

Name _____

Algebra I

Mr. Peralta

The Ultimate Algebra I Regents Review Guide

Individual Score Log:

Regents	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:

Test Component	Number of Questions	Credits per Question	Total Credits per Section
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



2. Practice Green Book Test #1:

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



3. Practice Green Book Test #2:

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



4. Practice Green Book Test #3:

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



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

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

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 2nd + 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

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

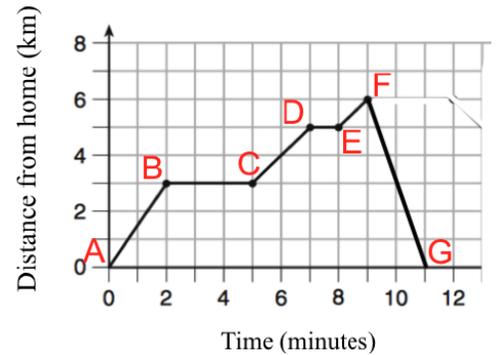
vi. $m(x) = 12\left(\frac{1}{2}\right)^x$ $m(-3) = \underline{\hspace{2cm}}$ $m(x) = \frac{3}{4}$ $\underline{\hspace{2cm}}$

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?

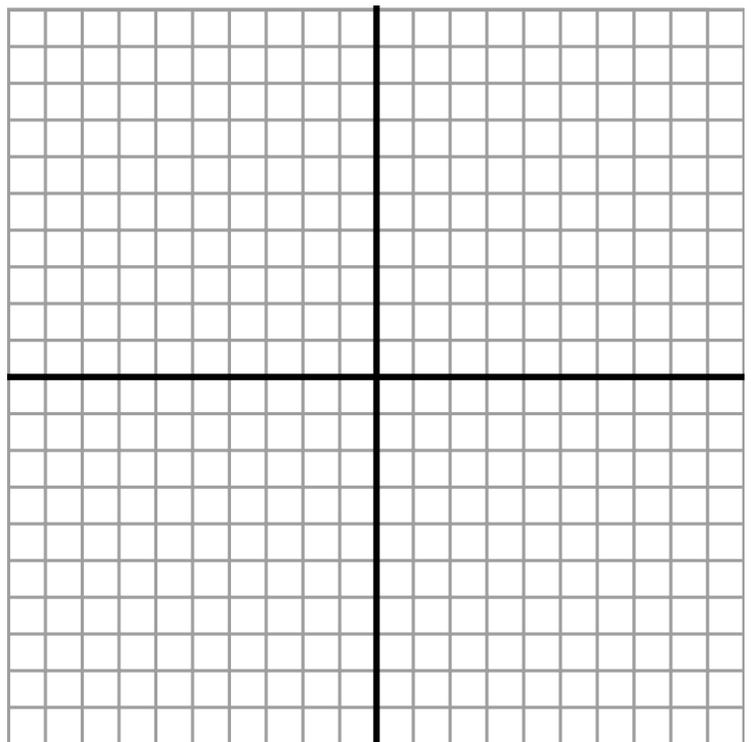
$$c(x) = \begin{cases} 1.75x, & \text{if } 0 \leq x \leq 9 \\ 1.25x, & \text{if } x \geq 10 \end{cases}$$

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

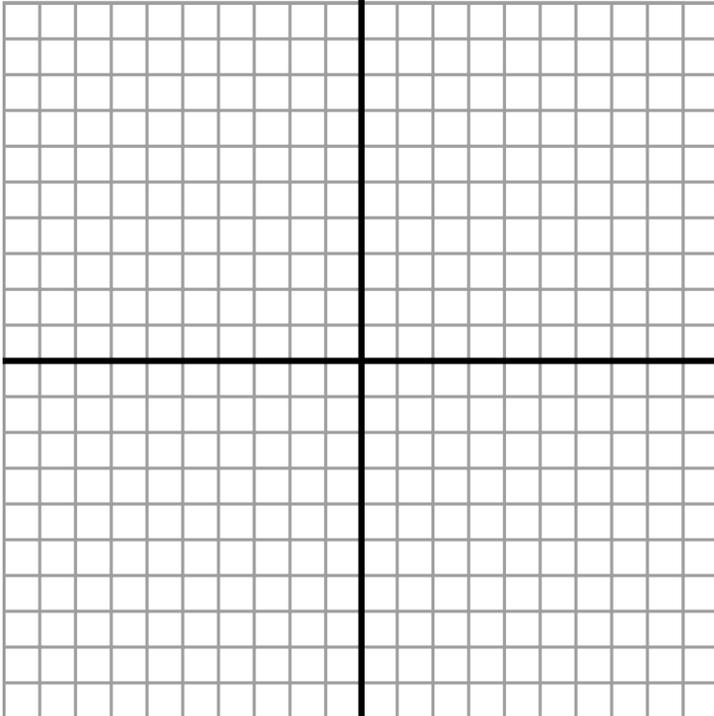
d. Factor: $5x^2 + 20x - 105$

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

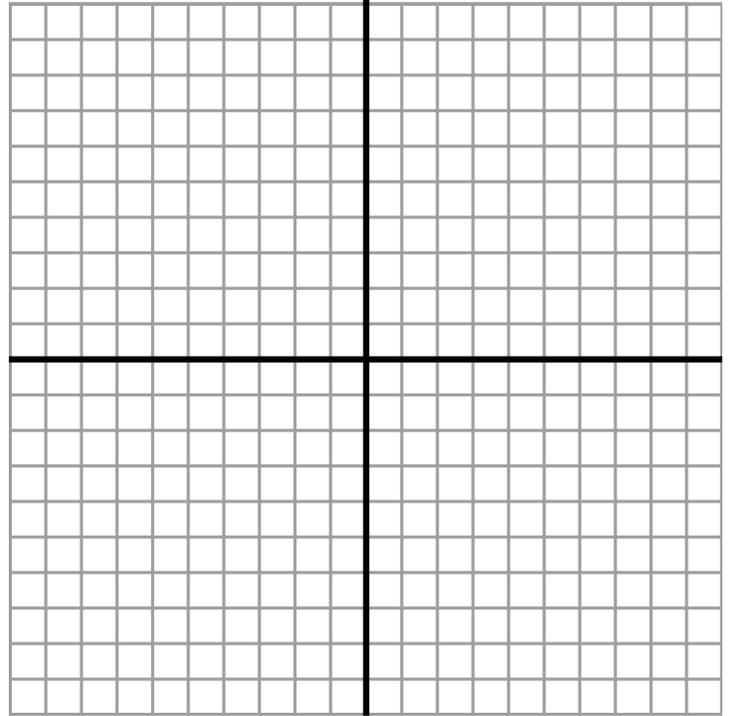
f. Factor Completely: $x^4 - 8x^2 + 7$

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:

$$3x + 7y = 29$$

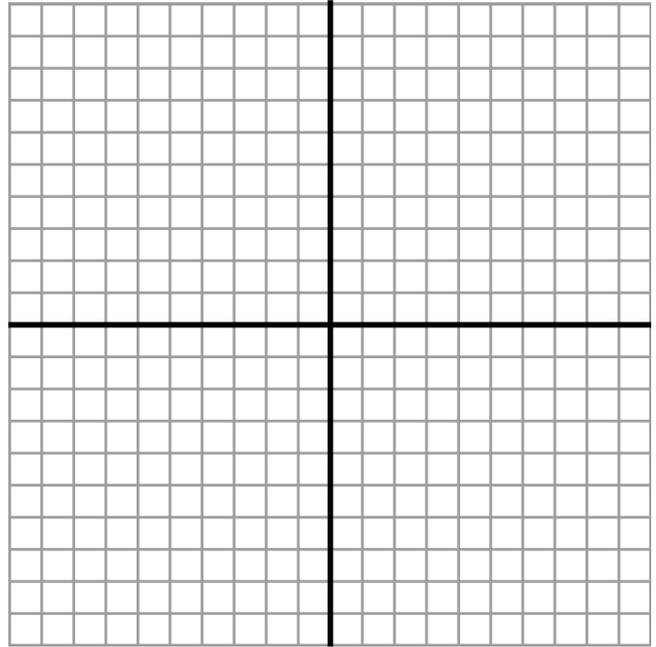
$$x - 2y = -12$$

- 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

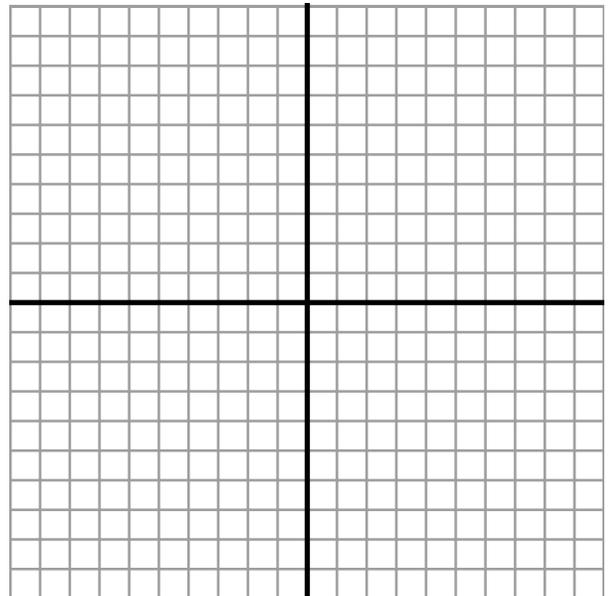
ii. $g(x) = \sqrt{5x + 4}$

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:

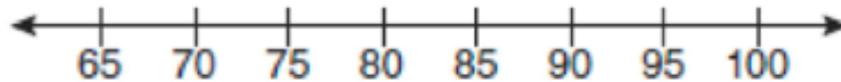
d) IQR:

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

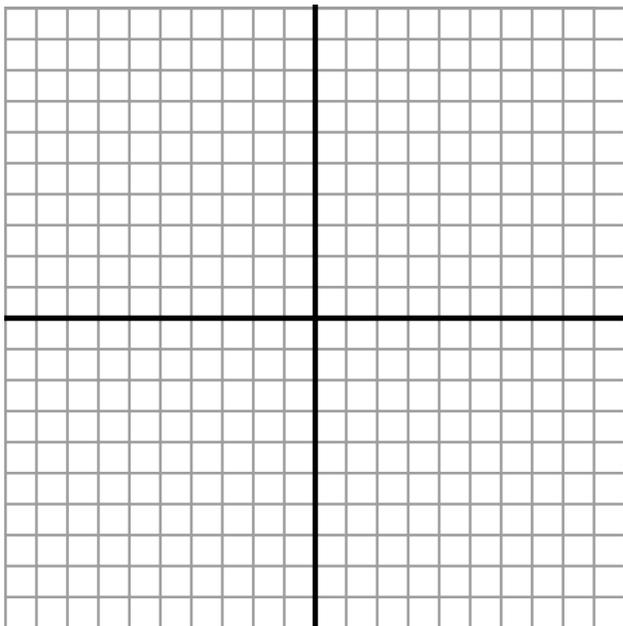
b. Determine the smallest possible integer value for x when $a = 3$:

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

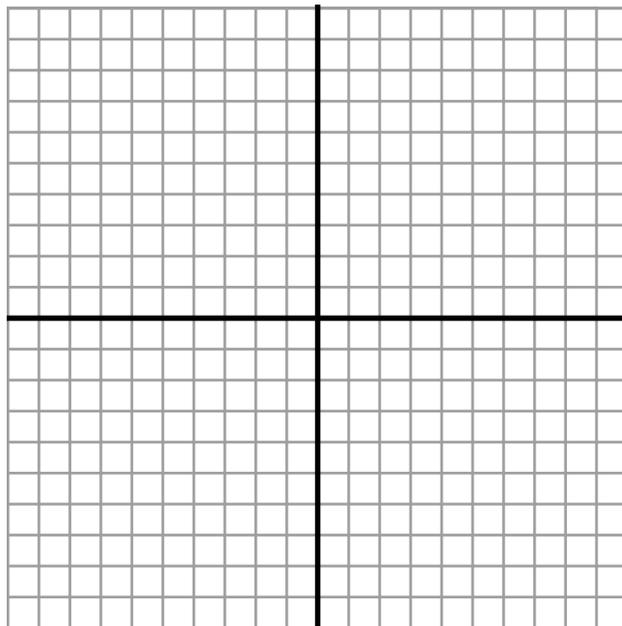
18. Graphing Special Functions

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

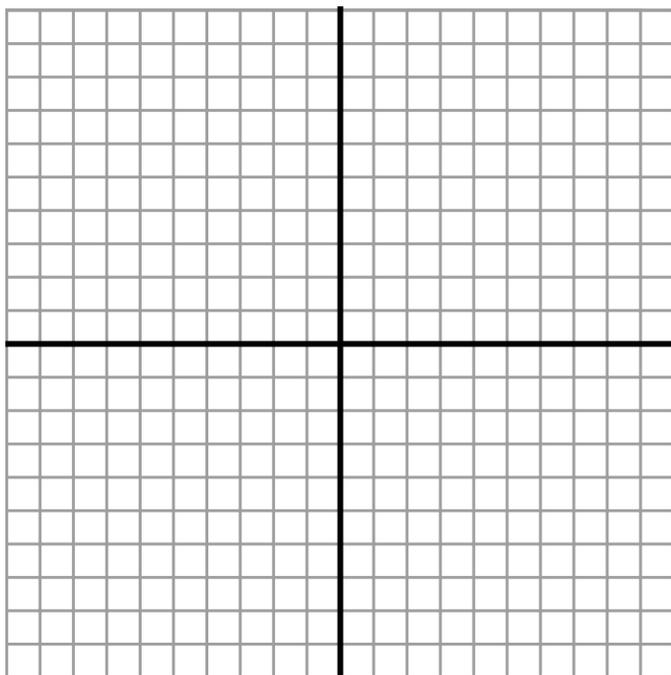
$$a(x) = \sqrt{x + 5} - 1$$



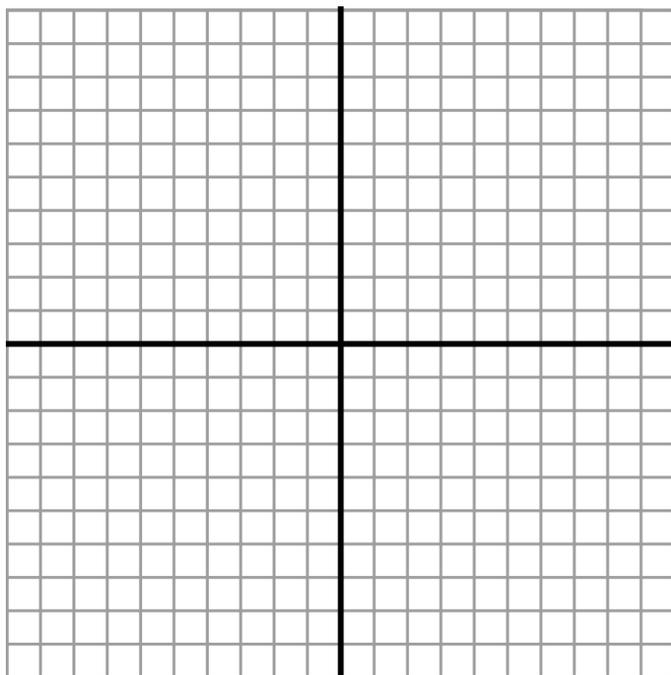
$$b(x) = \sqrt[3]{x - 2}$$



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



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



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

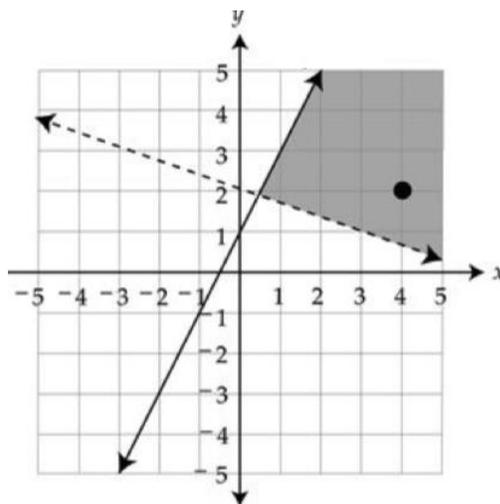
20. Transformations

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.

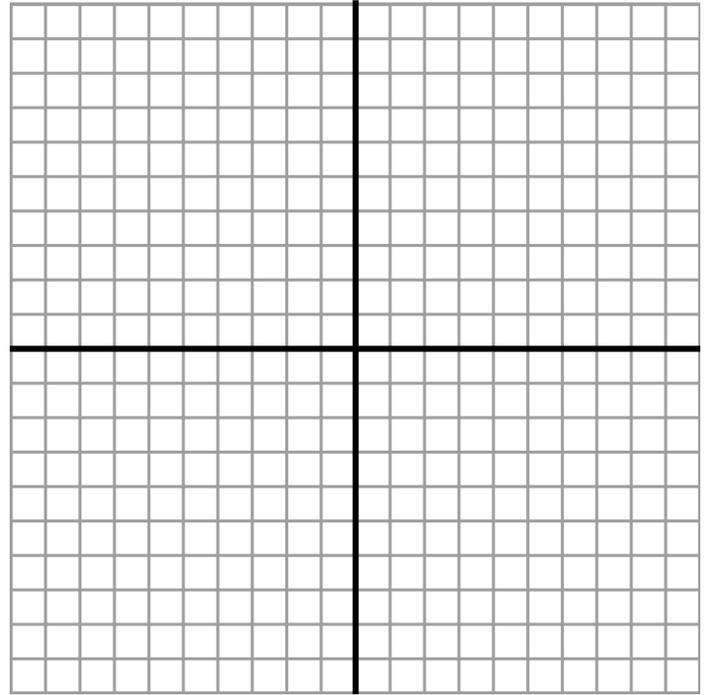
21. Systems of Inequalities:

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.

