

Name \_\_\_\_\_

Algebra I

Mr. Peralta

## *The Ultimate Algebra I Regents Review Guide*

### Individual Score Log:

<b>Regents</b>	June 2014	August 2014	January 2015	June 2015	August 2015	January 2016	June 2016	August 2016	January 2017
Part I									
Part II									
Part III									
Part IV									
Total Raw Score									

### Exam Layout:

<b>Test Component</b>	<b>Number of Questions</b>	<b>Credits per Question</b>	<b>Total Credits per Section</b>
Part I	24	2	48
Part II	8	2	16
Part III	4	4	16
Part IV	1	6	6
Total	37	-	86

### MathBits Review Resources:

(Scan using QR Code App)  
Topic Reviews/Practice



### Calculator Tips and Tricks:

Scroll down and look under the section titled *Algebra I*  
Tips are organized by topic (ignore Trig. Ratios)



## **Practice Regents Exams:**

Use the QR code or link to access each exam PDF

**1. June 2014 – January 2017 Regents Exams:**

Link: <http://www.nysedregents.org/algebraone/>

Click the (+) next to the desired date and then *Examination* to access PDF



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**2. Practice Green Book Test #1:**

Link: <https://ricemath.files.wordpress.com/2016/03/green-book-test-1.pdf>



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**3. Practice Green Book Test #2:**

Link: <https://ricemath.files.wordpress.com/2016/03/green-book-test-2.pdf>



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**4. Practice Green Book Test #3:**

Link: <https://ricemath.files.wordpress.com/2016/03/green-book-test-3.pdf>



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**5. LIC Practice Regents Exam:**

Link: <https://ricemath.files.wordpress.com/2016/03/li-city-practice-regents1.pdf>



## 25 Facts to Help Pass the Algebra I Common Core Regents

1. Average Rate of Change means *slope*. Use boundaries of given domain (x) to find corresponding range (y) values, then apply slope formula (change in y / change in x).
2. With multiple choice questions, check to see what answers look like before you begin the question.  
Ex) Solving Quadratic question with radicals in each choice → CTS or Quadratic formula must be used
3. Domain (x) and Range (y). If given a restricted domain for a graph, don't use arrows! (open/closed circles).
  - a. Interval notation → brackets [ ] indicate value is included, parenthesis not included.
  - b. Ex:  $[3, \infty)$  means starting at 3 (closed circle) to infinity (always not included)
  - c. Ex:  $(-2, 5]$  means starting at -2 (open circle) to 5 (closed circle)
4. Residual plot: Pattern indicates non-linear data, Randomness indicates linear data.
5. Functions: To be a function, graph must pass vertical line test or x-value can't repeat. Linear functions have a constant rate of change. Exponential functions have a non-constant rate of change (multiplier)
6. Factoring: Express a polynomial as a product of two or more polynomials
  - a. GCF: Factor out GCF of coefficients and/or the greatest variable exponent all the terms share
  - b. Difference of Perfect Squares: Must have two terms, subtraction, perfect squares
  - c. Sum/Product: For a trinomial, find numbers that have a sum of "b" and product of "c"
  - d. AC "Eyeglass": When  $a > 1$ , multiply "a" by "c" to create product, sum is still "b."
  - e. Factor Completely: Factor more than once!
7. Evaluating Functions:
  - a.  $f(2)$  means substitute a 2 in for x, find output
  - b.  $f(x) = 2$  means set equation equal to 2, find the input, x.
8. Creating Equations:
  - a. Linear:  $y = mx + b$       $m = \text{slope (rate of change)}$       $b = \text{y-int (starting value)}$
  - b. Exponential:  $y = a b^x$       $a = \text{initial, starting value}$       $b = \text{common multiplier}$
9. Correlation Coefficient: "r", close to 1 or -1 represents a stronger relationship for the data.
  - a. Use LINREG (STAT → CALC #4) to find. Diagnostics must be on
  - b. Correlation DOES NOT imply causation!
10. Explicit Sequences: "n" represents the term number in the sequence
  - a. Arithmetic:  $A_n = A_1 + d(n - 1)$ . Need first term and common difference (d).
  - b. Geometric:  $A_n = A_1 r^{n-1}$ . Need first term and common ratio (r)
  - c. Recursive formulas: Need to find each previous term to find desired term.
11. Completing the Square/Vertex Form
  - a. Once in standard form, make sure  $a = 1$ . If not, divide each term by "a"
  - b. Move constant over
  - c. Add "magic number"  $(b/2)^2$  to both sides to create perfect trinomial  $(\quad)^2$ 
    - i. To Solve: Use Square Root Property to solve
    - ii. Vertex Form: Move constant back over, get back into "y=" form.
12. Inequalities: FLIP sign when you multiply or divide by a negative value
  - a. At least and minimum:  $\geq$
  - b. At most and maximum:  $\leq$
  - c. Linear inequalities: Use dotted line for  $>$  and  $<$ , Use solid line for  $\geq$  and  $\leq$
  - d. Shade above the line for all  $>$  and shade below for  $<$ . Solutions are in shaded region
  - e. Systems of inequalities: Graph using intercepts or convert to "y" form. Look for overlap for solution set. LABEL!
13. Any Statistic question referencing mean, median, IQR, etc.. → Use L1 and then **1-VAR STATS** (STAT → CALC #1) for summary of information.  $\bar{x} = \text{mean}$ .
  - a.  $IQR = Q3 - Q1$

14. To multiply polynomials, use distributive property  $(x - 4)(x + 7) = x^2 + 3x - 28$
15. Add/Subtract Polynomials: Distribute the negative if subtracting entire polynomial. Watch out for **from** to switch the order of your polynomials. Combine like terms by adding coefficients (must have same exponent)
16. Equations: Use inverse operations and keep equation balanced. Multiply by reciprocal to get rid of fractional coefficients. Fractional equations, multiply by LCM of terms. Ex)  $\frac{1}{2x} + \frac{3}{5} = \frac{4}{x} + \frac{7}{2}$
17. To find intercepts:
- X – int: Let  $y = 0$ , solve for  $x$
  - Y – int: Let  $x = 0$ , solve for  $y$
18. Graphing Linear Functions: Put into “ $y=$ ” form.  $y = mx + b \rightarrow$  Begin with **b** value (y-int), slope (**m**) tells you how to move.
- $y = \#$  (horizontal line)     $x = \#$  (vertical line)
19. Exponential Growth/Decay:  $A = P(1 \pm r)^t$      $P =$  initial amount,  $r =$  rate as decimal,  $t =$  time
- Growth: Add to one
  - Decay: Subtract rate from one
20. Simplifying Radicals: Factor radical out the **largest** perfect square radical, simplify.
- $\sqrt{80} = \sqrt{16} \cdot \sqrt{5} = 4\sqrt{5}$
21. Rational vs. Irrational
- Rational Numbers: Terminating decimals, fractions, repeating decimals, perfect radicals
  - Irrational Numbers: Pi, non-perfect radicals. An irrational number times an irrational number can be either rational or irrational.
22. Systems of Equations – solution is coordinate(s) that satisfy both equations
- Graphically on Calculator: Enter each equation in “ $Y=$ ”, Hit 2<sup>nd</sup> + Trace, #5 Intersect, Hit Enter 3 times with cursor near intersection point.
  - Algebraically –use elimination (create inverse coefficient) or substitution (one variable isolated)
23. Parabolas: Graph of a quadratic equation
- Axis of Symmetry:  $x = -b/2a$
  - Make symmetric table of values with AOS/vertex in center. Use calculator table to complete
  - Roots are where  $y = 0$  or where graph hits x-axis
  - Vertex can be maximum (negative a-value) or minimum (positive a-value)
  - Vertex form:  $y = a(x - h) + k$     Vertex:  $(h, k)$
24. Solving Quadratics: Always simplify and put in standard form first  $ax^2 + bx + c = 0$
- Factoring: Easiest method, use t-chart with factored parts to create mini-equations( = 0). Solve
  - CTS: See #11, only works well if  $a = 1$
  - Quad. Formula: label a, b, and c. Plug into formula on sheet. Simplify radical if possible
  - Square Root Property: Works well if no “b” term or if you have a binomial squared. Isolate squared term, remember  $\pm$  when using square roots.
  - Graphing calculator: Find roots by looking for where  $y = 0$  (Use table or “Zero” function)
25. Transformations: Same rules apply to square root graphs, parabolas, absolute value, etc..
- $-f(x)$ : Reflects graph over x-axis
  - $f(x + \#)$ : Translates (slides) graph # units to the LEFT (IHOP)
  - $f(x - \#)$ : Translates (slides) graph # units to the RIGHT (IHOP)
  - $f(x) + \#$ : Graph moves UP # units
  - $f(x) - \#$ : Graph moves DOWN # units
  - $af(x)$ : If  $a > 1$ , graph is stretched vertically (narrower). If  $0 < a < 1$ , graph is compressed vertically (wider)

## Core Topics Practice

### 1. Analyzing Functions

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

<b>x</b>	-1	0	1	2	3	4	5
<b>y</b>	13	3	-3	-5	-3	3	13

<b>x</b>	-5	-3	-1	1	3	5	7
<b>y</b>	-12	-7	-2	3	8	13	18

<b>x</b>	-1	0	1	2	3	4	5
<b>y</b>	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	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.  $j(x) = \sqrt{3x + 1}$                        $j(16) = \underline{\hspace{2cm}}$                        $j(x) = 10$      $\underline{\hspace{2cm}}$

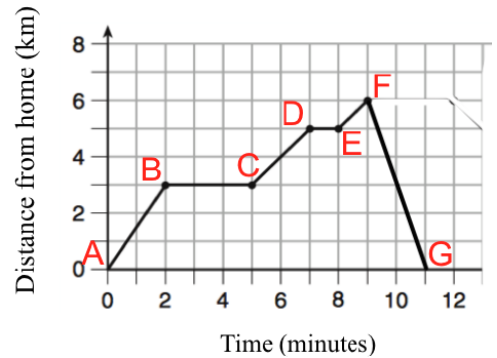
vi.  $m(x) = 12\left(\frac{1}{2}\right)^x$                        $m(-3) = \underline{\hspace{2cm}}$                        $m(x) = \frac{3}{4}$      $\underline{\hspace{2cm}}$

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?

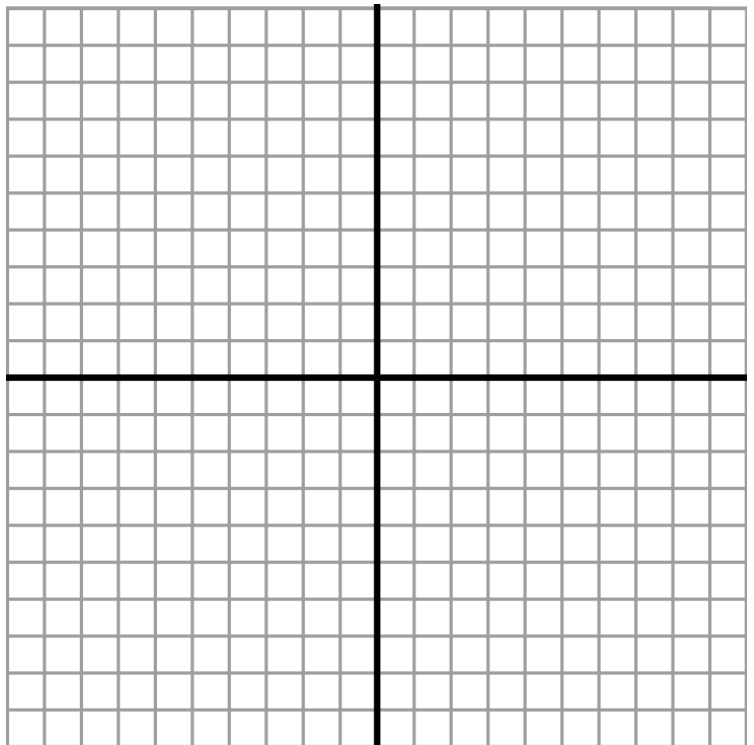
$$c(x) = \begin{cases} 1.75x, & \text{if } 0 \leq x \leq 9 \\ 1.25x, & \text{if } x \geq 10 \end{cases}$$

- 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:  $3x^2 + 17x - 6$

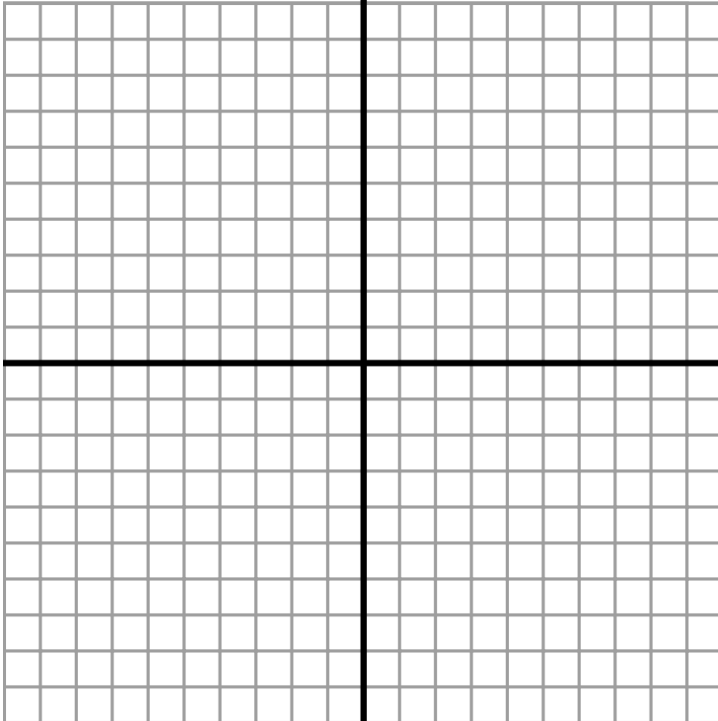
d. Factor:  $5x^2 + 20x - 105$

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

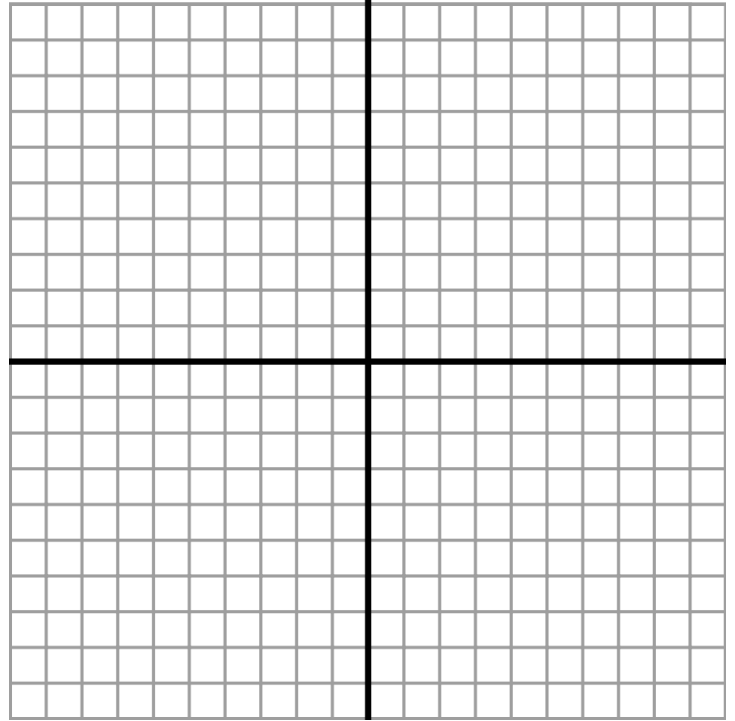
f. Factor Completely:  $x^4 - 8x^2 + 7$

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:

$$3x + 7y = 29$$

$$x - 2y = -12$$

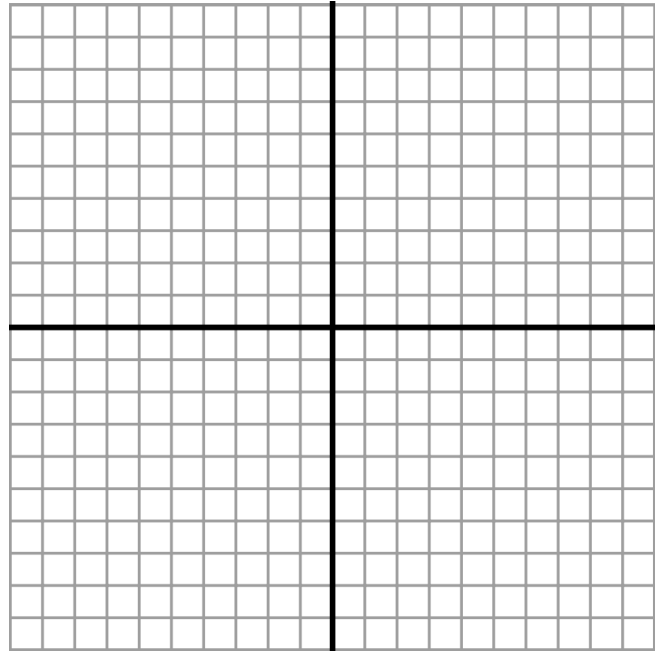
b. A movie theater sold 40 bags of popcorn during an evening show, earning \$96.40. If small bags of popcorn are \$1.75 and large bags are \$3.95, how many of each size were sold during that show?



- 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

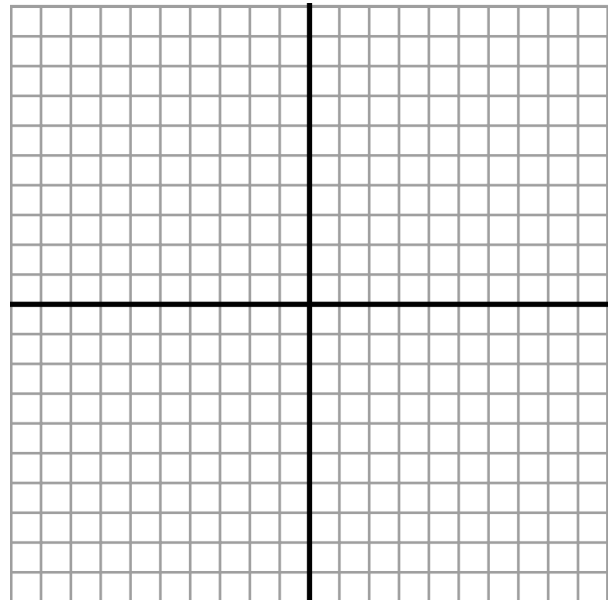
ii.  $g(x) = \sqrt{5x + 4}$

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:

<b>Days</b>	1	2	3	4
<b>Number of Bacteria</b>	160	400	1000	2500

i. Using your equation, predict the number of bacteria present on the 9<sup>th</sup> 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:

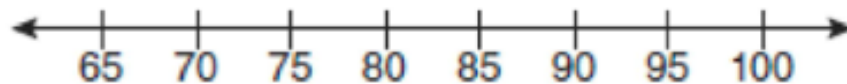
d) IQR:

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 5<sup>th</sup> term in an arithmetic sequence is 6 and the 7<sup>th</sup> 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  $x$ :  $8 - \frac{2}{3}x \leq \frac{1}{4}(x + 80) - 1$

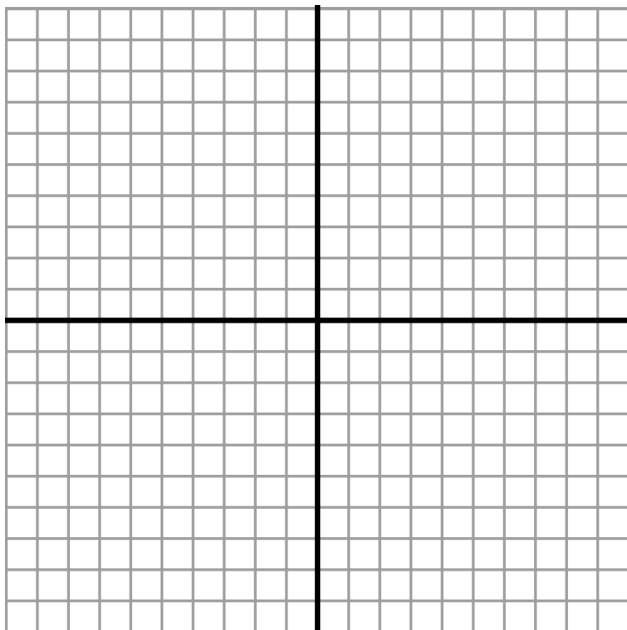
b. Determine the smallest possible integer value for  $x$  when  $a = 3$ :

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

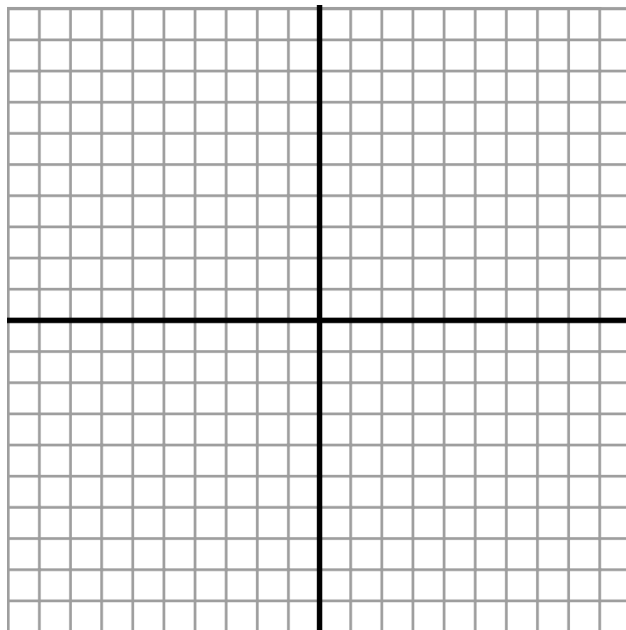
18. Graphing Special Functions

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

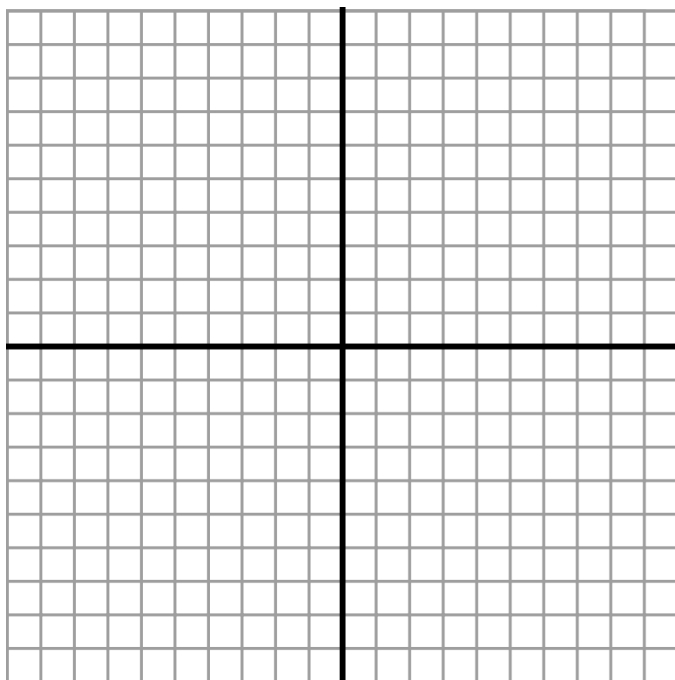
$$a(x) = \sqrt{x + 5} - 1$$



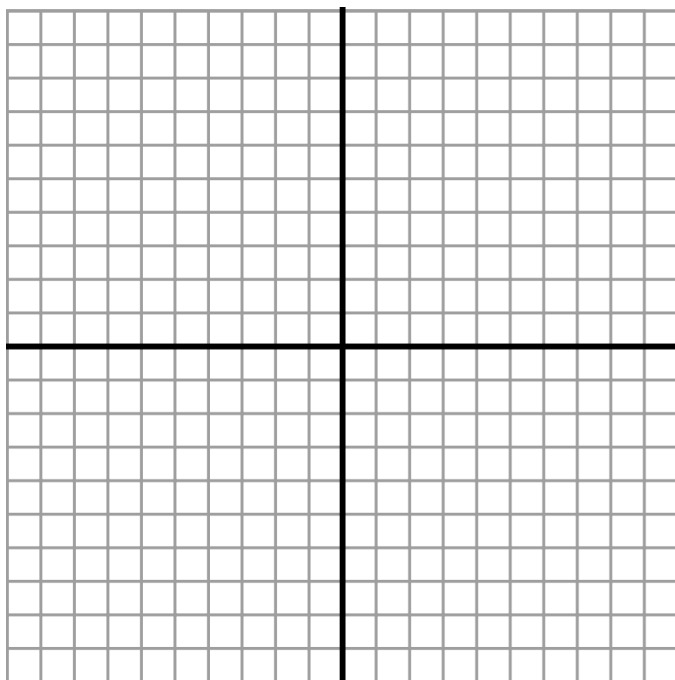
$$b(x) = \sqrt[3]{x - 2}$$



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



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





### 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:  $4(x - 2)^2 - (2x^2 + 5x) + (x + 3)^2$

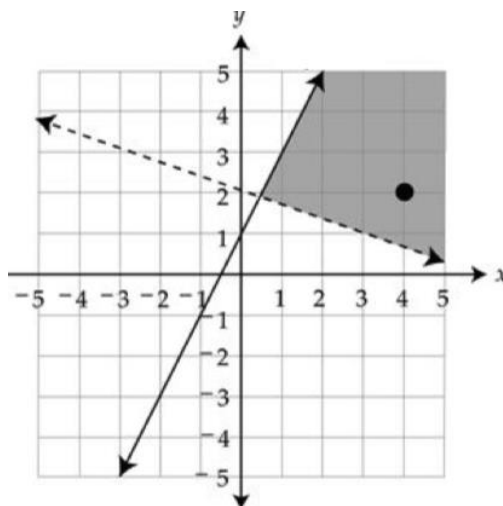
### 20. Transformations

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.

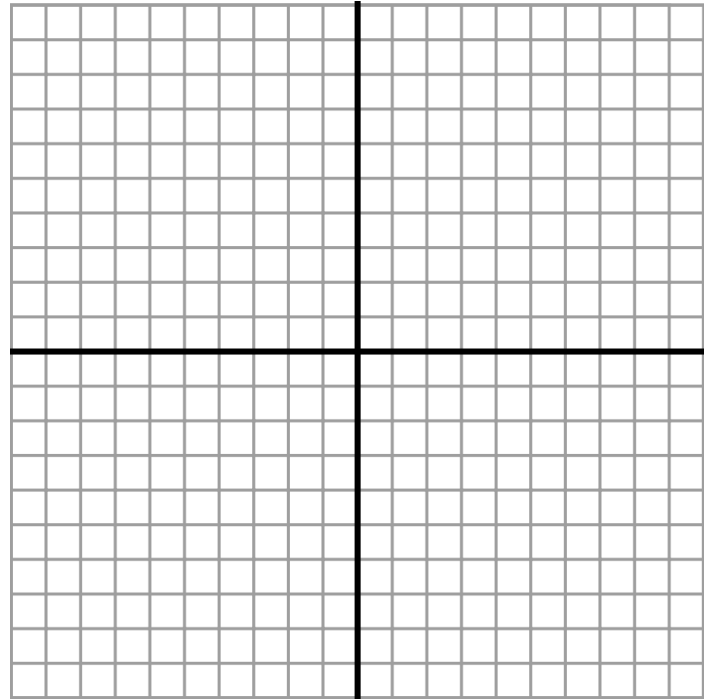
### 21. Systems of Inequalities:

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.

