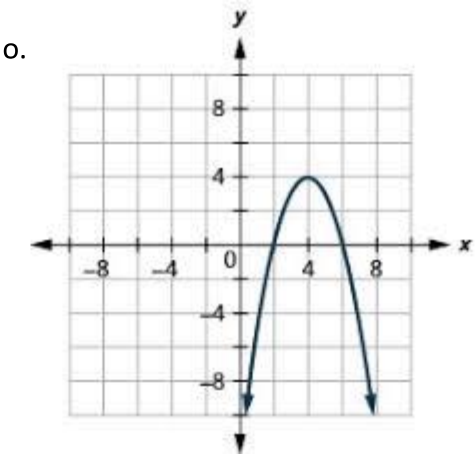
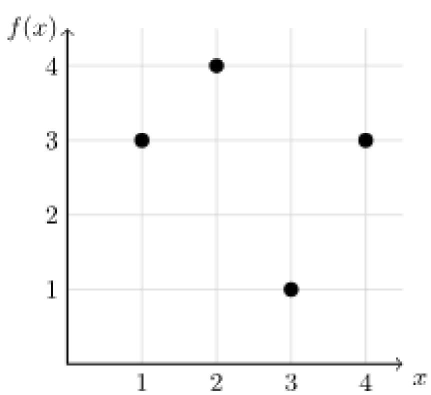


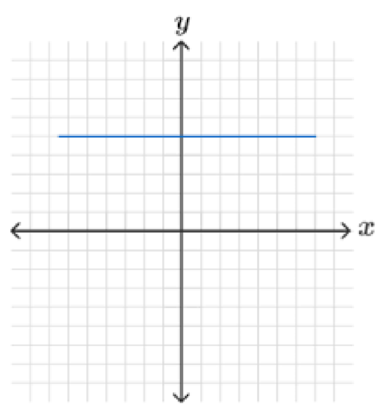
YES/NO

3.


YES/NO

4.


YES/NO

5.


YES/NO

True or False.

1. Every relation that passes the vertical line test is a function. __________
2. Functions can only be represented as equations. __________
3. A discrete data set can be classified as a function. __________

Match each input-output table to whether it represents a function.

1.

X	Y
-2	10
-4	5
-10	10

YES/NO

2.

X	Y
-2	2
2	4
3	8

YES/NO

3.

X	Y
9	4
-1	2
-3	3
-1	-6

YES/NO

4.

X	Y
1	78
-6.1	78
5	98
-6	90

YES/NO

Evaluate the following functions:

1. If f(x) = 2x+3

   f(4)=_______

   f(-5)=_______

   f(10)= ______

2. If g(r) = 25-3r

   g(4)=________

   g(9)=_________

   g(-3)=_______

3. If h(x) = $3x^2+6$

   h(3)= ________

   h(-3)= ________

   h(23)=________

Multiple choice

1. Given f(x) = x^2+3x+4, find f(-4)
   a. 0 b. 4 c. 8 d. 12

2. Which expression represents f(3a) when f(x)=$|2x^2-3x|$?
   a. $18a^2$-9a b. 6a(a-1) c. |9(2a-1) d. 4+3a

3. Given f(x)=$\frac{3x}{5}$, find f(20)
   a. 16 b. 12 c. 24 d. 10

4. Given f(x)= $\frac{2x+3y}{z}$ evaluate the function when x=-4, y=8, and z=-2
   a. 8 b. 16 c.-4 d. 20

Lesson 2: Domain and Range

Identify the domain and range from the given relations.

1. (1,3), (2,4), (3,5), (4,6)

   Domain: ____________________

   Range: ____________________

2. (-2,7), (0,8), (1,-1), (3,4)

   Domain: ____________________

   Range: ____________________

3. (a,b), b=|a|, a={-3,-2,-1,0,1,2,3}

   Domain: ____________________

   Range: ____________________

4. x>0

   Domain: ____________________

   Range: ____________________

5. 5x+3

   Domain:____________________

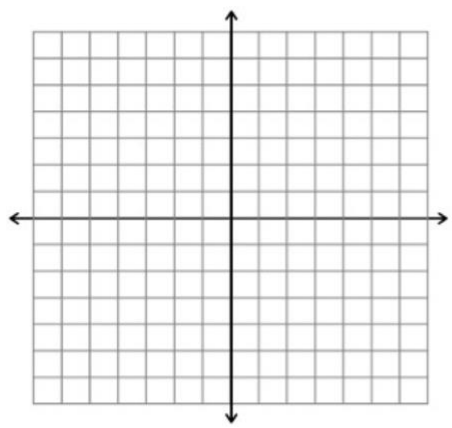
   Range: ____________________

6. x=9

   Domain: ____________________

   Range: ____________________

Determine the domain and range for the following problems and draw the functions on the graphs provided.



1. A line passing through points (2,4) and (6, 8).

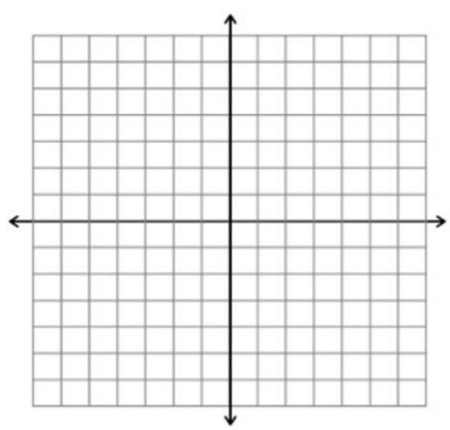
   Domain: ____________________

   Range: ____________________

2. A parabola with a vertex at (2,-9) and opening upwards.

   Domain: ____________________

   Range: ____________________



3. A horizontal line crossing the y-axis at (0,7.5)

   Domain: ____________________

   Range: ____________________

4. A circle centered at the origin with a radius of 5.

   Domain: ____________________

   Range: ____________________

Multiple Choice

1. Which of the following represents the domain of the function f(x)=2x+3 if x is a whole number?
   a. {0,1,2,3,4}   b. {1,2,3,4}   c. {-1,0,1,2,3}   d. {-2,-1,0,1}
2. If g(x)=x^2, what is the range of g(x) for x∈{−2,−1,0,1,2}?
   a. {0,1,4,9}   b. {0,1,4}   c. {-4,-1,0,1,4}   d. {4,1,0}
3. Which graph corresponds to a function with the domain [-2,2] and the range [0,4]?
   a. A parabola opening upwards with the vertex at (0,0)
   b. A straight line passing through the points (-2,0) and (2,4)
   c. A horizontal line at y=4
   d. V-shaped graph with the vertex at (0,0)
4. Given the function h(x)= $\frac{1}{x+1}$, which of the following represents the domain?

   a. $\{x : x \neq -1\}$
   b. $\{x : x > 0\}$
   c. $\{x : x < -1\}$
   d. $\{x : x \neq 1\}$

5. Which of the following statements is true about the domain of the function g(x)=$\sqrt{x-4}$?
   a. The domain is all real numbers
   b. The domain is x>4
   c. The domain is x<4
   d. The domain is x≥ 4

Word Problems

1. A parking lot charges $5 for the first hour and $3 for each additional hour. The function C(h)=5+3(h−1) represents the total cost C for h hours parked, where h is a whole number.

   What is the domain of the function? ______________________________

   What is the range of the function for h=1 to h=5? ______________________________

2. Jenny charges $10 per hour for babysitting. She limits her work to a maximum of 8 hours per day. Let E(h)=10, where h represents the hours worked, and E represents her earnings.

   Identify the domain of the function. ____

   What is the range of the function? ____

   If Jenny works 3 hours, what is her earning? _____________________________________

3. A bakery sells cookies in boxes of 12. The total cost C is determined by the equation C(n)=12n, where n represents the number of boxes purchased.

What is the domain of the function? ____

If the maximum order is 10 boxes, what is the range of the function? ______________________

What is the cost for purchasing 5 boxes? _______________________________________

4. A movie theater has 150 seats. The function $S(t)=150-t$ represents the number of available seats S, where t is the number of tickets sold.

   What is the domain of the function if tickets sold range from 0 to 150? _____________________

   What is the range of the function? ____

   How many seats are available if 120 tickets are sold? _________________________________

Match each equation with the correct domain and range option.

Equations	Options
1. $f(x)=x^2+1$	A. Domain: $x\neq -4$; Range: $y\neq 0$
2. $g(x)=\sqrt{x-3}$	B. Domain: $x\geq 3$; Range: $y\geq 0$
3. $h(x)=\frac{1}{x+4}$	C. Domain: All real numbers; Range $y\geq -5$
4. $p(x)=\|x\|-5$	D. Domain: All real numbers; Range: $y\geq 1$

True or False. Explain why it's true or not.

1. The domain of a quadratic function $f(x)=x^2$ is all real numbers.

   ____

2. The range of the function $f(x) = \sqrt{x}$ is all real numbers.'

   ____

3. The domain of $f(x)=2x-1$ is restricted to $x>0$.

   ____

4. A circle represented by $x^2+y^2=9$ has a domain and range limited to $-3 \leq x \leq 3$ and $-3 \leq y \leq 3$.

   ____

5. The range of $f(x)=\frac{1}{x}$ is all real numbers except $y=0$.

   ____

Lesson 3: Key Attributes of Functions

Word Problems

1. A toy rocket is launched and its height h(t) in meters as a function of time t (in seconds) is given by $h(t)=-5t^2+20t+3$.

   a. What is the maximum height of the rocket? ____

   b. At what time does the rocket reach its maximum height? ________________________________

   c. What is the height of the rocket at t=0? ____

2. A company's profit P(x) in dollars is modeled by $P(x)=-2x^2+60x-200$, where x is the number of items sold.

   a. What is the maximum profit the company can earn? ________________________________

   b. How many items need to be sold to maximize profit? __________________________________

   c. At what number of items sold does the company break even? ____________________________

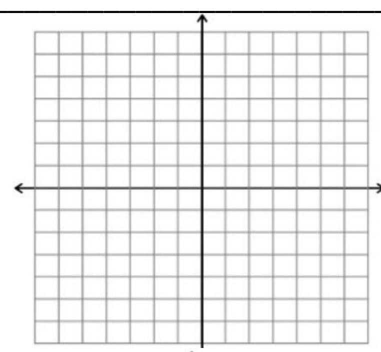
3. The temperature in a city is modeled by $T(h)=-2(h-6)^2+40$, where T(h) is the temperature in degrees Celsius and h is the hour past midnight.

   a. What is the highest temperature of the day? _______________________________________

   b. At what time does the highest temperature occur? ____________________________________

   What is the temperature at midnight? ____

Graphing

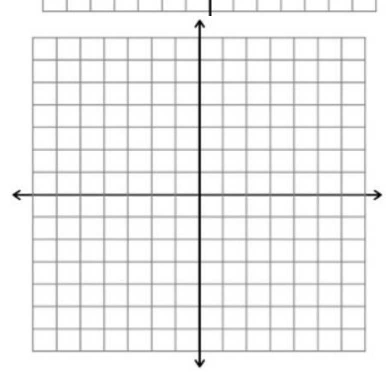


1. Graph $f(x)= -x^2+4x-3$. Identify:

   a. The vertex.

   b. The axis of symmetry.

   c. The x-intercepts and y-intercept.



2. Graph $f(x)= |x-2|-3$. Label the vertex and identify:

   a. The domain and range.

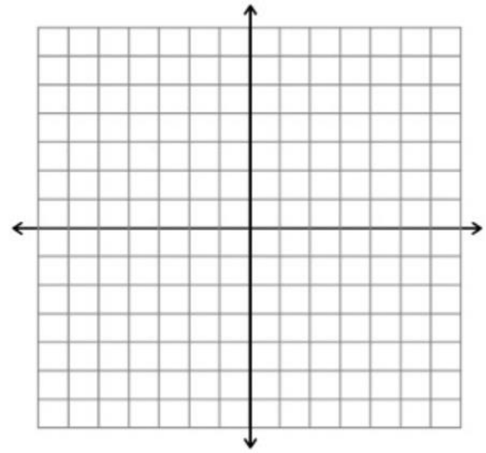
   b. The intercepts.

3. Graph $f(x)=2x-4$. Label:

   a. The slope

b. The y-intercept.

4. Graph the piecewise function:



$$f(x) = \begin{cases} x+2, & \text{if } x < 0 \\ -x+4, & \text{if } x \geq 0 \end{cases}$$

a. Identify the domain and range of the function.

b. What is the y-intercept?

Multiple Choice

1. What is the vertex of the quadratic function $f(x)=-3(x-2)^2+5$?
   a. (2,-5) b. (2,5) c. (-2,5) d. (-2,-5)

2. Which of the following functions has a minimum point?
   a. $f(x)=x^2-4x+3$ b. $f(x)=-x^2+2x-5$ c. $f(x)= -|x+1|$ d. $f(x)= -2x+6$

3. The y-intercept of the function $f(x)=3x+7$ is:
   a. 3 b. -3 c. 7 d. -7

4. For the linear function $f(x)=5x-10$, what is the slope?
   a. 5 b. -10 c. -5 d. 0

Match the key attribute to its correct value for the function $f(x)=-2(x-1)^2+8$.

Key attribute	Options
1. Vertex	A. y=8
2. Axis of symmetry	B. x=1
3. Maximum Value	C. (1,8)
4. Y-intercept	D. (0,6)

Fill in the blank

1. The vertex of $f(x)=a(x-h)^2+k$ is at ______________.
2. The slope of a line can be found using the formula ____________________________________.

3. The range of f(x)= |x-5|+2 is __________________.
4. The axis of symmetry of $f(x)=-2(x+3)^2+6$ is ______________________________.
5. The y-intercept of f(x)=-3x+4 is __________________________________.

Short answer + Unit 1 Review.

1. Explain the difference between the domain and range of a function.

   ____

2. What is the axis of symmetry, and what is the formula to find it for a quadratic function?

   ____

3. How can you tell if a quadratic function opens upwards or downwards by looking at its equation?

   ____

4. What is the difference between x and y intercepts and where does it lie on the graph?

   ____

5. What is the relationship between the slope and the steepness of a line?

   ____

6. In a piecewise function, how do you identify which rule to apply for a given value of x?

   ____

7. How does the value of the leading coefficient in a quadratic function affect the graph's width?

   ____

8. What is the purpose of the standard form of a quadratic equation, and how is it different from vertex form?

   ____

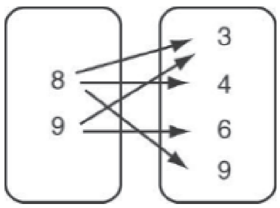
9. Why do some functions have restrictions on their domains, such as square root or rational functions?

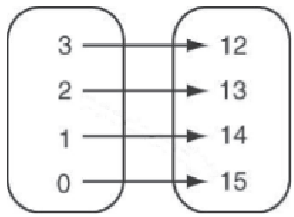
   ____

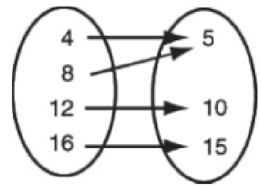
Unit 2: Graphing and Writing Linear Functions, Equations and Inequalities

Lesson 1: Intro to functions

Tell whether each relationship is a function.

1. 

2. 

3. 

4.

Input	0	1	2	3
Output	4	1	0	4

5.

Input	1	2	0	1	2
Output	4	5	6	7	8

Evaluate the following functions:

$If\ f(x) = 3x + 2\ find:$

1. f(0)
2. f(4)
3. f(−2)

$If\ g(x) = x^2 - 5x + 6, find:$

4. g(1)
5. g(3)
6. g(-1)

$If\ h(x) = \frac{2x}{x-3}, find:$

7. h(5)

8. h(3)

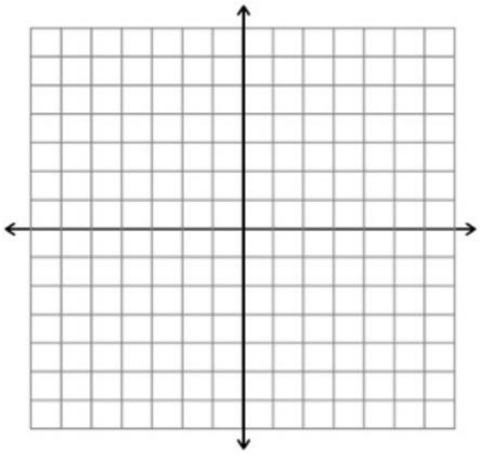
$k(x) = 4 - \sqrt{x}, find:$

9. k(9)

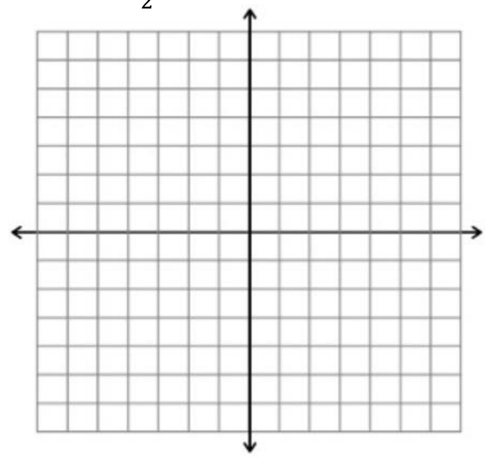
10.k(0)

Graph the following functions:

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



2. $g(x) = -\frac{1}{2}x + 3.$



Word Problems:

1. A car rental company charges a base fee of $20 plus $0.15 per mile driven. The total cost is modeled by C(x)=20+0.15x, where x is the number of miles. If the total cost is $50, how many miles were driven? What is the cost of driving 100 miles?

2. The temperature in degrees Fahrenheit at a certain time is modeled by T(t)=70−2t, where t is the number of hours past noon. What is the temperature at 3 PM? At what time will the temperature reach 50°F?

3. A shipping company charges a base fee of $10 plus $0.25 per pound of weight. The total cost is modeled by C(w)=10+0.25w, where w is the weight of the package in pounds. What is the cost to ship a package weighing 30 pounds? If the total shipping cost is $22.50, how much does the package weigh?

4. A candle company makes candles and sells them for $12 each. It costs $5 per candle for materials, plus $20 for setup. The profit P(x) is modeled by P(x)=12x−5x−20 where x is the number of candles sold. What is the profit for selling 10 candles? How many candles must be sold to break even (when P(x)=0)?

Find the common difference and the next 3 terms of the given sequences:

1. 8, 13, 18, 23,…

3. $\frac{1}{2}$, 1, $\frac{3}{2}$, 2,...

2. −2,−7,−12,−17,…

4. −4,−1, 2, 5,…

Write the recursive formula for the following sequences:

1. 6,9,12,15,...

2. 3. A sequence begins with a1=100, each term decreases by 8.

3. A sequence starts with a1=3, and each term increases by 5.

4. A sequence has a common difference of 7 and the first term is a1=12.

Find the term:

1. Given the sequence 2,5,8,11,… find the 16th term

2. Find the 20th term of the sequence −3,1,5,9,…

3. What is the 12th term of the sequence 100,95,90,85,…

4. What is the 6th term of the sequence 729,243,81,27,…

5. What is the 8th term of the sequence $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots$

Word problems:

1. A runner starts with a weekly mileage of 10 miles. Each week, they increase their mileage by 3 miles. Write the recursive formula and find the 18th term.

2. A bacteria culture triples in size every hour. The culture starts with 50 bacteria. Write the recursive formula. How many bacteria are there after 5 hours?

3. A bank account starts with $1,000, and the balance increases by 5% annually. Write the recursive formula for the account balance. Find the balance after 4 years (round to the nearest cent).

4. A population starts with 2,000 fish and decreases by 20% each year. Write the recursive formula. Find the population after 4 years.

5. A person deposits $100 into a savings account and adds $50 each year. The account also earns 3% interest annually. Write the recursive formula for the account balance. Find the balance after 5 years (round to the nearest cent).

6. A water tank holds 1,000 gallons initially, and 75 gallons are drained every hour. Write an explicit formula to represent the water remaining after n hours. How much water remains after 12 hours?

7. A staircase has 12 steps, and the height of each step increases by 8 inches. The first step is 4 inches high. Write an explicit formula for the height of the n-th step. What is the height of the 10th step?

8. A gym membership costs $20 for the first month and increases by $5 each month. Write an explicit formula for the cost in the n-th month. What is the cost in the 18th month?

Lesson 2: Rate of change and slope

Determine the slope of a line given two points:

1. (2,5) and (6,13)

2. (−3,−7) and (5,−7)

3. (0,0) and (8,−4)

4. (−4,10) and (3,−4)

5. (7,−3) and (−5,1)

6. (3,2) and (7,8)

Use the following tables to determine the slope:

1.

x	y
1	8
4	5
7	2

2.

x	y
-2	4
0	0
2	-4
4	-8

3.

Time (minutes) (x)	Distance (miles) (y)
0	0
5	1.5
10	3
15	4.5

Determine the slope from an equation in slope intercept form:

1. y=4x−7

2. y=−3x+5

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

4. $y = -\frac{3}{4}x - 6$

5. $y = -\frac{3}{17} + 4$

6. $y = 4\frac{1}{9} + 19$

Determine the slope from an equation in standard form:

1. $2x + 3y = 6$

2. $4x - y = 8$

3. $5x + 2y = 10$

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

5. $-6x + 2y = 8$

6. $\frac{1}{4}y + \frac{1}{3}x = 1$

Determine the slope from an equation in point-slope form:

1. $y - 2 = 3(x - 1)$

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

3. $y - 5 = \frac{1}{2}(x - 2)$

4. $y + 1 = -\frac{3}{4}(x + 4)$

5. $y - 0 = 4(x - 6)$

6. $y + 6 = \frac{1}{2}(x - 7)$

Lesson 3: Graphing and Writing Linear Equations

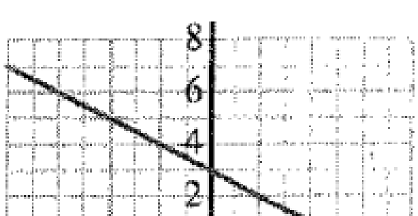
Constant of variation:

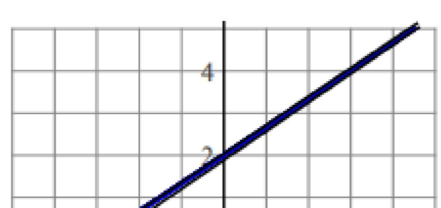
1. If y=8 when x=4, find the constant of variation k
2. If y=15 when x=3, find the constant of variation
3. A direct variation is represented by y=0.5x. What is the constant of variation?
4. In the equation y=7x, find y when x=5.
5. In the equation y=0.25x. Determine x when y=5.

Solve the direct variation problems:

1. The amount of money earned in a job varies directly with the number of hours worked. If $150 is earned after working 5 hours, how much money will be earned after working 8 hours?
2. In a certain city, the number of tourists t is directly proportional to the number of hotel rooms booked r. If 100 tourists book 50 rooms, how many tourists would book 80 rooms?
3. The force F needed to compress a spring is directly proportional to the distance x the spring is compressed. If F=30N when x=0.2 meters, find the force when x=0.5 meters.
4. If the amount of sugar needed to make cookies is directly proportional to the number of cookies, and 4 cups of sugar are needed to make 48 cookies, how many cups of sugar are needed to make 72 cookies?
5. The distance a car travels varies directly with the time it drives. If the car travels 180 miles in 3 hours, how far will it travel in 7 hours?

Find the domain, range, x-intercept, and y-intercept of the following linear functions:

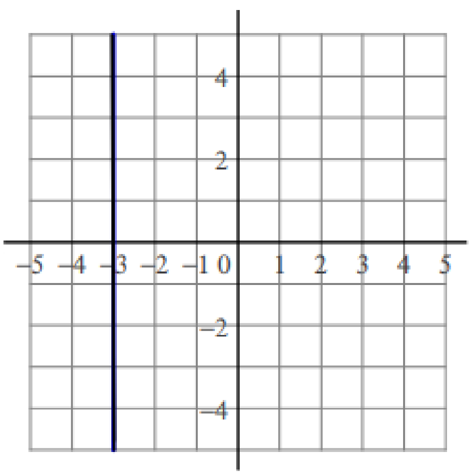




1.

2.

3.



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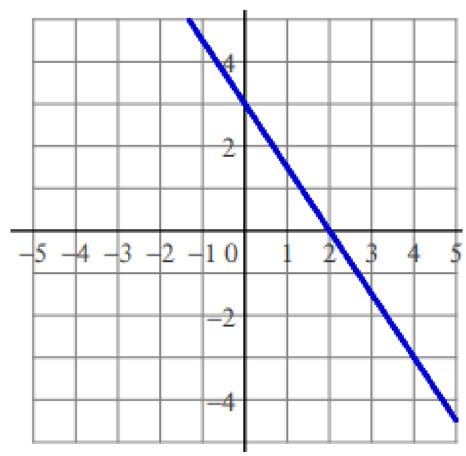


Write the equation for the linear function from description:

1. A line that passes through (3,5) with a slope of 2.

2. A line passing through the points (−2,4) and (1,−5).

3. A line has a slope of $\frac{3}{4}$ and passes through (0,−2).

4. A line passing through the points (5, −4) and (3, −4).

Word Problems:

1. A car rental company charges a $20 base fee plus $0.50 per mile. Write and graph the equation for the total cost based on the number of miles driven. Identify the slope and interpret its meaning.

2. A pool is being filled with water. The equation y=30x represents the number of gallons y after x minutes. Graph the equation and interpret the slope.

3. The graph of a line represents a plumber's charges: y=25x+50. What do the slope and intercepts represent?

4. The equation y=−5x+100 represents the amount of fuel remaining in a tank after driving x miles. Identify and interpret the key features of the graph.

Lesson 4: Linear regression

Determine if the functions are linear or non-linear:

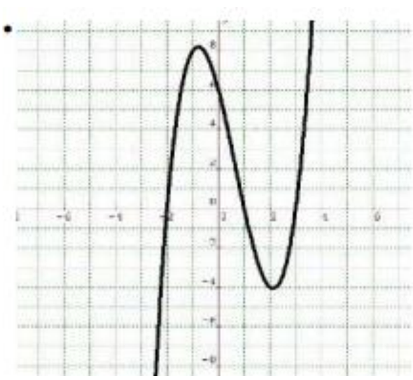
1. •

x	1	2	3	4
y	1	2	6	24

2.

x	y
1	4
2	8
3	12
4	16

3. •



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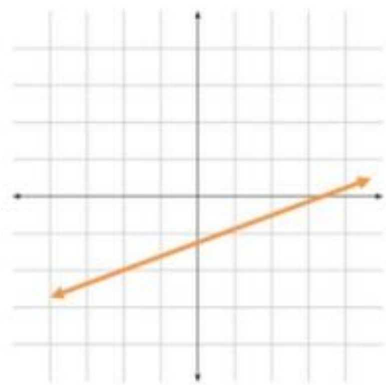
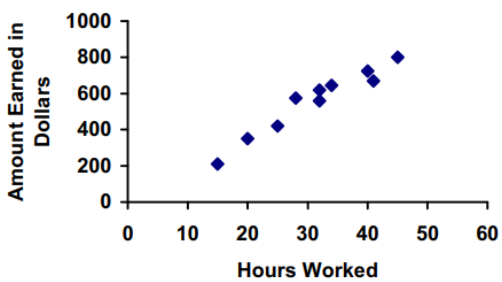


Determine the type of correlation:

1.



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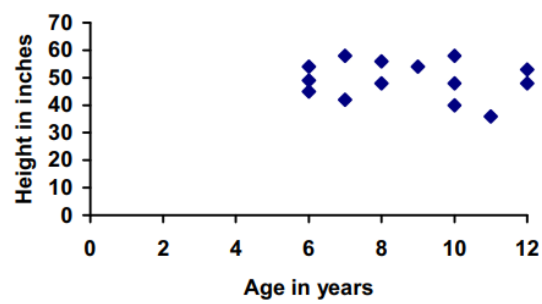

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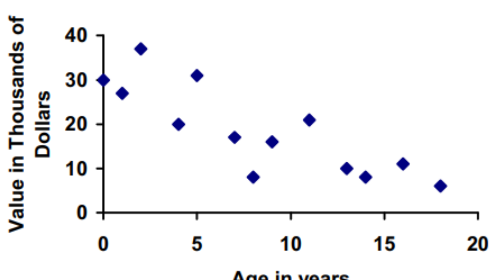

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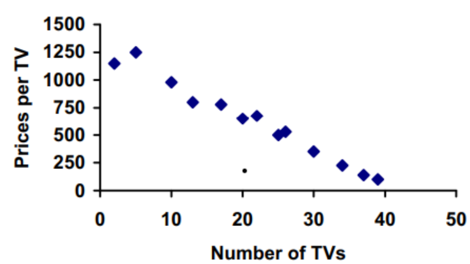


Determine whether the statements are examples of correlation or causation:

1. A study shows that as the number of hours spent studying increases, test scores also tend to increase.

2. A study shows that as the number of hours spent watching TV increases, the number of hours spent exercising decreases.

3. A person takes medication prescribed by a doctor to treat an infection, and over time, their infection improves.

4. A study finds that people who drink more soda tend to gain weight.

5. A study finds a strong correlation between the number of cigarettes smoked and the risk of lung cancer.

Find and graph the linear equation that models the data (use calculator):

1.

Femur length (cm)	Height (cm)
50.1	178.5
48.3	173.6
45.2	164.8
44.7	163.7
44.5	168.3
42.7	165.0
39.5	155.4
38.0	155.8

2.

High Temperature ($^\circ$F)	Number of Cans Sold
55	340
58	335
64	410
68	460
70	450
75	610
80	735
84	780

3.

Diameter (in.)	Age (years)
2.5	15
4.0	24
6.0	32
8.0	56
9.0	49
9.5	76
12.5	90
15.5	89

4.

Temperature ($^\circ$F)	Chirping Rate (chirps/min)
50	20
55	46
60	79
65	91
70	113
75	140
80	173
85	198
90	211

Lesson 5: Linear Inequalities in 2 Variables

Verify if the coordinate pair is in the inequality:

1. $y \leq 2x+3$; (1,4)

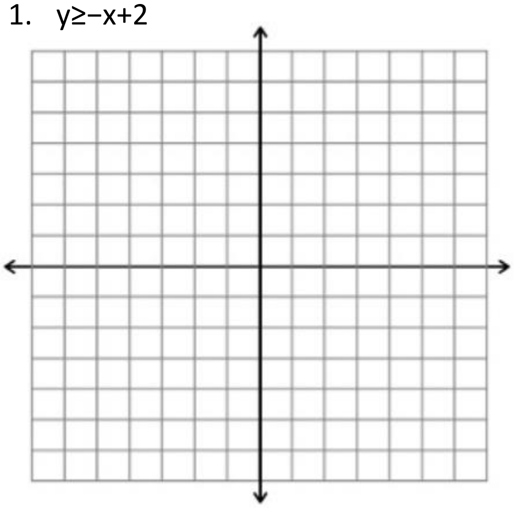
2. $3x-2y > 6$; (2,1)

3. $y \geq 3x-5$; (2,4)

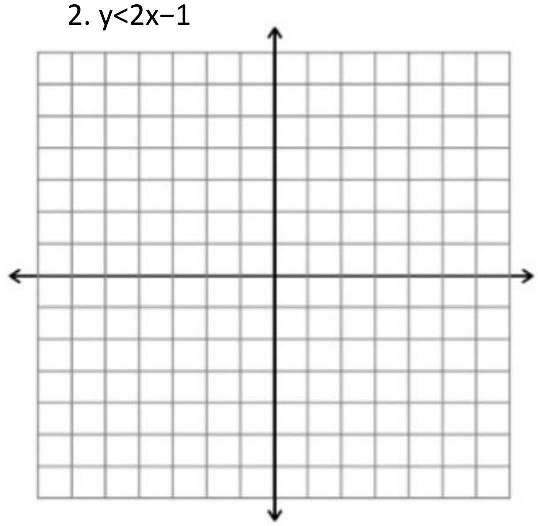
4. $5x-y \leq 10$; (4,2)

Graph the linear inequality on a coordinate plane:

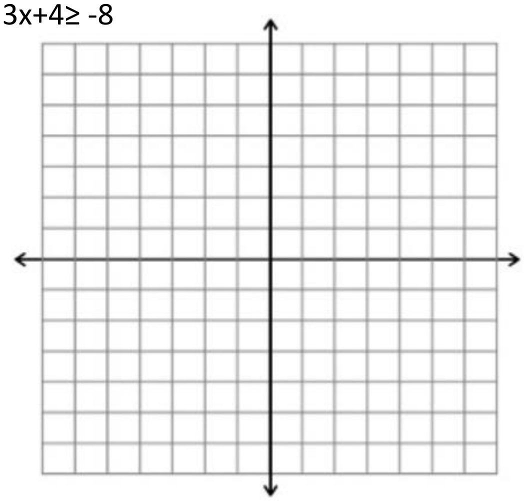
1. $y \geq -x+2$



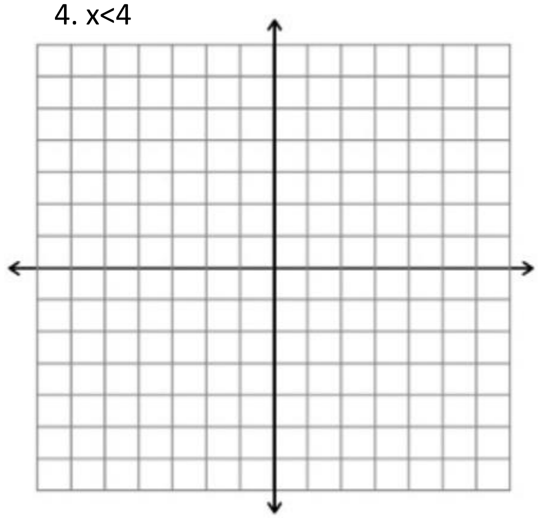
2. $y < 2x-1$



3. $3x+4 \geq -8$

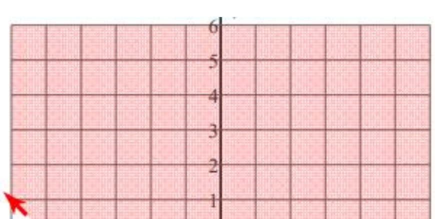


4. $x < 4$



Write the inequality from the graph:

Algebra



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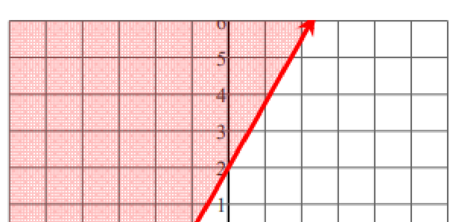
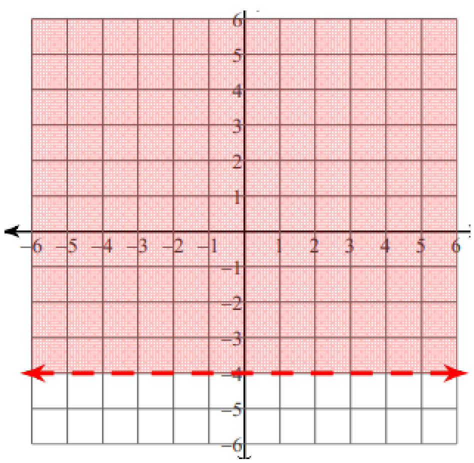


1.

2.

3.



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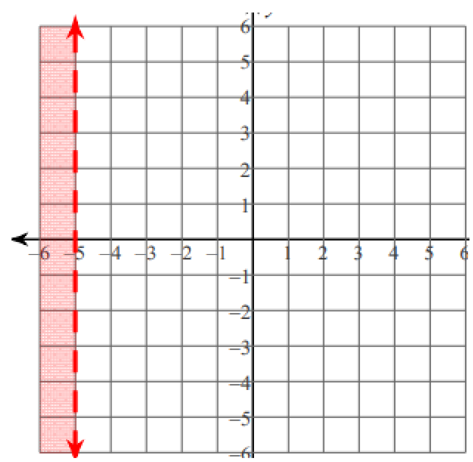


Word Problems:

1. A clothing store is having a sale on jackets and scarves. Each jacket costs $30, and each scarf costs $20. The store has a budget of $600 for the sale. Let x represent the number of jackets and y represent the number of scarves.

2. A small bakery sells muffins and cookies. The bakery has 200 grams of sugar available. Each muffin requires 25 grams of sugar, and each cookie requires 10 grams of sugar. Let x represent the number of muffins and y represent the number of cookies made.

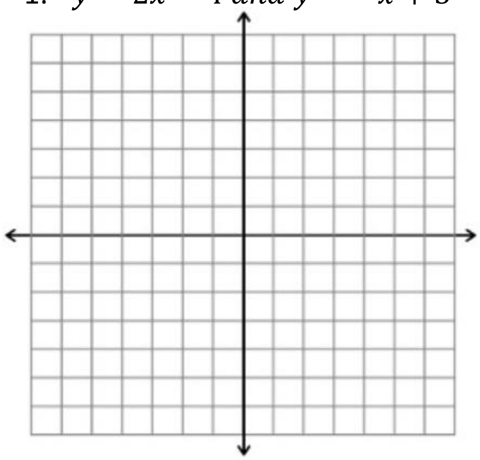
Unit 3: Systems of Linear Equations and Inequalities

Lesson 1: Representing Systems of Equations

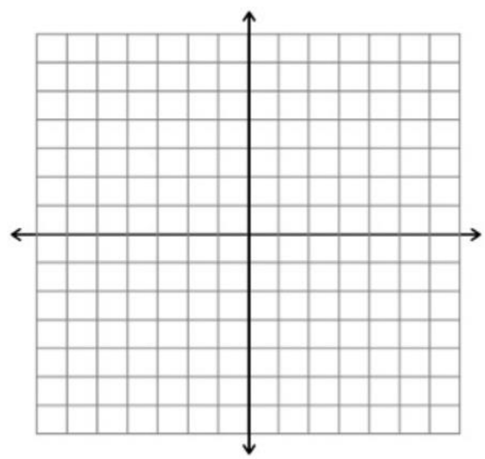
If your system has…	**then it will graph as:**	**Reasoning**
No solution	2 parallel lines	Parallel lines never intersect
One solution	2 lines intersecting at a single point	2 straight lines only have 1 intersection
Infinitely many solutions	1 line (lines overlapping/ one line on top of another making it look like 1 single line)	The graphs are the same

Graph the system of the linear equations and find the solution:

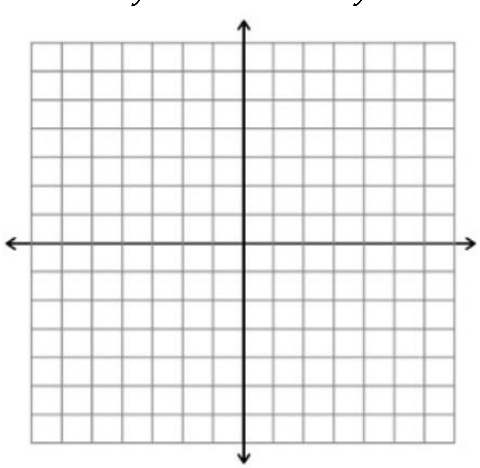
1. $y = 2x - 4 \; and \; y = -x + 5$



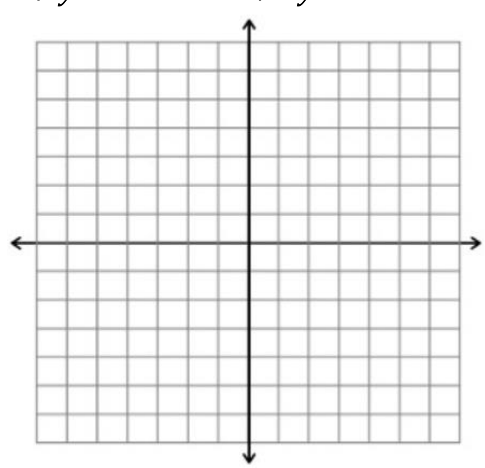
5. $y = x - 2 \; and \; 2x + y = -5$



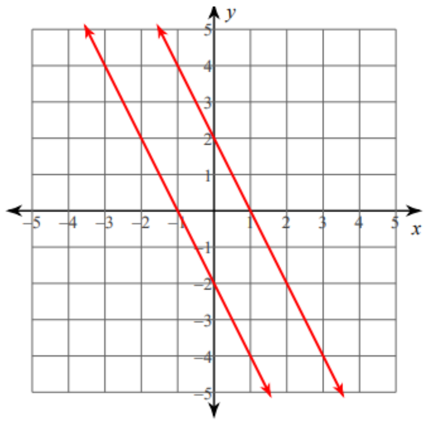
3. $2x - y = 2 \; and \; 3x + y = 18$

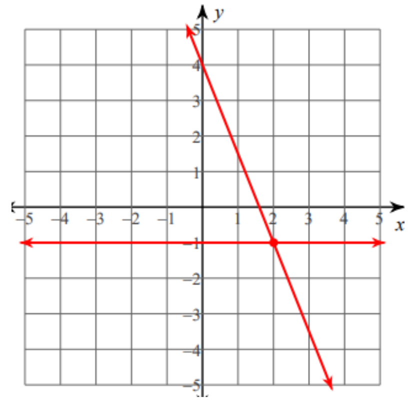


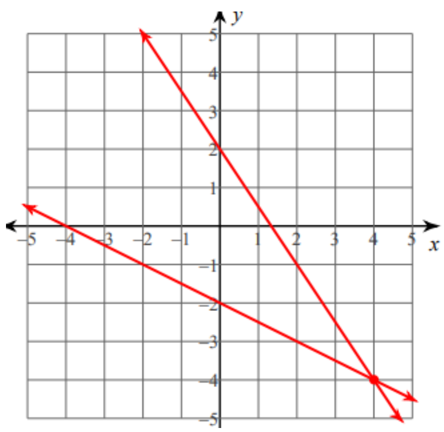
4. $x + y = 29 \; and \; x + 2y = 12$

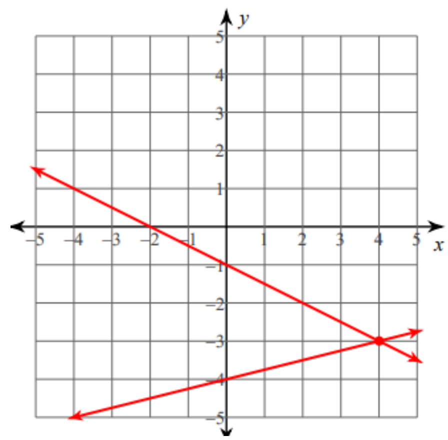


Write a system of equations for each graph and identify the solution:

1. 

2. 

3. 

4. 

Identify the systems of equations from a table:

1. A table shows the costs of two plans. Write a system of equations for the costs of Plan A and Plan B.

Gigabytes (GB)	Plan A Cost ($)	Plan B Cost ($)
0	20	10
1	22	13
2	24	16
3	26	19

2. A theater sells tickets for two categories: adults and children. The table shows the total revenue generated for different combinations of tickets sold. Write a system of equations to represent the revenue generated by adult and child tickets.

Adult Tickets	Child Tickets	Total Revenue ($)
5	10	100
8	5	110
10	0	120

3. A grocery store sells apples and oranges. The following table shows the total cost for different amounts. Write a system of equations to represent the cost of apples and oranges.

Apples (lbs)	Oranges (lbs)	Total Cost ($)
2	3	8
1	5	9
4	1	7

Lesson 2: Solving Systems of Equations

Solve the following systems using substitution:

1. $y = 2x + 1 \; and \; 3x - y = 4$
2. $x = 5y - 2 \; and \; 3x + 2y = 7$
3. $y = x + 3 \; and \; 2x + y = 12$
4. $y = -4x + 4 \; and \; 3x + 4y = 3$
5. $-2x + 5y = -7 \; and \; y = -6x + 5$
6. $y = -2x - 8 \; and \; y = 6x$

Solve the following systems using elimination:

1. $2x + 3y = 12 \; and \; 4x + 6y = 24$
2. $5x - 4y = 20 \; and \; 3x + 4y = 10$
3. $x - y = 6 \; and \; 2x + y = 10$
4. 4x + 8y = 20 and −4x + 2y = −30
5. $-6x + 6y = 6 \; and - 6x + 3y = -12$
5. x − y = 11 and 2x + y = 19

Choose the best method to solve the equations:

1. $2x + y = 8 \; and \; x = 4$
2. $3x - 2y = 4 \; and \; 6x - 4y = 8$
3. $y = -x + 3 \; and \; 2x + 2y = 6$
4. $8x + y = -16 \; and - 3x + y = -5$
5. $5x + 4y = -30 \; and \; 3x - 9y = -18$
6. $3x - 2y = 2 \; and \; 5x - 5y = 10$

Lesson 3: Systems of Linear Inequalities

Verify if the points given are a solution to the system of inequalities:

1. Point (2,3). Inequality: $y > 2x - 1 \ and \ y \leq x + 4$

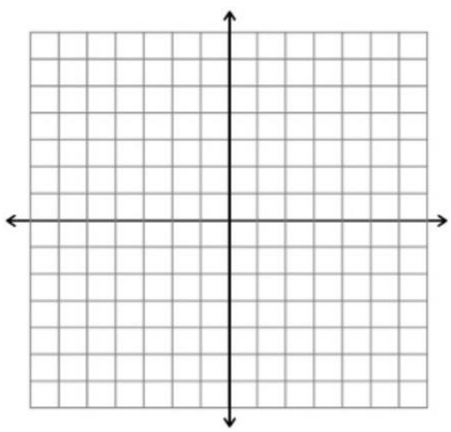
2. Point (-1,5). Inequality: $y \geq -3x + 2 \ and \ y < x + 6$

3. Point (0,-1). Inequality: $y < x - 2 \ and \ y > -2x + 1$

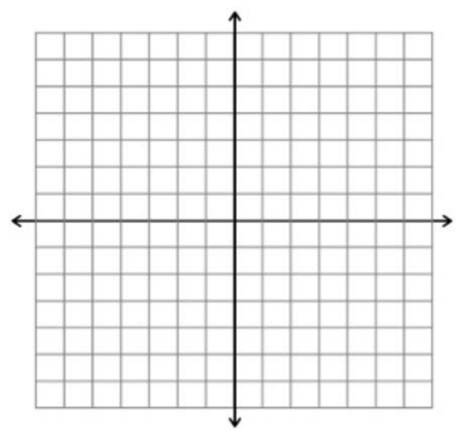
4. Point (4,0). Inequality: $y \leq \frac{1}{2}x + 2 \ and \ y > -x + 3$

Graph the systems of linear inequalities:

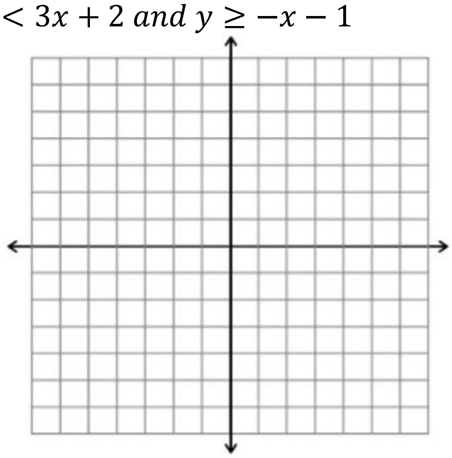
1. $y > 2x - 3 \ and \ y \leq -x + 4$



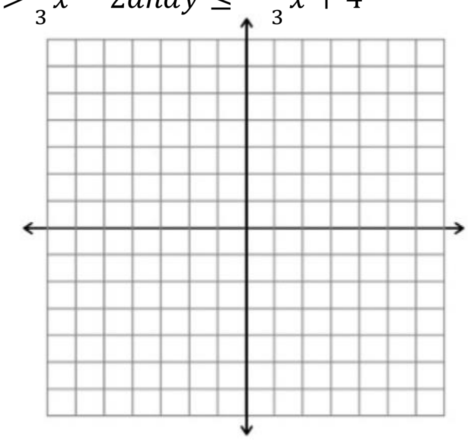
2. $y \geq -\frac{1}{2}x + 1 \ and \ y < x - 2$



3. $y < 3x + 2 \ and \ y \geq -x - 1$



4. $y > \frac{1}{3}x - 2andy \leq -\frac{2}{3}x + 4$



Unit 4: Operations of Polynomial Functions

Lesson 1: Adding and Subtracting Polynomials

Add or subtract the monomials:

1. $(4x + 1) + (6x + 7)$

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

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

4. $(6x + 4) - (2x + 4)$

5. $(8x^2 + x) - (x^2 + 3x)$

6. $4x^2 - 3x^2$

Simplify the polynomials by adding like terms:

1. $(5x + 2) + (4x + 5)$

2. $(3x + 3) + (4x - 2)$

3. $(9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$

4. $(-7x^5 + 14 - 2x) + (10x^4 + 7x + 5x^5)$

5. $(-4k^4 + 14 + 3k^2) + (-3k^4 - 14k^2 - 8)$

6. $(-x^4 + 13x^5 + 6x^3) + (6x^3 + 5x^5 + 7x^4)$

Simplify the polynomials by subtracting like terms:

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

2. $(8x^2 + x) - (x^2 + 3x)$

3. $(3 - 6n^5 - 8n^4) - (-6n^4 - 3n - 8n^5)$

4. $(13a^2 - 6a^5 - 2a) - (-10a^2 - 11a^5 + 9a)$

5. $(10p^4 + 11) - (11p^4 + 13 + 16p^2)$

6. $(20v^2 - 9v^3) - (7v^3 - 10v^4 - 14v^2)$

Additional Practice:

17) $(7 - 13x^3 - 11x) - (2x^3 + 8 - 4x^5)$

18) $(13a^2 - 6a^5 - 2a) - (-10a^2 - 11a^5 + 9a)$

19) $(3v^5 + 8v^3 - 10v^2) - (-12v^5 + 4v^3 + 14v^2)$

20) $(8b^3 - 6 + 3b^4) - (b^4 - 7b^3 - 3)$

21) $(k^4 - 3 - 3k^3) + (-5k^4 + 6k^3 - 8k^5)$

22) $(-10k^2 + 7k + 6k^4) + (-14 - 4k^4 - 14k)$

Lesson 2: Multiplying Monomials and Polynomials

Multiply the monomial:

1. 8x(6x + 6)
2. 2(9x – 2y)
3. 8(2 – x)
4. 5(3x – 6y)
5. 6x(x + 2y)
6. 12x(3x + 9)

Multiply the polynomials:

1. $3x(-2x\ 2y + 3y)$
2. $2x^2(3x^2 - 5x + 12)$
3. $2x^3(2x^2 + 5x - 4)$
4. $)2x(2x^2 - 3xy + 2x)$
5. $-x(-x^2 - 5x + 4xy)$
6. $3(x^2 - 4xy - 8)$

Additional Practice:

1. $(-2x^3)(5x^2y)$
2. $(3x^2)(4x^3)$
3. $-7x^2(3x^3 + 2x - 4)$
4. $2xy(4x^2y - 3x + 6)$
5. $-5y^2(3y^3 - 2y + 7)$
6. $(2x + 5)(x^2 - 3x + 4)$
7. $(x^2 + 2x + 1)(x - 1)$
8. $(3x - 4y)(2x + y)$
9. $(x^2 - 3x + 2)(2x^2 + x - 1)$
10. $(3x - 1)(4x^2 + 2x + 5)$

Lesson 3: Dividing Monomials and Polynomials

Divide the Monomials:

1) $\frac{2r^4}{r^4}$

2) $\frac{3v^4}{v^3}$

3) $\frac{12x^3}{4x}$

4) $\frac{5xy^3}{xy^2}$

5) $\frac{12x^2y^5}{6xy^2}$

6) $\frac{15h^3j^{10}k^{12}}{10h^2j^6k^7}$

Divide the Polynomials:

1. $\frac{6x^2+12x}{3x}$

2. $\frac{-15x^3y+10x^2y^2}{5x^2y}$

3. $\frac{8x^3y^2-4x^2y+12xy}{4xy}$

4. $\frac{21x^4y^3-14x^3y^2+7x^2y}{7x^2y}$

5. $\frac{2x^2-5x+3}{x-1}$

6. $\frac{4x^3-8x^2+6x}{2x}$

7. $\frac{3x^3+4x^2-x-6}{x+2}$

8. $\frac{2x^3-3x^2+4x-6}{x-1}$

Extra Practice:

1. $\frac{18x^4y^3z^2}{-6x^2y^2z}$

2. $\frac{10x^3y^4-5x^2y^3+15xy}{5xy}$

3. $\frac{x^3+2x^2-3x-6}{x+3}$

4. $\frac{6x^4+9x^3-3x^2}{3x^2}$

5. $\frac{2x^4-5x^3+4x^2-3x+1}{x^2-x+1}$

6. $\frac{-36x^6y^5z^4}{12x^3y^3z^2}$

7. $\frac{x^4-3x^3+2x^2-x+5}{x^2-1}$

8. $\frac{50x^6y^5z}{10x^2y^3}$

9. $\frac{-24x^6y^4}{8x^3y^2}$

10. $\frac{36x^5y^8}{9x^4y^7}$

Lesson 4: Factoring Polynomials

Factor out the greatest common factor (GCF):

1. $6x^3 + 9x^2$
2. $15x^4y^2 - 10x^3y$
3. $14x^6y^4 + 21x^4y^3 + 7x^2y^2$
4. $-20x^4y^2 + 10x^3y - 5x^2y^3$

Factor the following trinomials:

1. $x^2 + 5x + 6$
2. $x^2 + 7x - 8$
3. $2x^2 + 9x + 7$
4. $5x^2 + 8x - 4$
5. $3x^2 - 11x - 4$
6. $x^2 + 10x + 24$

Factor the following polynomials by grouping:

1. $x^3 + 3x^2 + 2x + 6$
2. $2xy + 6x + ay + 3a$
3. $3x^3 - 6x^2 + 5x - 10$
4. $xy - 2x + 3y - 6$
5. $x^3 - 4x^2 + 2x - 8$
6. $5x^3 - 10x^2 + 3x - 6$
7. $x^3 + 2x^2 + x + 2$
8. $2xy - 4x + ay - 2a$

Factor the perfect square trinomials:

1. $x^2 + 6x + 9$
3. $x^2 + 10x + 25$

2. $4x^2 + 12x + 9$

4. $x^2 - 16x + 64$

Factor using difference of two squares:

1. $x^2 - 16$

3. $36x^2 - 121$

2. $9x^2y^2 - 25z^2$

4. $9x^2 - 49$

Additional practice:

1. $4x^3 + 8x^2 - 12x$

5. $x^4 - 16$

2. $x^4 - 5x^2 + 4$

6. $4x^2 - 8x + 3x - 6$

3. $2x^3 - x^2 - 18x + 9$

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

4. $x^6 - 64$

8. $3x^4 - 9x^3 + 2x^2 - 6x$

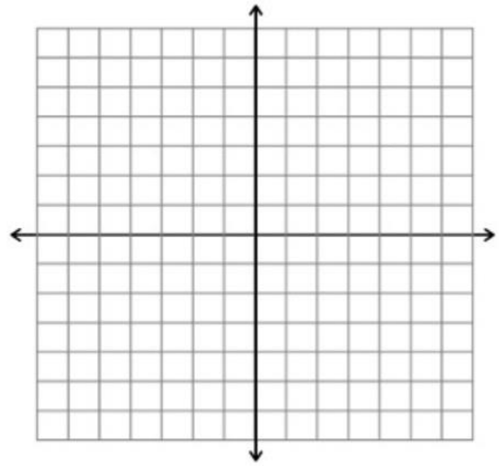
Unit 5: Graphs of Quadratic Functions

Lesson 1: Graphing and Writing Quadratic Functions

Graph the following quadratic function with a table:

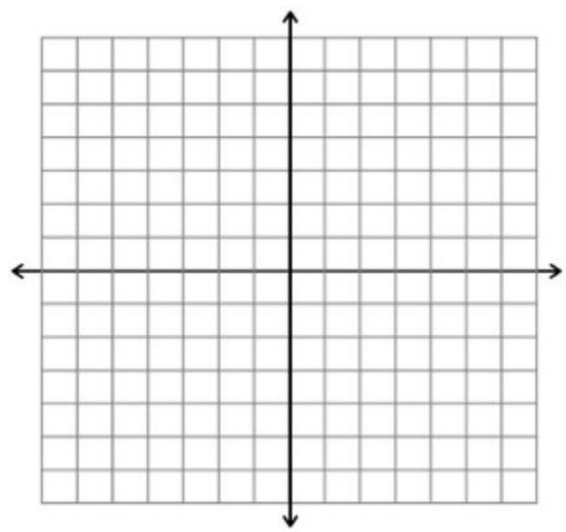
1. $f(x) = x^2 - 4x + 3$

X	y

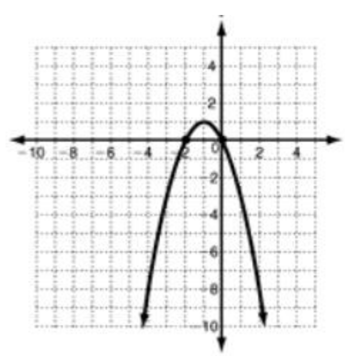


2. $f(x) = -2x^2 + 4x - 1$

x	y

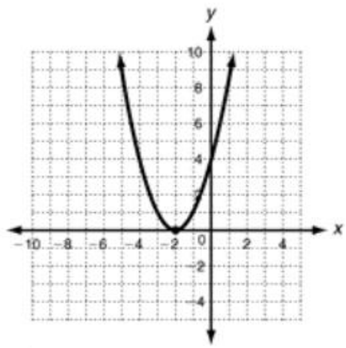


Identify the Key Features of Quadratic Functions from the Graphs:



Zeros:

Axis of symmetry:

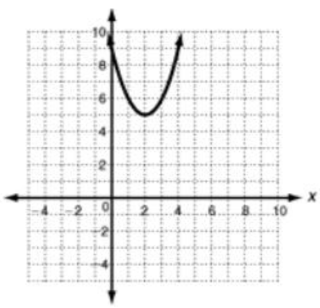


Zeros:

Axis of symmetry:

Max or Min:

Vertex:

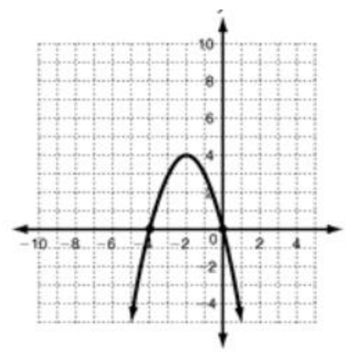


Zeros:

Axis of symmetry:

Max or Min:

Vertex:



Zeros:

Axis of symmetry:

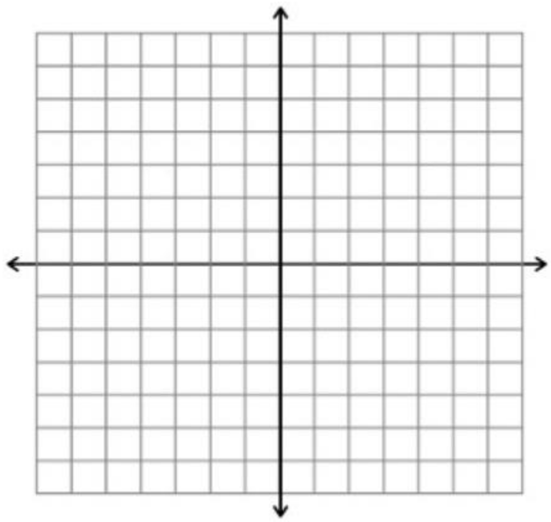
Max or Min:

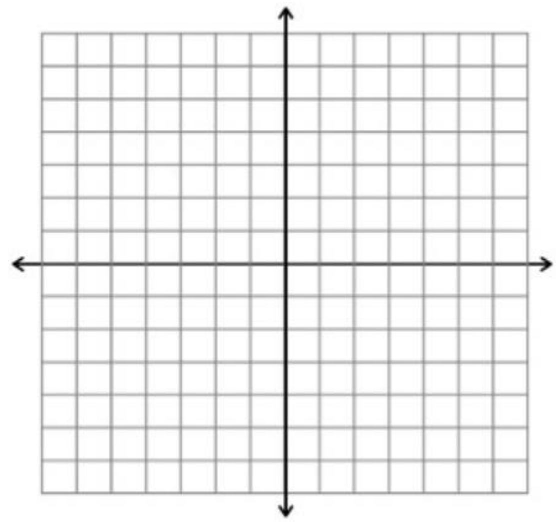
Vertex:

Graph/ Apply the following transformations to the parent function $f(x) = x^2$:

1. Horizontal shift right 4, vertical shift up 3

2. Vertical stretch by 2, horizontal shift left 1, vertical shift down 2





Identify the transformations that occurred to the parent function $f(x) = x^2$:

1. $g(x) = (x - 3)^2 + 4$

2. $g(x) = 2(x - 2)^2$

3. $g(x) = 0.5(x - 2)^2 - 2$

4. $(\frac{1}{3}x)^2$

5. $\frac{1}{5}(x)^2 - 4$

6. $3(\frac{1}{4}x + 7)^2 + 12$

Write an equation in vertex form with the given information:

1. vertex at (2,3) and a point on the graph (4,7)

2. vertex at (−1,−2) and a point on the graph (1,6)

3. vertex at (4,5) and a point on the graph at (6,1)

4. vertex at (−2,3) and a point on the graph at (0,7)

Write the equation of a quadratic function that has the following properties:

1. The vertex is at (0,0). The parabola passes through the point (2,4).

2. The vertex is at (3,−2). The parabola passes through the point (4,0)

3. The vertex is at (1,2). The parabola passes through the point (4,−1)

4. The vertex is at (−1,5). The parabola passes through the point (1,1)

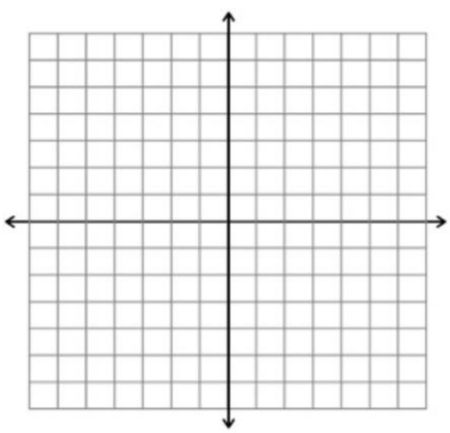
Lesson 2: Solving Quadratic Equations by Graphing and Factoring

Solve the Quadratics by Factoring and Find the Zeros:

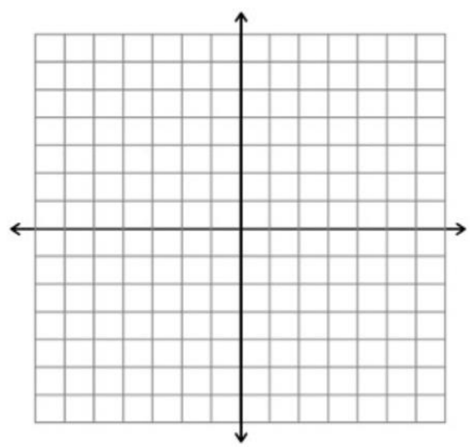
1. $x^2 - 5x + 6 = 0$
2. $2x^2 + 7x - 3 = 0$
3. $x^2 + 8x + 15 = 0$
4. $3x^2 - 14x + 8 = 0$
5. $x^2 - 9 = 0$
6. $15x^2 + 4x - 4 = 0$
7. $6x^2 - 42x + 72 = 0$
8. $x^2 = 2x$
9. $x^2 - 64 = 0$
10. $3k^2 - 18k - 21 = 0$

Graph and find the point of intersection for the following equations:

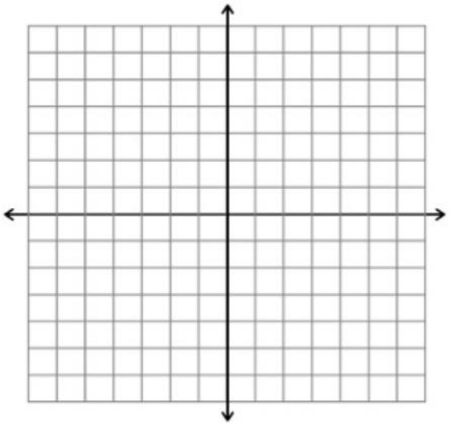
1. $y = x^2 + 2x - 3$ *and* $y = 4$



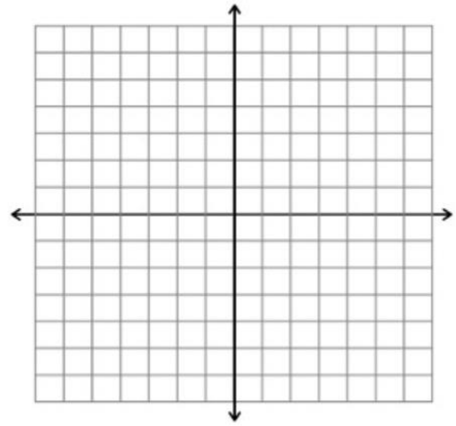
2. $y = 2x^2 + 3x$ *and* $y = 5$



3. $y = x^2 - 6x + 9 \text{ and } y = 2$



4. $y = x^2 + 5x \text{ and } y = 3$



Word Problems:

1. A projectile is launched from a height of 20 meters with an initial velocity of 25 meters per second. The height, h, of the projectile as a function of time, t, is given by the equation $h(t) = -5t^2 + 25t + 20$. At what times will the projectile hit the ground (when h(t)=0)?

2. A ball is thrown from the top of a building with an initial velocity. Its height hhh in meters is given by the equation $h(t) = -4.9t^2 + 20t + 30$. Solve for the time, t, when the ball will hit the ground.

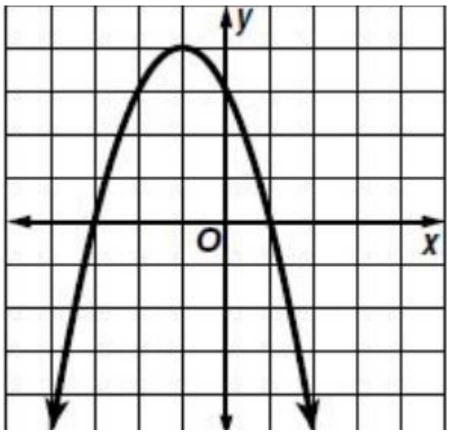
3. A soccer ball is kicked upward, and its height in meters after t seconds is given by the equation $h(t) = -4.9t^2 + 14t + 2$. How long will it take for the soccer ball to reach the ground?

4. The height, h, of a dropped object after t seconds is modeled by the equation $h(t) = -16t^2 + 48t$. How long will it take for the object to hit the ground?

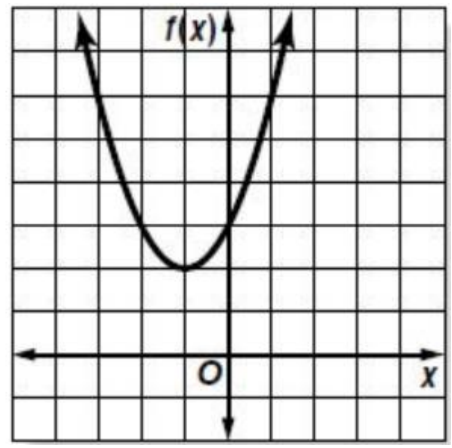
Lesson 3: Connections and Applications of Quadratic Graphs

Write quadratic equations given a graph of its related function and the solutions to the equation:

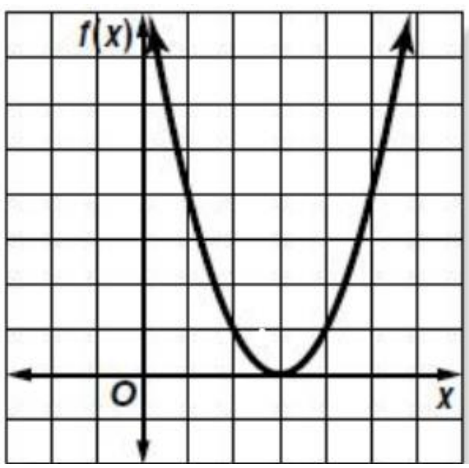
1.



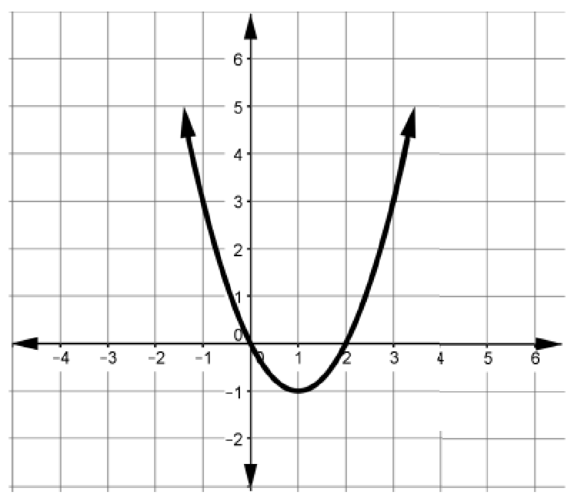
2.



3.



4.



Write the equation of a quadratic function with the following features:

1. The graph has zeros at x=−2 and x=4. The parabola passes through the point (0,−8).

2. Zeros at x=0 and x=5. The graph passes through (2,−10).

3. A parabola has a vertex at (−2,1) and passes through the point (0,−7). (write in vertex form).

4. A parabola has a vertex at (1,−9) and passes through the point (3,−1). (write in vertex form).

Word Problems:

1. A football is kicked into the air, and its height h(t) in meters after t seconds is modeled by the equation $h(t) = -5t^2 + 20t$. How long will it take for the football to hit the ground? At what time does the football reach its maximum height? What is the maximum height?

2. A toy rocket is launched from the ground with an initial velocity. Its height is modeled by the equation $h(t) = -16t^2 + 64t$. When will the rocket return to the ground? How high does the rocket go?

3. A company's profit in thousands of dollars is modeled by the equation $P(x) = -x^2 + 6x$. Find the number of units x that will result in zero profit. At what number of units is the company's profit maximized? What is the maximum profit?

4. The area of a rectangular garden is modeled by the equation $A(x) = x^2 - 10x + 21$. Factor the equation to find the dimensions x of the garden when the area is zero. Explain what the solutions mean in this context.

Unit 6: Solving Quadratic Equations

Perfect squares fill the blank.

$\sqrt{1} = 1$ because $1^2 = 1$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{25} = 5$ because $5^2 = 25$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{49} = 7$ because $7^2 = 49$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{100} = 10$ because $10^2 = 100$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{144} = 12$ because $12^2 = 144$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{196} = 14$ because $14^2 = 196$

$\sqrt{15} = 225$ because $15^2 = 225$

$\sqrt{256} = 16$ because $16^2 = 256$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{361} = 19$ because $19^2 = 361$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{441} = 21$ because $21^2 = 441$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{576} = 24$ because $24^2 = 576$

$\sqrt{625} = 25$ because $25^2 = 625$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{729} = 27$ because $27^2 = 729$

$\sqrt{784} = 28$ because $28^2 = 784$

$\sqrt{\qquad} =$ _____ because _____$^2 =$ _______

$\sqrt{900} = 30$ because $30^2 = 900$

Lesson 1: Simplifying Radical Expressions

Simplify each expression by factoring to find perfect squares and then taking their root.

1) $\sqrt{75}$

2) $\sqrt{16}$

3) $\sqrt{36}$

4) $\sqrt{64}$

5) $\sqrt{80}$

6) $\sqrt{30}$

7) $\sqrt{8}$

8) $\sqrt{18}$

9) $\sqrt{32}$

10) $\sqrt{12}$

11) $\sqrt{8}$

12) $\sqrt{108}$

13) $\sqrt{125}$

14) $\sqrt{50}$

15) $\sqrt{175}$

16) $\sqrt{28}$

17) $\sqrt{45}$

18) $\sqrt{72}$

19) $\sqrt{20}$

20) $\sqrt{150}$

Add or subtract radicals by simplifying each term and then combining like terms

1) $3\sqrt{6} - 4\sqrt{6}$

2) $-3\sqrt{7} + 4\sqrt{7}$

3) $-11\sqrt{21} - 11\sqrt{21}$

4) $-9\sqrt{15} + 10\sqrt{15}$

5) $-10\sqrt{7} + 12\sqrt{7}$

6) $-3\sqrt{17} - 4\sqrt{17}$

7) $-10\sqrt{11} - 11\sqrt{11}$

8) $-2\sqrt{3} + 3\sqrt{27}$

9) $2\sqrt{6} - 2\sqrt{24}$

10) $2\sqrt{6} + 3\sqrt{54}$

11) $-\sqrt{12} + 3\sqrt{3}$

12) $3\sqrt{3} - \sqrt{27}$

13) $3\sqrt{8} + 3\sqrt{2}$

14) $-3\sqrt{6} + 3\sqrt{6}$

Simplify the expression

1) $\sqrt{6} \cdot 4\sqrt{6}$

2) $-\sqrt{5} \cdot \sqrt{20}$

3) $-\sqrt{2} \cdot \sqrt{3}$

4) $4\sqrt{8} \cdot \sqrt{2}$

5) $\sqrt{12} \cdot \sqrt{15}$

6) $\sqrt{5} \cdot -2\sqrt{5}$

7) $-3\sqrt{5} \cdot \sqrt{20}$

8) $\sqrt{15} \cdot 3\sqrt{5}$

9) $\sqrt{9} \cdot \sqrt{3}$

10) $-4\sqrt{8} \cdot \sqrt{10}$

11) $\frac{\sqrt{8}}{\sqrt{7}}$

12) $\frac{7}{8\sqrt{7}}$

13) $\frac{\sqrt{2}}{\sqrt{6}}$

14) $\frac{\sqrt{21}}{\sqrt{15}}$

Additional Practice

1. $\sqrt{5}\,\sqrt{15}$

2. $\sqrt{14}\,\sqrt{35}$

3. $\sqrt{2}\,(\sqrt{3} - \sqrt{5})$

4. $\sqrt{3}\,(\sqrt{27} - \sqrt{3})$

5. $\sqrt{2}\,(\sqrt{6} + \sqrt{10})$

6. $\sqrt{7}\,(3 - \sqrt{7})$

7. $\sqrt{5}\,(3\sqrt{5} - 4\sqrt{3})$

8. $\sqrt{y}\,(\sqrt{y} - \sqrt{5})$

9. $\sqrt{\frac{27}{16}}$

10. $\sqrt{\frac{14}{y^2}}$

11. $\sqrt{\frac{24}{25}}$

12. $\sqrt{\frac{7}{5}}$

13. $\sqrt{\frac{10}{7}}$

14. $\frac{2}{\sqrt{3}}$

15) $-3\sqrt{20}-\sqrt{5}$

16) $2\sqrt{45}-2\sqrt{5}$

17) $3\sqrt{18}-2\sqrt{2}$

18) $-3\sqrt{18}+3\sqrt{8}-\sqrt{24}$

Lesson 2: Solve Quadratic Equations by Square Root Method

A. Solve for the roots of the following quadratic equations by extracting the roots.

1. $x^2 = 121$
2. $4x^2 - 3 = 9$
3. $5x^2 - 100 = 0$
4. $4x^2 - 100 = 0$
5. $m^2 + 12 = 48$

B. Use the square root property to solve for the roots of the following quadratic equations.

1. $(x + 4)^2 = 36$
2. $(x + 1)^2 = 14$
3. $4(x - 5)^2 = 20$
4. $3(x - 3)^2 = 27$
5. $2(3x + 1)^2 - 8 = 0$

Multiple choice

1. $x^2 = 100$

   [A] $\sqrt{10},\ -\sqrt{10}$ [B] $\sqrt{10}$

   [C] 10 [D] $-10,\ 10$

2. $x^2 = 121$

   [A] $\sqrt{11},\ -\sqrt{11}$ [B] $\sqrt{11}$

   [C] $-11,\ 11$ [D] 11

3. $x^2 = 36$

   [A] $\sqrt{6}$ [B] $-6,\ 6$

   [C] $\sqrt{6},\ -\sqrt{6}$ [D] 6

4. $x^2 = 25$

   [A] $-5,\ 5$ [B] $\sqrt{5},\ -\sqrt{5}$ [C] $\sqrt{5}$ [D] 5

Solve each equation.

1) $\sqrt{x} = 10$

2) $10 = \sqrt{\frac{m}{10}}$

3) $\sqrt{v-4} = 3$

4) $6 = \sqrt{v-2}$

5) $\sqrt{n} = 9$

6) $5 = \sqrt{x+3}$

7) $2 = \sqrt{4b}$

8) $\sqrt{n+9} = 1$

9) $-8 + \sqrt{5a-5} = -3$

10) $10\sqrt{9x} = 60$

Lesson 3 Solve Quadratic Equations by Completing the Square

Solve each of the following quadratic equations by completing the square.

1. $x^2+4x-6=0$
2. $x^2-8x-5=0$
3. $x^2-12x+15=0$
4. $x^2-5x+3=0$
5. $-x^2+3x-5=0$
6. $x^2+5x-3=0$
7. $-2x^2+8x-18=0$
8. $4x^2-16x+12=0$
9. $3x^2-18x-12=0$
10. $5x^2-3x+2=0$
11. $3x^3-2x-4=0$
12. $-2x^2+3x+7=0$

Lesson 4: Solve Quadratic Equations by Quadratic Formula

The Quadratic Formula: For quadratic equations: $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Solve each equation using the Quadratic Formula.

1. $4x^2 + 11x - 20 = 0$
2. $x^2 - 5x - 24 = 0$
3. $x^2 = 3x + 3$
4. $x^2 + 5 = -5x$
5. $x^2 = -x + 1$
6. $4x^2 - 1 = -8x$
7. $4x^2 + 7x - 15 = 0$
8. $x^2 + 3x - 10 = 0$

1) State the formula for the Quadratic Formula:

2) State the formula for the discriminant, and describe how to interpret it.

Use the discriminant to determine the number of real solutions to each equation.

3) $2k^2 - 2k - 3 = 0$

4) $p^2 + 6p + 9 = 0$

5) $-6b^2 + 10b - 15 = -8$

6) $6n^2 + 2n - 10 = -2$

Solve each equation with the quadratic formula.

7) $n^2 - 4n - 5 = 0$

8) $4r^2 + 4r - 120 = 0$

9) $-3x^2 - 3x + 6 = 0$

10) $2x^2 - 8x + 8 = 0$

Additional Practice

1. $2x^2 - 3 = -3x$

2. $6x^2 - x - 5 = 0$

3. $4x + 1 = 5x^2$

4. $-8x^2 + 5 = -4x$

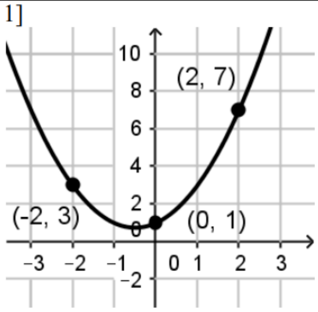
5. $4x^2 - 6x + 2 = 0$

6. $3x^2 - 3x + 8 = 0$

Lesson 5: Quadratic Regression

Write the quadratic function in standard form for each parabola graphed below and use it to find the missing information.

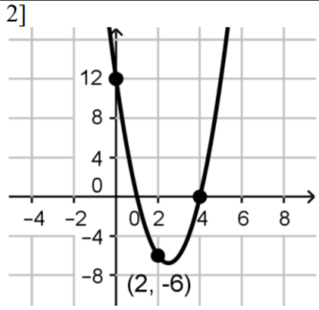
1]



y =

Find the coordinates of the vertex.

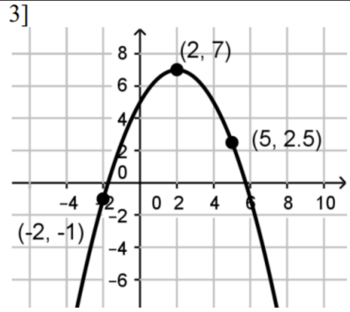
2]



y =

(-2, ______) and (5, _______) are also on the graph.

3]



y =

Find the coordinates of the y-int.

1. The table shows the monthly sales (thousands) for a new hair salon since its grand opening in March.

Month	0	1	2	3	4	5
Sales	5.6	5.8	6.2	6.9	7.9	9.0

1) Find the best fitting quadratic model. ______________________________

2) What is the prediction for total sales in September? __________________

3) How do you know that the better model to use a quadratic fit rather than a linear fit?

2. The following data represents the average maximum and minimum temperatures recorded each month in Raleigh, NC, over a 6-month period. The temperatures recorded are in degrees Fahrenheit.

Max	72.3	79.0	85.2	88.2	87.1	81.6
Min	46.5	55.3	62.6	67.1	68.0	60.4

(A) Find the QUADRATIC equation that best models the data.

(B) Predict minimum temperature if the maximum temperature is 90.

(C) Predict the maximum temperature if the minimum temperature is 40.

Word problems

1) A square field had 3 m added to its length and 2 m added to its width. The field then had an area of 90 m^2. Find the length of a side of the original field.

2) The altitude of a triangle is 2 cm shorter than its base. The area is 15 cm^2. Find the base of the triangle.

3) The perimeter of a garden is 34 feet. It covers an area of 60 square feet. Find the dimensions of the garden (assume it is rectangular).

4) A rectangular painting measures 3 m by 5 m. A frame of uniform width is put around the painting. If the painting and the frame together cover an area of 39 m^2, how wide is the frame?

Write an equation for each Parabola

5. Focus (-2, 3); Vertex (-2, 5)

6. Focus (1, 3); Dir: $y = 1$

7. Vertex (3, -2); Dir: $y = -4$

8. Vertex (-1, 2); Focus (-1, 0)

9. Vertex (0, 4); Dir: $y = 2$

10. Focus (0, 0); Dir $y = 4$

Lesson 6: Solving Quadratic Equations by Best Method

	Equation	A	B	C	D
1	$x^2 + 4x + 3 = 0$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
2	$5x^2 - 1 = 6$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
3	$x^2 - 7x + 1 = 0$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
4	$x^2 + 10x + 4 = 0$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
5	$x^2 - 14x = 5$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
6	$5 - 3x^2 = 20$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
7	$x^2 + x = 10$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form
8	$x^2 - 4x - 12 = 0$	Sq. Roots	Factor/ZPP	Complete Sq.	Quad. Form

Choose which method is best

1. $y = 2\,(x + 2)^2 + 24$	2. $y = x^2 - 6x + 8$
3. $y = 2x^2 - 5x - 12$	4. $y = x^2 - 12x + 1$

Find the discriminant and determine the number and type of solutions.

	Discriminant	Number and Type of Solutions
5. $y = 3x^2 - 3x + 2$		
6. $y = x^2 - 10x + 1$		
7. $y = x^2 - 4x + 4$		

Unit 6 Review

Solving Quadratic Equations:

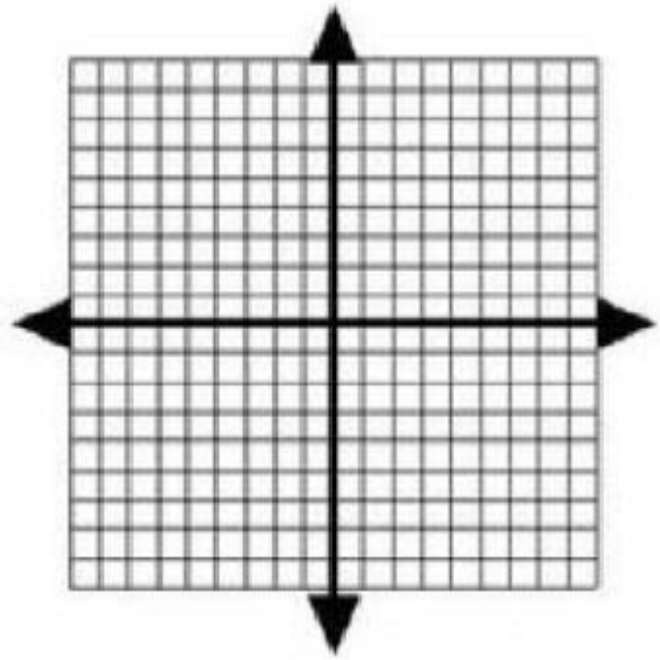
1. Solve for x: $x - 4 = \frac{-3}{x}$

2. Find the roots of $3x^2 - 5x = 36 - 2x$

3. Solve for x in simplest form: $3x^2 + 25 = 0$

4. Solve for x: $5(x-1)^2 = 50$

5. Use graphing to solve the given equation for x: $x^2 + 5x + 6 = 0$



6. Find the zeros of $f(x) = 4x^2 - 16 - 20$

7. Solve for x in simplest form: $(2x + 3)(x - 4) = 2x^2 + 13x + 15$

8. Solve for x: $x^2 + x - 1 = (-4x + 3)^2$

Solving Quadratics by Completing the Squares

1. Find the value of c that makes the expression a perfect square trinomial. Then write the expression as the square of a binomial.

$x^2 + 10x + c$	$y^2 - 7y + c$

2. Solve the following equations by completing the square and express the results in simplest form.

a. $x^2 + 6x + 3 = 0$

b. $t(t - 8) = 5$

c. $7y^2 + 28y + 56 = 0$

d. $4x^2 - 30x = -9 - 10x$

3. Determine whether you would use factoring or the square root method to solve each equation. Then solve the equation.

a. $x^2 - 4x - 21 = 0$

b. $(x+4)^2 = 16$

c. $5x^2 - 10x + 1 = 2x^2 - 5x + 13$

d. $(x+3)^2 = 17x + 21$

4. Error Analysis: Describe and correct the error in solving the equation below

$$4x^2 + 24x - 11 = 0$$

$$4(x^2 + 6x) = 11$$

$$4(x^2 + 6x + 9) = 11 + 9$$

$$4(x+3)^2 = 20$$

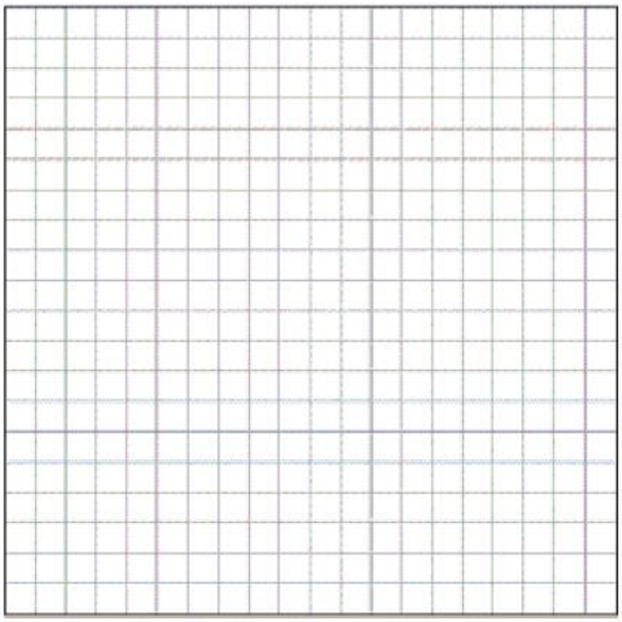
$$(x+3)^2 = 5$$

$$x + 3 = \pm\sqrt{5}$$

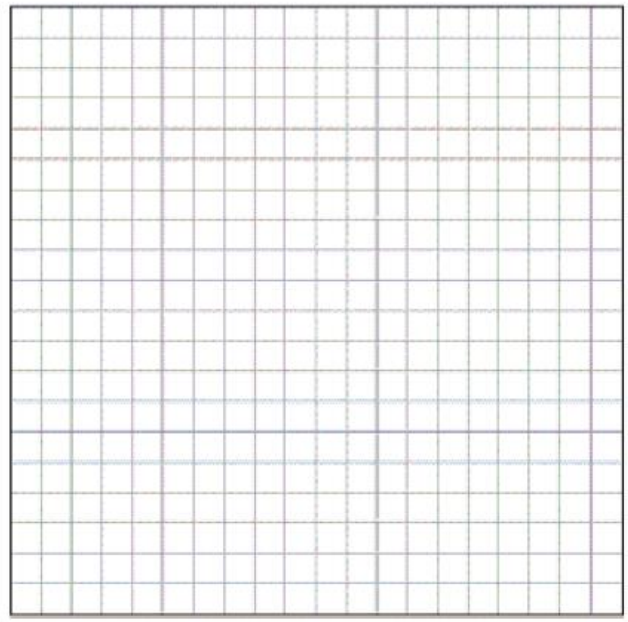
$$x = -3 \pm \sqrt{5}$$

5. Determine the roots of the following equations graphically:

a. $x^2 - 5x - 14 = 0$



b. $x^2 = 9$



6. The zeros of the function $f(x) = (x + 2)^2 - 25$ are

1) -2 and 5 2) -3 and 7 3) -5 and 2 4) -7 and 3

7. A student was given the equation $x^2 + 6x - 13 = 0$ to solve by completing the square. The first step that was written is shown below.

$$x^2 + 6x = 13$$

The next step in the student's process was $x^2 + 6x + c = 13 + c$. State the value of c that creates a perfect square trinomial. Explain how the value of c is determined.

Solving Quadratics by using the Quadratic Formula

1. Solve the following equations by using the quadratic formula and express the results in simplest form.

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

b. $2y^2 + 3y - 5 = 4$

2. Matt's rectangular patio measures 9 feet by 12 feet. He wants to increase the patio's dimensions so its area will be twice the area it is now. He plans to increase both the length and the width by the same amount, x. Find x, to the *nearest hundredth of a foot.*

3. Determine the best method to solve each equation and use it to find all values of x in simplest form.

a. $x^2 - 2x = 12$	b. $(x-2)^2 = 8$
c. $2x^2 - 54 = 12x$	d. $5x^2 + 38 = 3$

4. Find all real solutions to the equation $(x^2 - 6x + 3)(2x^2 - 4x - 7) = 0$

Solving System of Equations Graphically

1. Which of the following systems of equations has exactly one point of intersection?

(1) $y = x^2 - 5x + 7$ and $y - 1 = 2x$

(2) $y - 4x^2 = x - 3$ and $y = 3$

(3) $y - x^2 = 2x + 4$ and $y = 3$

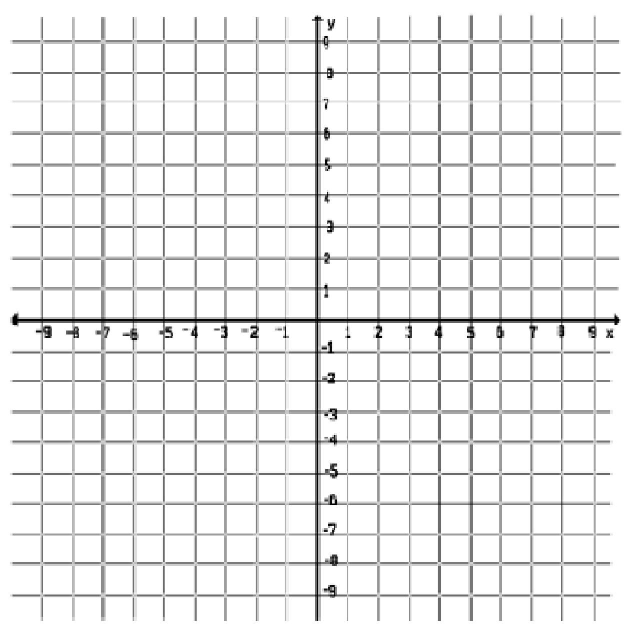
(4) $y + 9x^2 = -8$ and $y = -1$

2. Given the equation of a circle is $3x^2 + 3y^2 - 12x + 30y - 10 = 0$, state the length of the radius and coordinates of the center.

3. Find all values of k so that the following system has exactly one solution. Illustrate with a graph.

$$y = 5 - (x - 3)^2$$

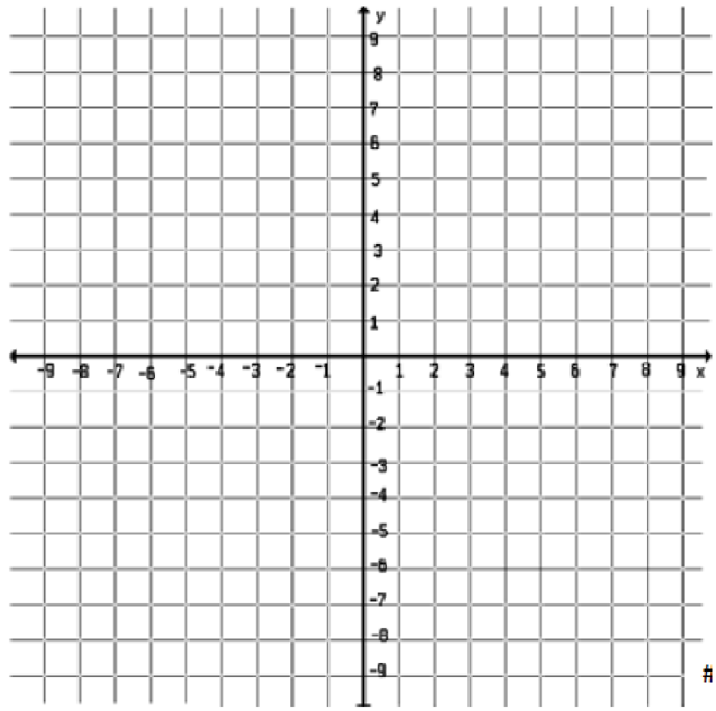
$$y = k$$



4. Find all solutions to the following system of equations.

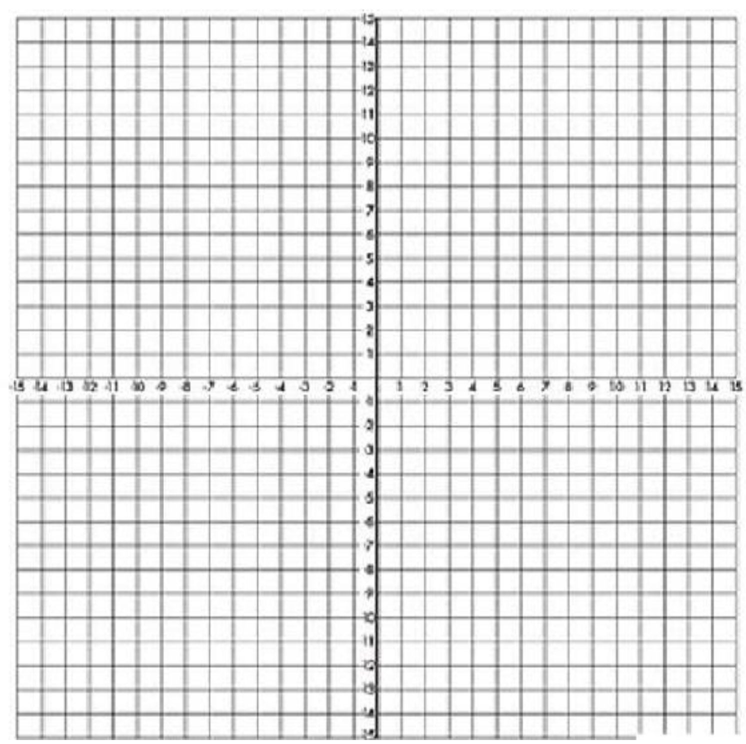
$$y + 2x = 3$$

$$y = x^2 - 6x + 3$$



5. Solve the following system of equations graphically.

$$\{2x + y = 15\ (x - 2)^2 + (y - 1)^2 = 25$$



Solving System of Equations Algebraically

1. Find all solutions of the system of equation algebraically:

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

2. Given $f(x)=-2x+3$ and $g(x)=x^2-6x+3$, find the x-value(s) that satisfy $f(x)=g(x)$.

3. Algebraically, determine the points of intersection of $-y^2+6y+x-9=0$ and $6y=x+27$

4. A boy standing on the top of a building in Albany throws a water balloon up vertically. The height, h (in feet) of the water balloon is given by the equation

$h(t)=-16t^2+64t+192$, where t is the time (in seconds) after he threw the water balloon. What is the value of t when the balloon hits the ground? Explain and show how you arrived at the answer.

5. What is the total number of points of intersection of the graphs of the equations $2x^2 - y^2 = 8$ and $y = x + 2$?

(1) 1 (2) 2 (3) 3 (4) 0

6. Amy solved the equation $2x^2 + 5x - 42 = 0$. She stated that the solutions to the equation were $\frac{7}{2}$ and -6. Do you agree with Amy's solutions? Explain why or why not.

Unit 7: Exponential Function

Lesson 1 Geometric Sequences

1) Geometric sequences have a common ___________________________

2) To find the common ratio (r) = _______________________

3) To find the nth term of a geometric sequence use the explicit formula:

Determine if the sequence is geometric. If it is, find the common ratio.

4) 8, 10, 13, 17, ...

5) 4, 24, 144, 864, ...

6) 2, −4, 8, −16, ...

7) 4, 16, 36, 64, ...

Determine if the sequence is geometric. If it is, find the common ratio and the three terms in the sequence after the last one given.

8) 4, 16, 36, 64, ...

9) 3, 15, 75, 375, ...

10) −2, 8, −32, 128, ...

11) 2, 8, 32, 128, ...

Determine if the sequence is geometric. If it is, find the 8th term.

12) $-1, \ 2, \ -4, \ 8, \ldots$

13) $3, \ 15, \ 75, \ 375, \ldots$

14) $2, \ 8, \ 32, \ 128, \ldots$

15) $-4, \ -16, \ -64, \ -256, \ldots$

Determine if the sequence is geometric. If it is, find the explicit formula.

16) $-1, \ 3, \ -9, \ 27, \ldots$

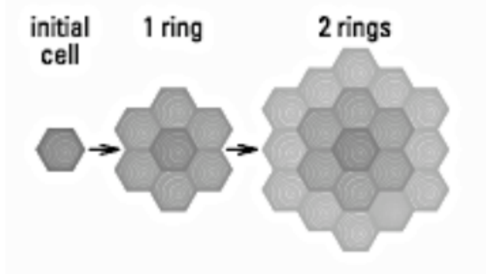
17) $-4, \ -24, \ -144, \ -864, \ldots$

18) $2, \ 6, \ 18, \ 54, \ldots$

19) $1, \ -5, \ 25, \ -125, \ldots$

1. An auditorium has 20 seats on the first row, 24 seats on the second row, 28 seats on the third row, and so on and has 30 rows of seats. How many seats are in the theatre?

2. Domestic bees make their honeycomb by starting with a single hexagonal cell, then forming ring after ring of hexagonal cells around the initial cell, as shown. The numbers of cells in successive rings form an arithmetic sequence.



a. Write a rule for the number of cells in the nth ring.

b. What is the total number of cells in the honeycomb after the 9th ring is formed? (Hint: Do not forget to count the initial cell.)

3. Suppose you go to work for a company that pays one penny on the first day, 2 cents on the second day, 4 cents on the third day and so on. If the daily wage keeps doubling, what will your total income be for working 31 days?

4. The first year a toy manufacturer introduces a new toy, its sales total $495,000. The company expects its sales to drop 10% each succeeding year. Find the total expected sales in the first 6 years.

5. The deer population in an area is increasing. This year, the population was 1.025 times last year's population of 2537.

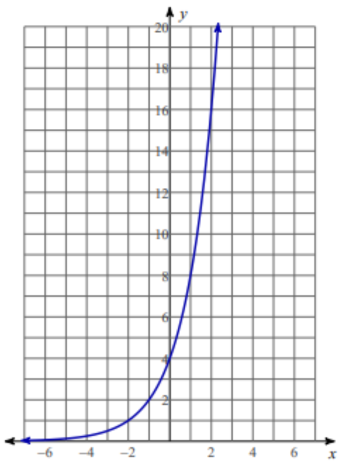
a. Assuming that the population increases at the same rate for the next few years, write an explicit formula for the sequence where n is the number of years since the population was 2537.

b. Find the expected deer population for the tenth year.

Lesson 2 Graphing and Writing Exponential Functions

Write an equation for each graph.

1)



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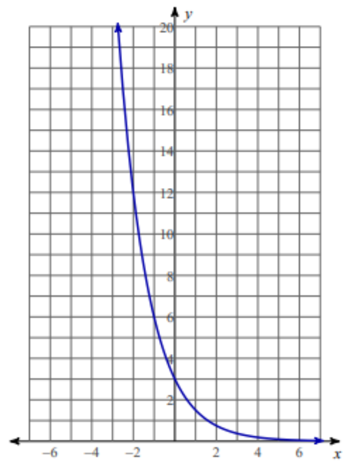

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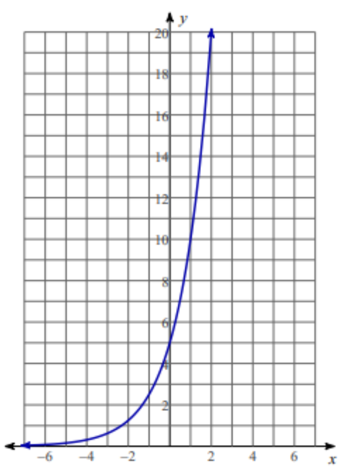

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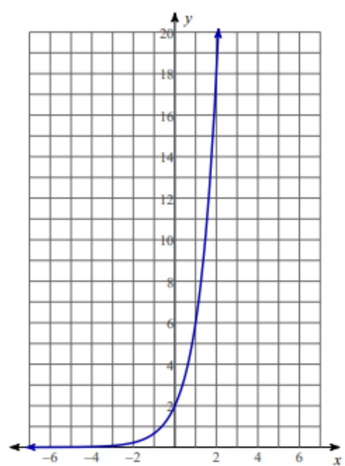

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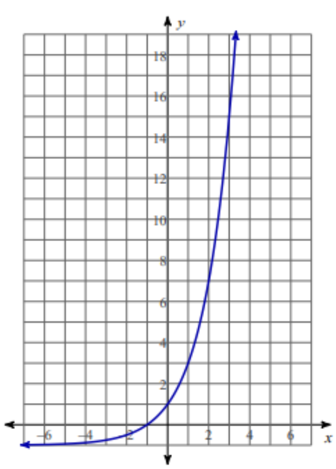

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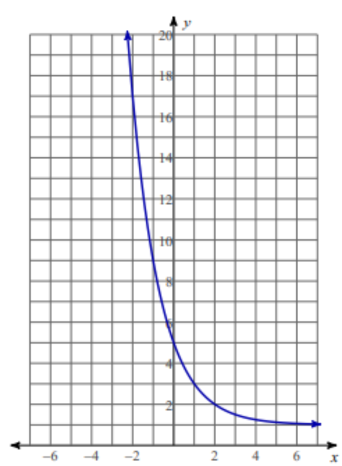
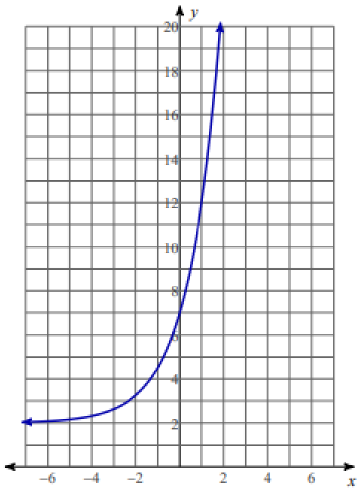
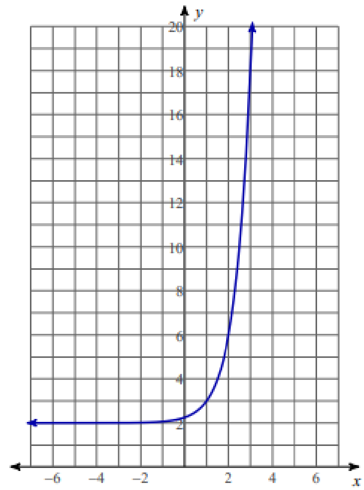


7)



y
20
18
16
14
12
10
8
6
4
2
−6
−4
−2
2
4
6
x

8)



y
20
18
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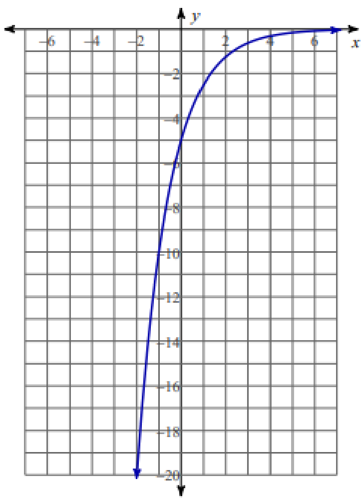
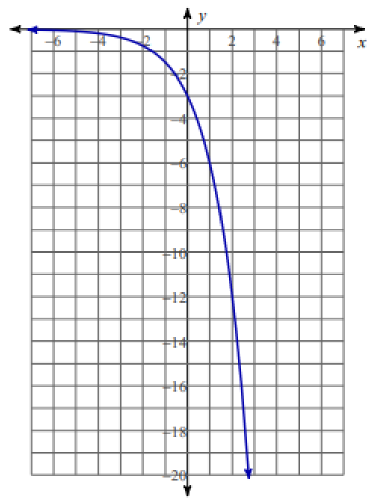
10
8
6
4
2
−6
−4
−2
2
4
6
x

9)



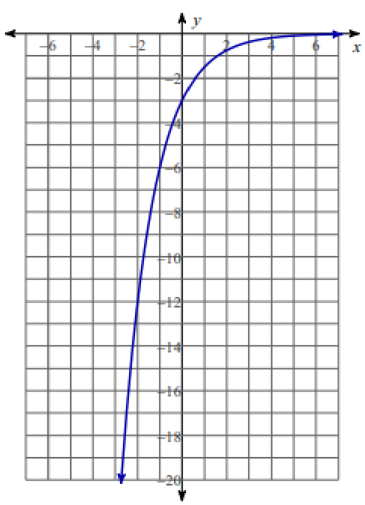
y
−6
−4
−2
2
4
6
x
−2
−4
−6
−8
−10
−12
−14
−16
−18
−20

10)



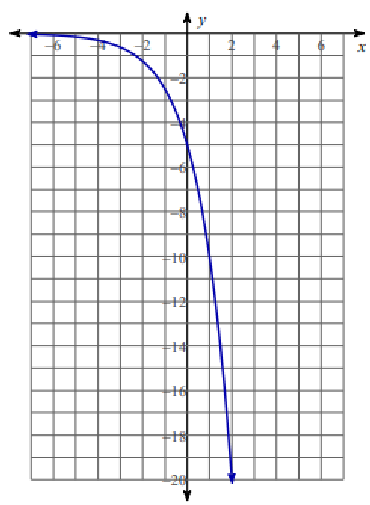
y
−6
−4
−2
2
4
6
x
−2
−4
−6
−8
−10
−12
−14
−16
−18
−20

11)



y
−6
−4
−2
2
4
6
x
−2
−4
−6
−8
−10
−12
−14
−16
−18
−20

12)



y
−6
−4
−2
2
4
6
x
−2
−4
−6
−8
−10
−12
−14
−16
−18
−20

Lesson 3 Exponential Growth and Decay

1) Which of the exponential functions below show **growth** and which show **decay**?

a) $y = 5(2)^x$ b) $y = 100(.5)^x$ c) $y = 80(1.3)^x$

d) $y = 20(0.8)^x$ e) $y = 20(1 + 0.025)^x$ f) $y = 40(1 - 0.4)^x$

2) Since January 1980, the population of the city of Brownville has grown according to the mathematical model $y = 720{,}500(1.022)^x$, where *x* is the number of years since January 1980.

a) Explain what the numbers 720,500 and 1.022 represent in this model.

b) What would the population be in 2000 if the growth continues at the same rate.

c) Use this model to predict about when the population of Brownville will first reach 1,000,000.

3) A population of 800 beetles is growing each month at a rate of 5%.

a) Write an equation that expresses the number of beetles at time x.

b) About how many beetles will there be in 8 months?

4) The half-life of a medication is the amount of time for half of the drug to be eliminated from the body. The half-life of *Advil* or ibuprofen is represented by the equation

$R = M(0.5)^{\frac{t}{2}}$, where *R* is the amount of Advil remaining in the body, *M* is the initial dosage, and *t* is time in hours.

a) A 200 milligram dosage of Advil is taken at 1:00 pm. How many milligrams of the medication will remain in the body at 6:00 pm?

b) If a 200 milligram dosage of Advil is taken how many milligrams of the medication will remain in the body 12 hours later?

5) Your new computer cost $1500 but it depreciates in value by about 18% each year.

a) Write an equation that would indicate the value of the computer at x years.

b) How much will your computer be worth in 6 years?

c) About how long will it take before your computer is worth close to zero dollars, according to your equation?

Lesson 4 Exponential Regression

Write, using technology, exponential functions that provide a reasonable fit to data and make predictions for real-world problems.

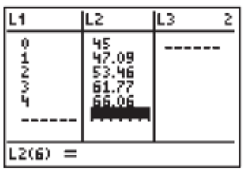
Multi-Step Example

The value of a stock *x* years after the initial investment is given in the table below.

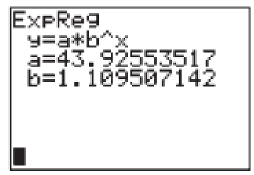
Year	0	1	2	3	4
Value	$45	$47.09	$53.46	$61.77	$66.06

Use a graphing calculator to find an exponential function that models the growth of the stock's value.

Step 1 Enter the data into lists. List L_1 contains the *x*-values and list L_2 contains the *y*-values.



Step 2 Perform a exponential regression on the data.



The exponential function of best fit is $y = 43.93(1.11)^x$.

1 The table shows the difference between a skydiver's terminal velocity of 56 m/s and her current speed.

Time	0	1	2	3
Difference	56	42	33	25

Time	4	5	6	7
Difference	24	19	13	12

Use a graphing calculator to find an exponential function that best fits the data. Use the equation to estimate the difference after 10 seconds.

A 5.61 m/s

B 5.97 m/s

C 6.12 m/s

D 6.22 m/s

2 A turkey is placed in the oven to be cooked. The difference between the temperature of the oven and the temperature of the turkey *x* minutes after being placed in the oven is given in the table below.

Time	0	0.5	1	1.5	2
Temp	275	253	239	235	210

Time	2.5	3	3.5	4	4.5
Temp	191	171	166	140	134

Use a graphing calculator to find an exponential function that gives the difference as a function of time.

F $y = 283 \cdot 0.85^x$

G $y = 275 \cdot 0.85^x$

H $y = 298 \cdot 0.82^x$

J $y = 134 \cdot 1.18^x$

3 The number of endangered lizards living on an island are given in the table below.

Year	1990	1995	2000	2005	2010
Lizards	1525	1608	1598	1669	1726

Use a graphing calculator to find an exponential function $y = ab^x$ that models the number of lizards, where x is the number of years after 1990. What is the value of b to the nearest thousandth?

Record your answer and fill in the bubbles on your answer document.

4 Use a graphing calculator to find an exponential function that best fits the data.

x	0	10	20	30	40
y	750	600	520	450	400

Use your function to estimate the value of y when $x = 15$.

A 573

B 568

C 563

D 558

5 After drinking a can of cola, the amount of caffeine in milligrams in a person's body x hours after drinking it is given.

Time	0	2	4	6	8	10
Caffeine	35	28	23	18	14	11

Find an exponential function that models the amount of caffeine in the body after x hours.

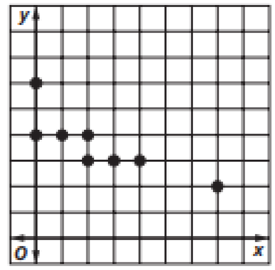
F $y = 35.2(1.12)^x$

G $y = 34(0.8)^x$

H $y = 34.2(0.86)^x$

J $y = 35.6(0.89)^x$

6 Use a graphing calculator to find an equation for an exponential function that best fits the points in the scatterplot below.



A $y = 5.1(0.86)^x$

B $y = 4.65(0.88)^x$

C $y = 4.31(0.91)^x$

D $y = 4.24(0.92)^x$

7 The population of the United States in millions of people is given in the table below.

Year	1970	1980	1990	2000	2010
Population	205	227	249	282	310

Use a graphing calculator to find an exponential function that best fits this data, where x represents the number of years after 1970 and y is in millions of people.

F $y = 204(1.01)^x$

G $y = 208(1.008)^x$

H $y = 209(1.007)^x$

J $y = 206(0.99)^x$

Unit 7 Review

A Geometric Sequence is a sequence in which each term after the first is found by multiplying the previous term by a constant r, called the common ratio.

Find the next two terms of each geometric sequence.

1) $6, 12, 24, \ldots$

2) $2000, -1000, 500, \ldots$

Find the first five terms of each geometric sequence described.

3) $a_1 = \frac{1}{9}, r = 3$

4) $a_1 = 240, r = -\frac{3}{4}$

Find the indicated term of each geometric sequence.

5) $a_1 = -10, r = 4, n = 2$

6) $a_1 = -6, r = -\frac{1}{2}, n = 8$

7) $a_4 = 16, r = 2, n = 10$

8) $a_4 = -54, r = -3, n = 6$

Write an equation for the nth term of each geometric sequence.

9) $500, 350, 425, \ldots$

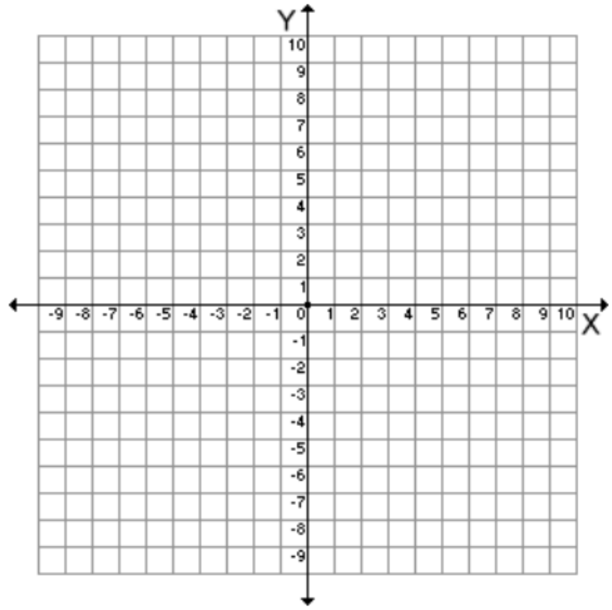
10) $8, 32, 128, \ldots$

11) $11, -24.2, 53.24, \ldots$

Graph the following functions and tell whether they show exponential growth or decay.

1)

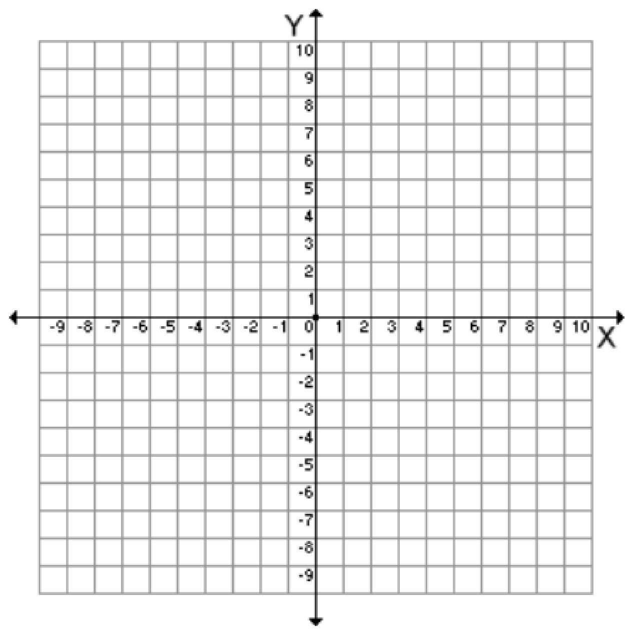
x	$y = 2^x$	y	(x, y)
-3			
-2			
-1			
0			
1			
2			
3			



Does the function above show exponential GROWTH or DECAY?

2)

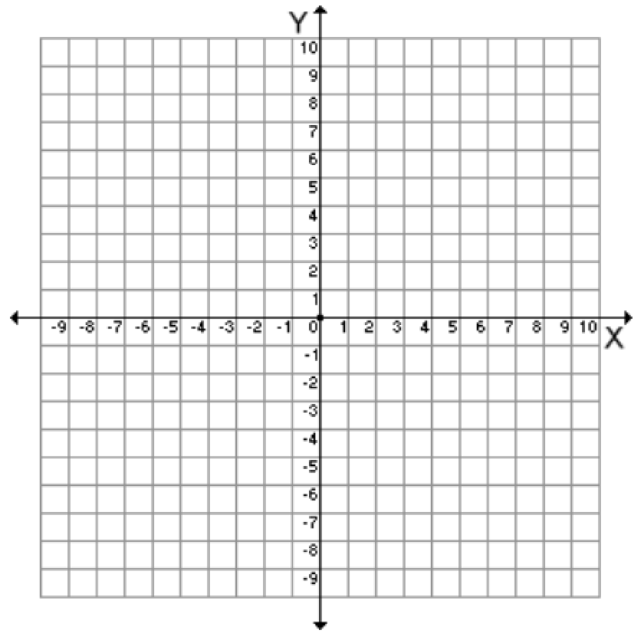
x	$y = \left(\frac{1}{2}\right)^x$	y	(x, y)
-3			
-2			
-1			
0			
1			
2			
3			



Does the function above show exponential GROWTH or DECAY?

3)

x	$y = 1^x$	y	(x, y)
-3			
-2			
-1			
0			
1			
2			
3			



Does the function above show exponential GROWTH or DECAY?

Tell whether the functions below show exponential GROWTH or DECAY.

4) $y = 9^x$

5) $y = \left(\frac{1}{5}\right)^x$

6) $y = 4^x$

7) Jeremiah owns a side business detailing cars. His first year he made \$10,500 and each of the following years his profit increased 9%.

8) There are 128 teams entered in a basketball tournament. Half of the teams are eliminated each round. How many teams are left after 4 rounds?

9) Bacteria in a dirty glass triple every year. If there are 25 bacteria to start, how many are in the glass after 1 day?

10) The population of a city with 750,000 is devastated by an unknown virus that kills 20% of the population per day. How many people are left after a week?