

Core Topics Practice

1. Analyzing Functions

a. Identify each table below as linear, exponential, or quadratic. Explain your selection

x	-1	0	1	2	3	4	5
y	13	3	-3	-5	-3	3	13

x	-5	-3	-1	1	3	5	7
y	-12	-7	-2	3	8	13	18

x	-1	0	1	2	3	4	5
y	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	8

b.

c. If $f(x) = 3x + 1$, find $g(x)$ if $g(x) = 2[f(x)]^2 - 1$

d. Explain how you can determine if a given graph is a function

e. Evaluate each function below:

i. $a(x) = 4x - 3$ $a(-2) = \underline{\hspace{2cm}}$ $a(x) = 13$ $\underline{\hspace{2cm}}$

ii. $f(x) = 3^x - 1$ $f(3) = \underline{\hspace{2cm}}$ $f(x) = 0$ $\underline{\hspace{2cm}}$

iii. $g(x) = 2x^2 - 8x + 7$ $g(-2) = \underline{\hspace{2cm}}$ $g(x) = 17$ $\underline{\hspace{2cm}}$

iv. $h(x) = -|x + 6| + 3$ $h(-8) = \underline{\hspace{2cm}}$ $h(x) = -6$ $\underline{\hspace{2cm}}$

v. $j(x) = \sqrt{3x + 1}$ $j(16) = \underline{\hspace{2cm}}$ $j(x) = 10$ $\underline{\hspace{2cm}}$

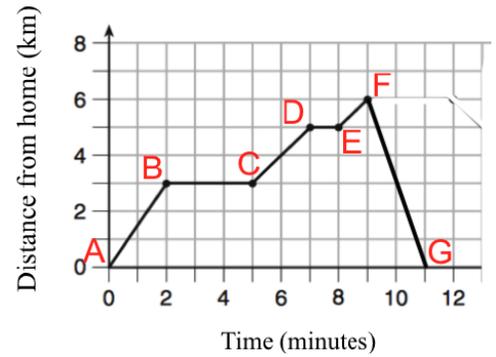
vi. $m(x) = 12\left(\frac{1}{2}\right)^x$ $m(-3) = \underline{\hspace{2cm}}$ $m(x) = \frac{3}{4}$ $\underline{\hspace{2cm}}$

vii. Over what interval is $h(x) > 0$? (*Use interval notation*)

viii. Over what interval is $g(x)$ increasing? (*Use interval notation*)

2. Piecewise Functions

- During which interval(s) was this car stopped?
- During which interval was this person traveling at the fastest speed? Explain how you know this.



- Suppose the graph was modified so that the y-axis was re-labeled to represent **SPEED**. What would change about section B – C?

- The cost of x packs of gum can be represented by the function to the right. Jim wants to buy 5 packs of gum and Steve wants to buy 7 packs of gum. How much would they save *in total* by purchasing them together rather than separately?

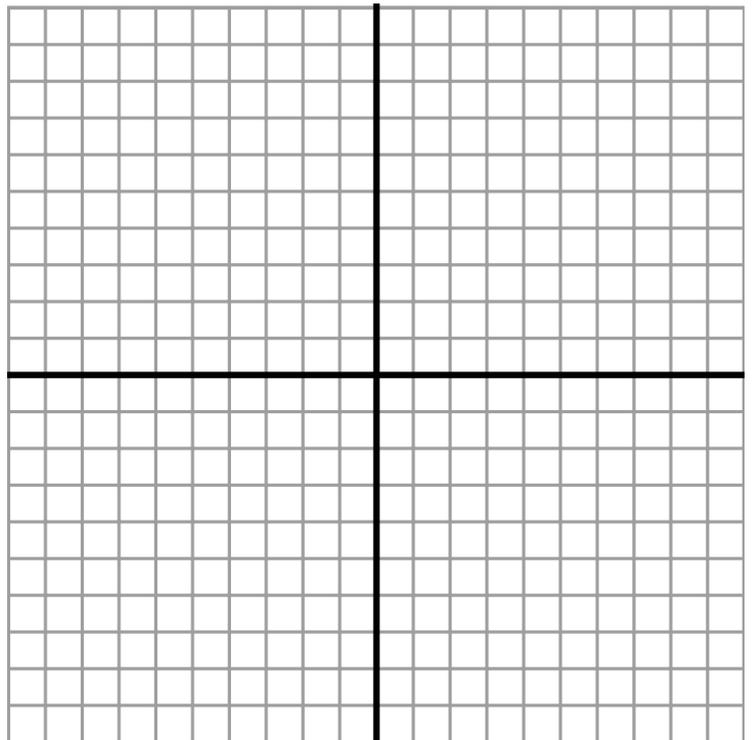
$$c(x) = \begin{cases} 1.75x, & \text{if } 0 \leq x \leq 9 \\ 1.25x, & \text{if } x \geq 10 \end{cases}$$

- On the set of axes below, graph:

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

and

$$f(x) = \begin{cases} 4 - x^2, & x \leq 0 \\ 2x + 1, & x > 0 \end{cases}$$



How many values of x satisfy the equation $f(x) = g(x)$? Explain using evidence from your graph.

3. Factoring Polynomials

a. Factor: $x^8 - 25y^2$

b. Factor: $x^2 + 5x - 24$

c. Factor: $3x^2 + 17x - 6$

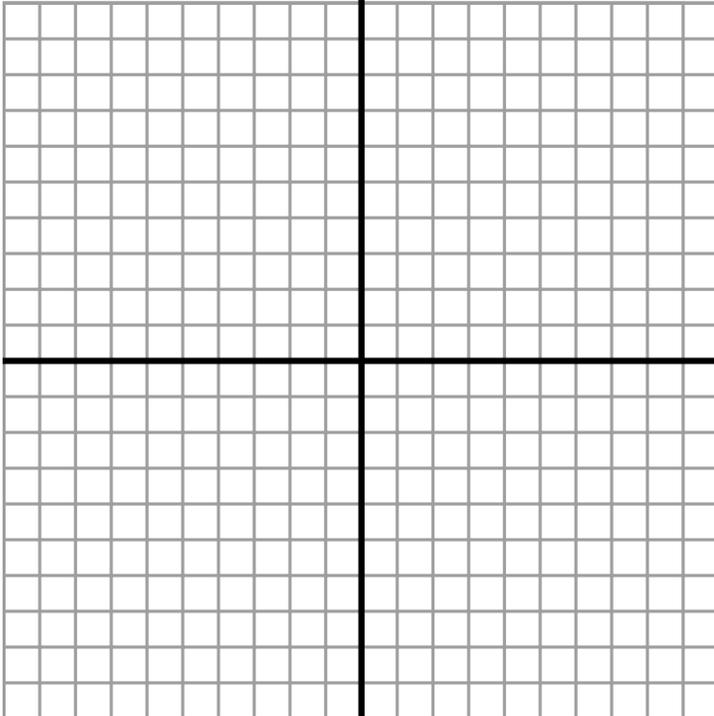
d. Factor: $5x^2 + 20x - 105$

e. Factor Completely: $x^3 - 9x^2 + 20x$

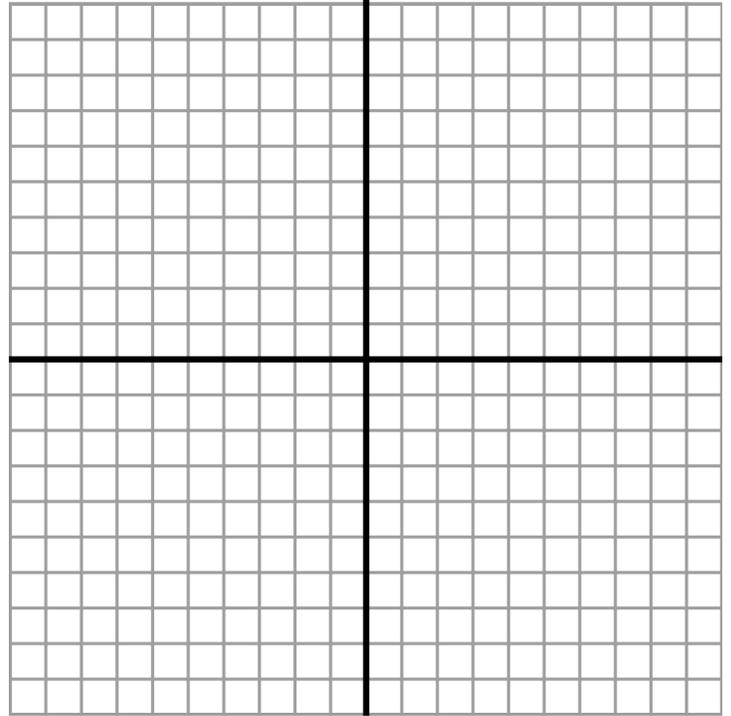
f. Factor Completely: $x^4 - 8x^2 + 7$

4. Graphing Linear Functions and Inequalities

a. $f(x) = \frac{2}{3}x - 5$



b. $y + 2x < 7$



5. Systems of Equations

- a. Create an equivalent pair of equations for the given system below, then solve:

$$3x + 7y = 29$$

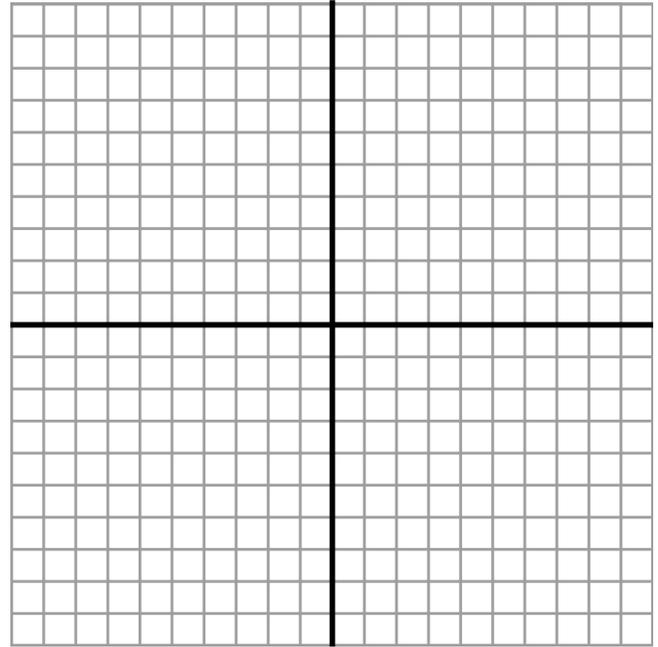
$$x - 2y = -12$$

- b. A movie theater sold 40 bags of popcorn during an evening show, earning \$96.40. If small bags of popcorn are \$1.75 and large bags are \$3.95, how many of each size were sold during that show?

- c. Graph $f(x)$ and $g(x)$ on the graph. Determine and state all values for which $f(x) = g(x)$.

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

$$g(x) = 2x + 1$$



6. Number Sets

- a. Rational or Irrational?

i. $\sqrt{5} \cdot \sqrt{3}$ _____

ii. $\sqrt{8} \cdot \sqrt{8}$ _____

iii. $\frac{1}{2} + \pi$ _____

iv. $\sqrt{13} - \sqrt{4}$ _____

- b. Identify the appropriate number set for each

i. Measuring the mass of a rock sample:

ii. Counting number of products made:

- c. If you run 100m in 14.5 seconds, find your time in terms of *minutes* and *hours*:

7. Domain and Range:

- a. James throws a ball off the roof of his house. The path of the ball can be modeled by the function $h(t) = -4t^2 + 16t + 20$, where t represents the time in seconds and $h(t)$ represents the height of the ball in the feet. What is a realistic domain for this function?

- b. If $b(x) = -6x + 7$ is defined on the domain $-2 \leq x \leq 5$. Find the range of this function.

- c. Identify the domain and range of the function, $g(x) = \sqrt{x - 2} + 5$

8. Solving Quadratics:

a. Find the roots of the function $f(x) = 3x^2 + 1x - 10$

b. What are the solutions to the equation $x^2 + 4x = -2$?

c. When solving an equation a student arrived at the step: $\left(x - \frac{9}{2}\right)^2 = -\frac{3}{4}$. Find an original equation this student could have begun with.

d. Solve for y: $y(y + 5) = 2(y + 1)^2 + 8(y - 4)$

9. Average Rate of Change:

a. Given each function below, find the average rate of change over the interval $5 \leq x \leq 12$ to the nearest tenth.

i. $f(x) = 0.4x^2$

Find AROC in the interval $0 \leq x \leq 4$

x	0	2	4	5
$f(x)$	26	17	5	1

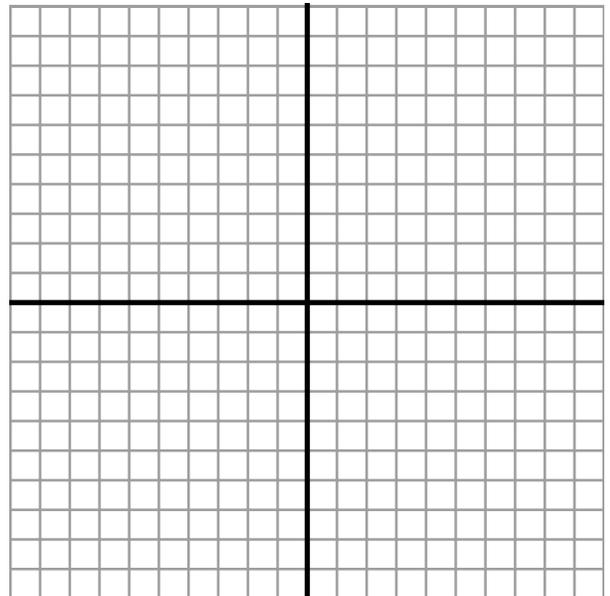
ii. $g(x) = \sqrt{5x + 4}$

10. Modeling Functions:

- a. Steph has 244 large cinder blocks outside of his house. He plans to move 2 of these blocks each day when he gets home from school. Write a function to represent the number of blocks outside of his house after x number of days. How long will it take him to move all of the blocks outside of his house?
- b. On a cruise ship, an Internet package has a base price of \$45. If the customer uses more than 4 GB of data, then they are charged an additional \$7 for each GB. Write a function, $c(x)$, to model the cost of this internet package for a customer who goes over the 4 GB, using x gigabytes.

11. Quadratic Applications:

- a. Graph the function $f(x) = x^2 - 8x + 9$ on the provided grid to the right. Identify the vertex and axis of symmetry.



- b. The path of a football thrown in the air by Eli Manning is modeled by the function $E(x) = -8x^2 + 48x + 2$, where x represents time in seconds and $E(x)$ represents the height of the ball in yards. What is the maximum height of this ball/how long does it take to reach this height? To the nearest tenth of a second, how long does it take the ball to hit the ground after Eli throws it?

c. Write in vertex form: $f(x) = -x^2 + 12x - 10$

d. The width of a rectangular football field is 3 meters less than twice its length. If the area of the field is 104 square meters, determine the dimension *algebraically*.

e. Which function has the largest maximum value? Explain

i. $a(x) = -x^2 + 10x - 3$

ii. $b(x) = -((x + 4)(x - 5))$

iii. $c(x) = -(x - 5)^2 + 14$

12. Correlation/Regression:

a. In Mr. Rice's math class, students take an exam (out of 100 points) and have a HW grade (out of 50) for each unit.

i. Using the table of sample scores, state the linear regression function, $R(t)$, that estimates a student's HW grade, given their test grade (t). Round all values to the nearest hundredth.

ii. State the correlation coefficient to the nearest hundredth. Does it indicate a strong or weak relationship between the variables? Explain

iii. Using the linear regression function $R(t)$ from part i, predict the homework grade of a student that has a 75 test score.

Test Mark (x)	Homework Mark (y)
61	35
95	50
44	5
93	50
63	15
80	34
62	16
95	50
65	7
88	38

13. Exponential Functions:

a. The population of Springfield is modeled by the function $S(t) = 2500(1.012)^t$, where t represents time (in years). What is the growth/decay rate of this city? Explain

i. What will be the change in population from year 4 to year 7? (Round to nearest whole number)

b. Write an exponential equation that models the data in the table below:

Days	1	2	3	4
Number of Bacteria	160	400	1000	2500

i. Using your equation, predict the number of bacteria present on the 9th day *to the nearest whole number*.

14. Solving Equations (rearranging formulas):

a. Solve for a: $D = \frac{1}{4}a^2h + e$

b. Solve for c: $\frac{3}{c} = y + b$

c. Solve for x: $\frac{-1}{2x} + \frac{3}{4} = \frac{21}{12x}$

15. Statistics:

- a. Given the math scores below for each student, complete the following:

Jim: 65, 72, 80, 95, 77, 81

Dwight: 92, 74, 83, 97, 53, 60

Jim

Dwight

a) Standard Deviation:

a) Standard Deviation:

b) Median:

b) Median:

c) Mean:

c) Mean:

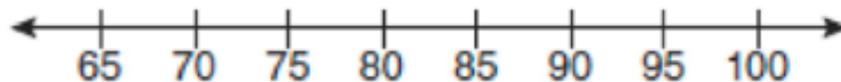
d) IQR:

d) IQR:

Based on your results, who was the more consistent math student?

- b. *Construct a box plot using the data below*

72, 73, 66, 71, 82, 85, 95, 85, 86, 89, 91, 92



16. Sequences:

a. Given the recursive sequence $f(n + 1) = 2f(n) + 5$ where $f(1) = -2$. Find $f(5)$.

b. The 5th term in an arithmetic sequence is 6 and the 7th term is 22. Write a function, A_n , that can be used to find the n th term of this sequence.

17. Solving Inequalities:

a. Solve for x : $8 - \frac{2}{3}x \leq \frac{1}{4}(x + 80) - 1$

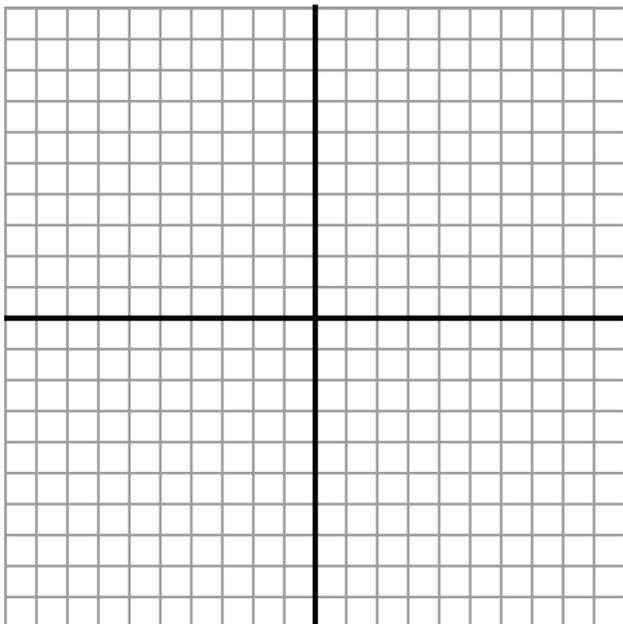
b. Determine the smallest possible integer value for x when $a = 3$:

i. $2ax - 2(5x + a) < -5 - 3a$

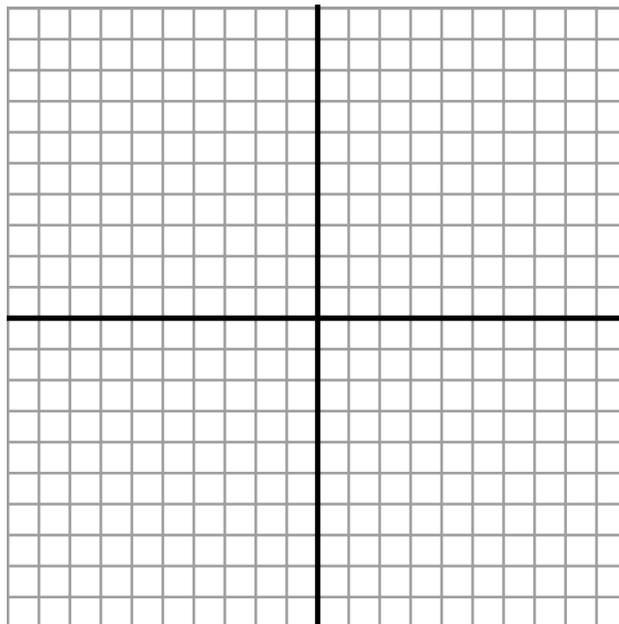
18. Graphing Special Functions

a. Graph each function on the provided graphs. (Create a table of values for each)

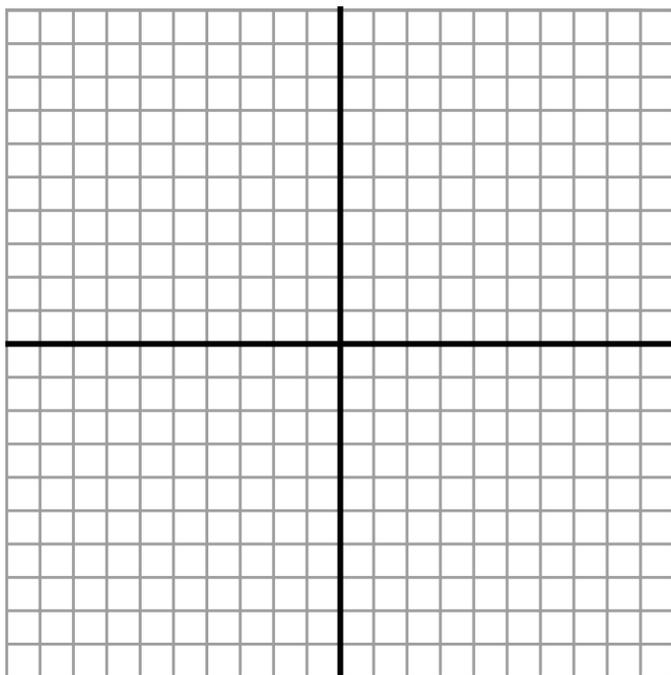
$$a(x) = \sqrt{x+5} - 1$$



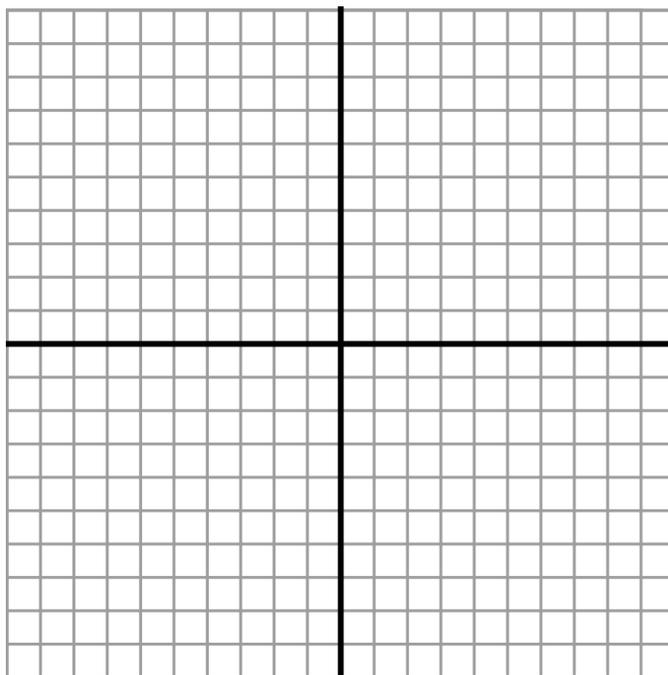
$$b(x) = \sqrt[3]{x-2}$$



$$c(x) = |x-3|$$



$$d(x) = \frac{1}{4}(2)^x$$



19. Polynomial Operations

a. Simplify and express in standard form: $(4x^2 + 5x - 9) - (6x^2 - 7x + 3)$

i. Multiply your result from part (a) by $\frac{1}{2}x^2$

b. Simplify and express in standard form: $4(x - 2)^2 - (2x^2 + 5x) + (x + 3)^2$

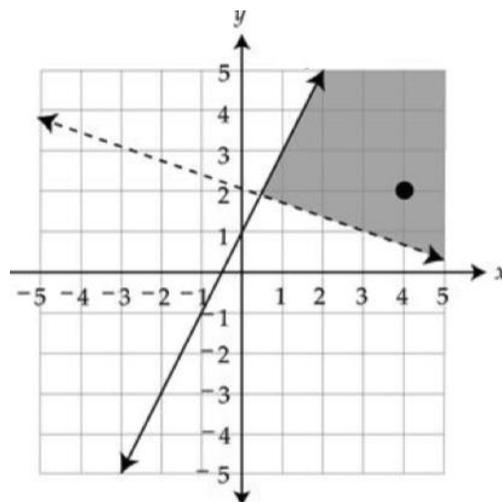
20. Transformations

a. Identify the transformation from the parent function ($f(x) = x^2$): $g(x) = -2(x + 1)^2 + 5$

b. The function $d(x) = \sqrt{x + 5} + 2$ is shifted 7 units to the left and 4 units down. Write a new function, $e(x)$, to represent $d(x)$ after this transformation.

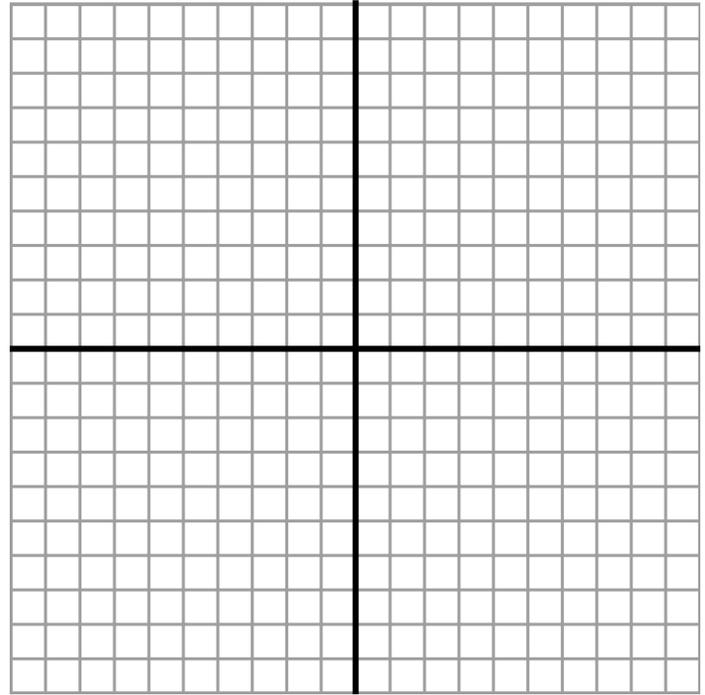
21. Systems of Inequalities:

a. Write the system of inequalities featured in the completed graph to the right:



- b. Graph the system on the provided grid below. Label the solution region “S” and identify a point in the solution set.

$$y + 2x > 3$$
$$3y - 3x \geq -12$$



- c. A concert hall is planning for an upcoming show. The theater has 150 seats available for and tickets are sold at children and adult prices. Tickets for children cost \$8.50 and adult seats are \$14.45. The theaters goal is to make at least \$1445 in revenue from the show.
- Write a system of inequalities to represent this situation for the number of children tickets, x , and adult, y , sold.
 - Graph these inequalities on the axes below. Label the solution set S.
 - Would selling 30 children tickets and 75 adult tickets help the concert hall reach their goal? Explain based on your graph.

