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

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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 = slope (rate of change) b = y-int (starting value)
    b. Exponential: $y = a\,b^x$ a = initial, starting value b = 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: ≥
    b. At most and maximum: ≤
    c. Linear inequalities: Use dotted line for > and < , Use solid line for ≥ and ≤
    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. x = 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:
    a. X – int: Let y = 0, solve for x
    b. Y – int: Let x = 0, solve for y
18. Graphing Linear Functions: Put into "y=" form. **y = mx + b** → Begin with **b** value (y-int), slope (**m**) tells you how to move.
    a. 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
    a. Growth: Add to one
    b. Decay: Subtract rate from one
20. Simplifying Radicals: Factor radical out the **largest** perfect square radical, simplify.
    a. $\sqrt{80} = \sqrt{16} \cdot \sqrt{5} = 4\sqrt{5}$
21. Rational vs. Irrational
    a. Rational Numbers: Terminating decimals, fractions, repeating decimals, perfect radicals
    b. 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
    a. Graphically on Calculator: Enter each equation in "Y=", Hit 2nd + Trace, #5 Intersect, Hit Enter 3 times with cursor near intersection point.
    b. Algebraically –use elimination (create inverse coefficient) or substitution (one variable isolated)
23. Parabolas: Graph of a quadratic equation
    a. Axis of Symmetry: x = -b/2a
    b. Make symmetric table of values with AOS/vertex in center. Use calculator table to complete
    c. Roots are where y = 0 or where graph hits x-axis
    d. Vertex can be maximum (negative a-value) or minimum (positive a-value)
    e. Vertex form: y = a(x – h) + k Vertex: (h, k)
24. Solving Quadratics: Always simplify and put in standard form first $ax^2 + bx + c = 0$
    a. Factoring: Easiest method, use t-chart with factored parts to create mini-equations(= 0). Solve
    b. CTS: See #11, only works well if a = 1
    c. Quad. Formula: label a, b, and c. Plug into formula on sheet. Simplify radical if possible
    d. Square Root Property: Works well if no "b" term or if you have a binomial squared. Isolate squared term, remember ± when using square roots.
    e. 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..
    a. –f(x): Reflects graph over x-axis
    b. f(x + #): Translates (slides) graph # units to the LEFT (IHOP)
    c. f(x – #): Translates (slides) graph # units to the RIGHT (IHOP)
    d. f(x) + #: Graph moves UP # units
    e. f(x) – #: Graph moves DOWN # units
    f. 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	$^1/_8$	¼	½	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) = _____ a(x) = 13 _____

   ii. $f(x) = 3^x - 1$ f(3) = _____ f(x) = 0 _____

   iii. $g(x) = 2x^2 - 8x + 7$ g(-2) =_____ g(x) = 17 _____

   iv. $h(x) = -|x + 6| + 3$ h(-8) =_____ h(x) = -6 _____

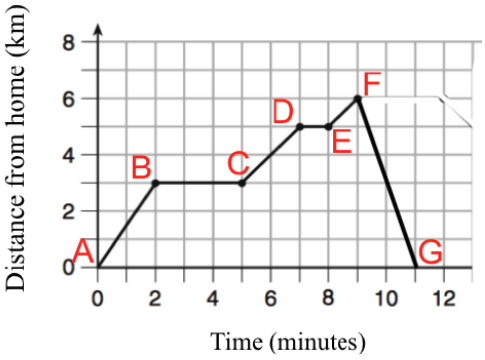
   v. $j(x) = \sqrt{3x + 1}$ j(16) =_____ j(x) = 10 _____

   vi. $m(x) = 12\left(\frac{1}{2}\right)^x$ m(-3) =_____ m(x) = ¾ _____

   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



a. During which interval(s) was this car stopped?

b. During which interval was this person traveling at the fastest speed? Explain how you know this.

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

d. 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?

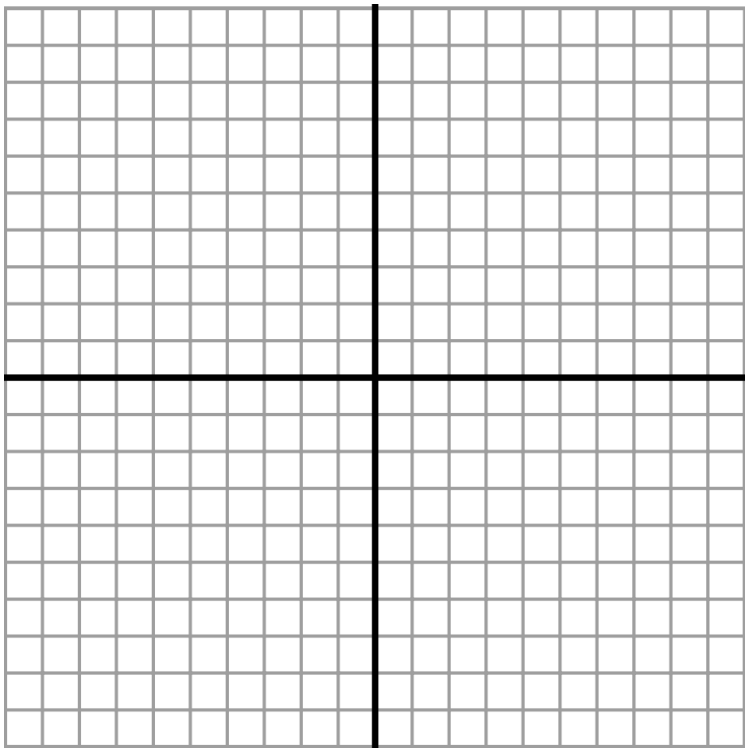
$$c(x) = \begin{cases} 1.75x, \text{ if } 0 \le x \le 9 \\ 1.25x, \text{ if } x \ge 10 \end{cases}$$

e. On the set of axes below, graph:

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

and

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



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

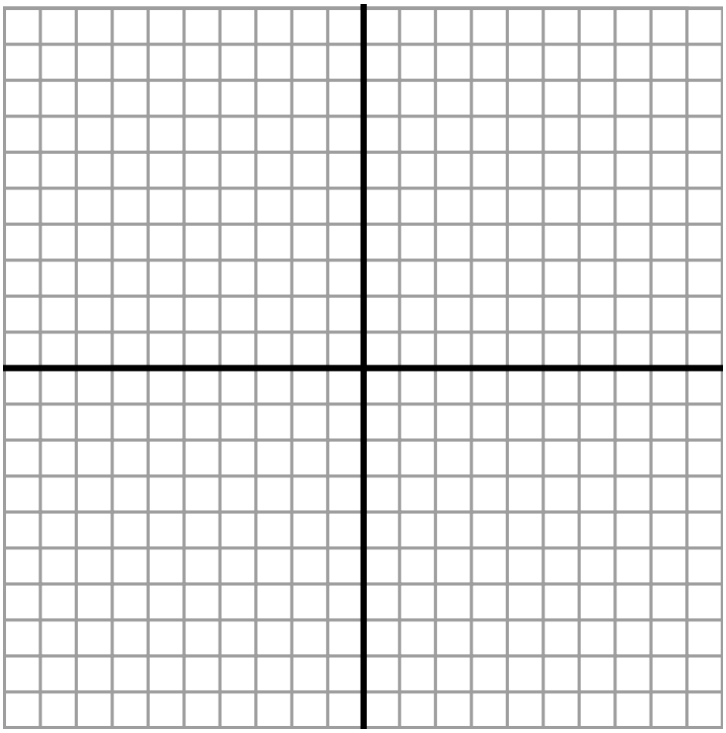
d. Factor: $5x^2 + 20x - 105$

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

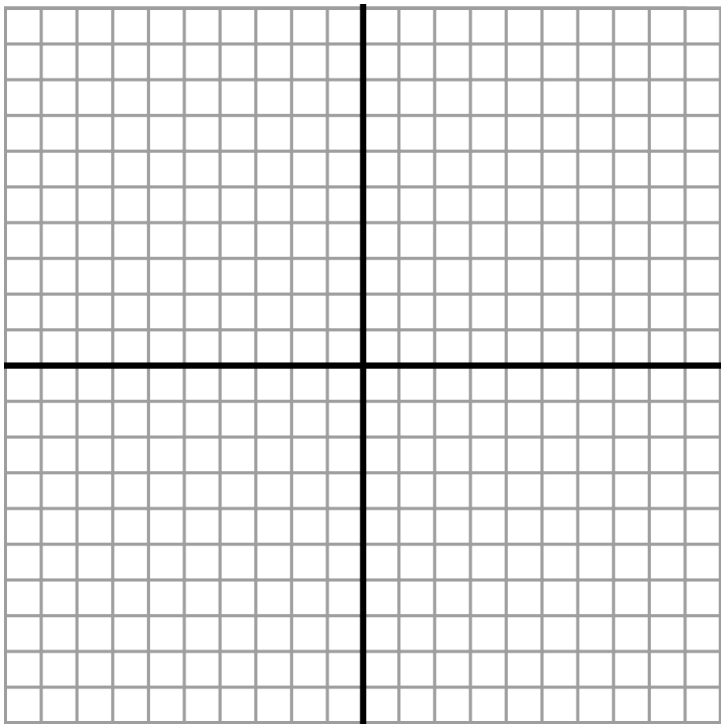
f. Factor Completely: $x^4 - 8x^2 + 7$

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:

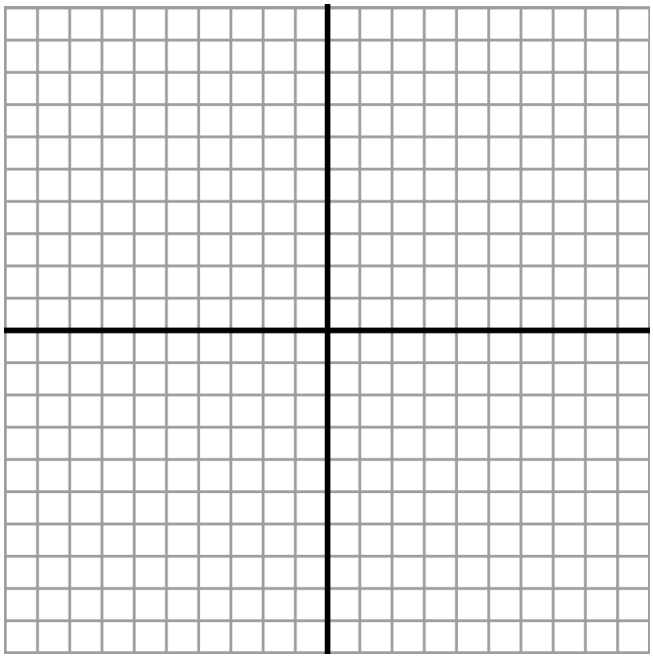
$3x + 7y = 29$
$x - 2y = -12$

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).

$$\boldsymbol{f(x) = x^2 - 2}$$

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



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

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

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

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

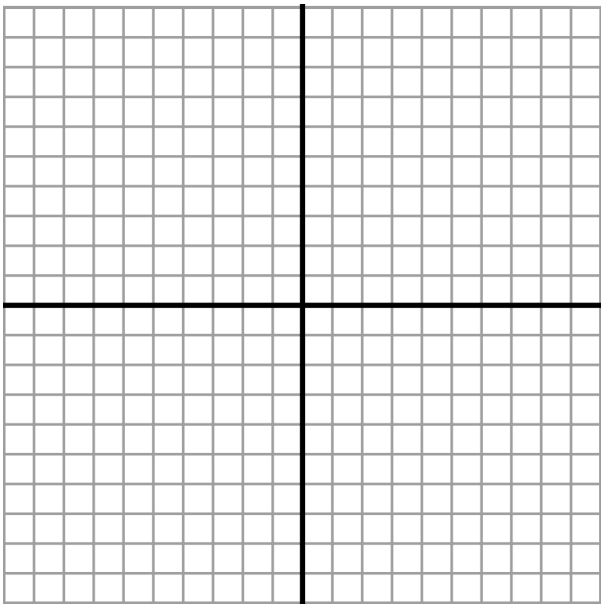
10. Modeling Functions:

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 students 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:

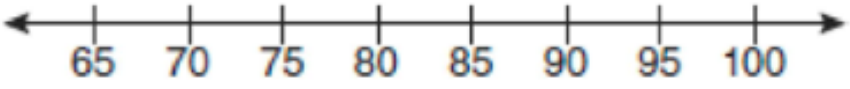
Jim: 65, 72, 80, 95, 77, 81

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 5^{th} term in an arithmetic sequence is 6 and the 7^{th} term is 22. Write a function, A_n, that can be used to find the nth term of this sequence.

17. Solving Inequalities:

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

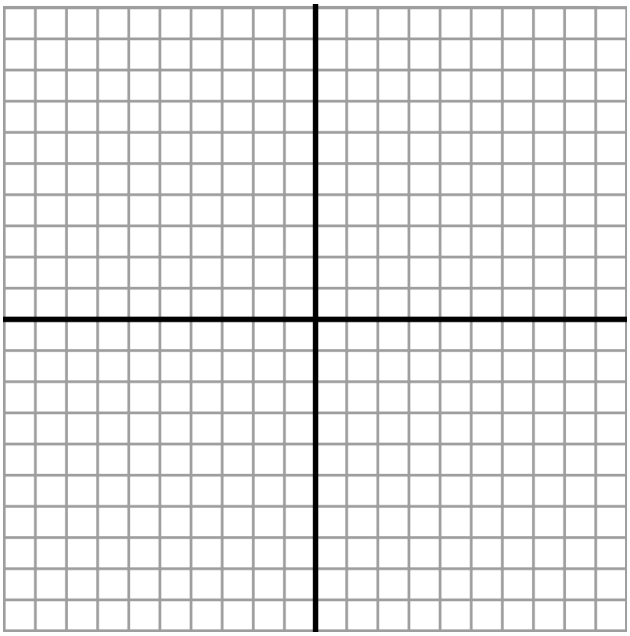
b. Determine the smallest possible integer value for x when a = 3:

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

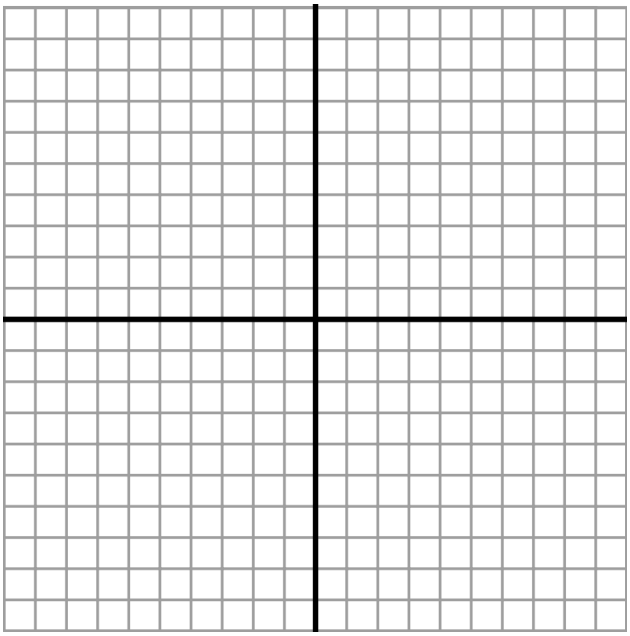
18. Graphing Special Functions

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

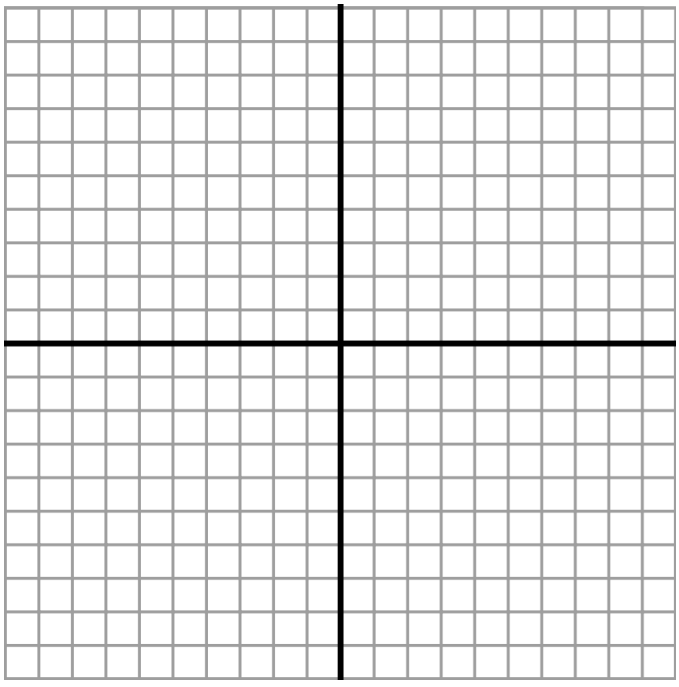
$a(x) = \sqrt{x+5} - 1$



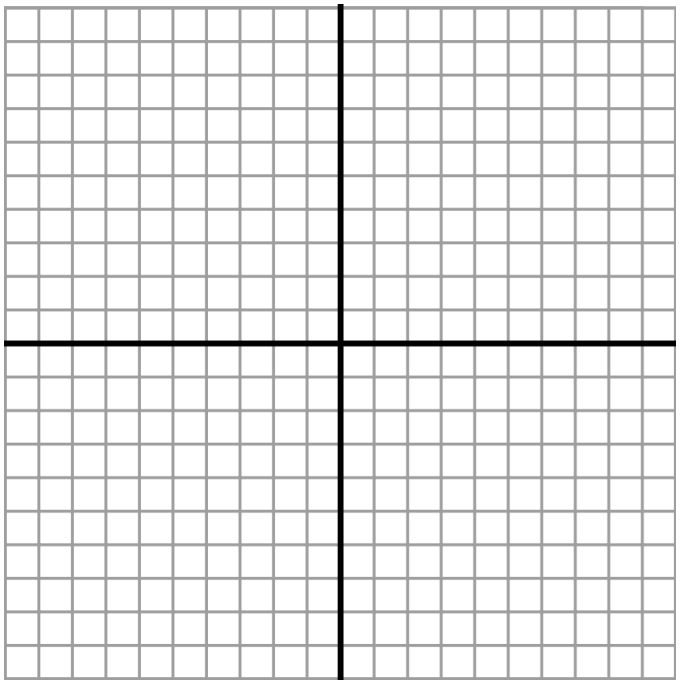
$b(x) = \sqrt[3]{x-2}$



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



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



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

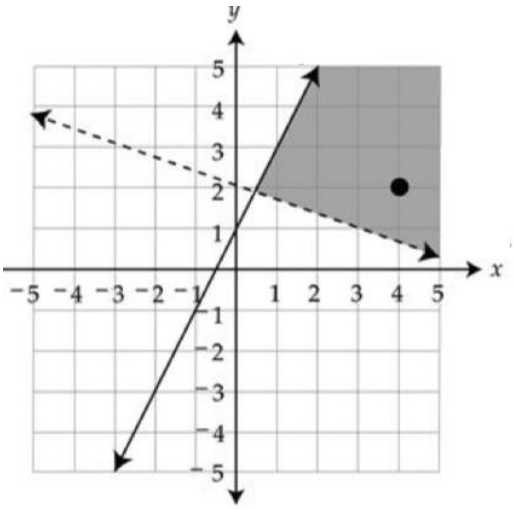
20. Transformations

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.

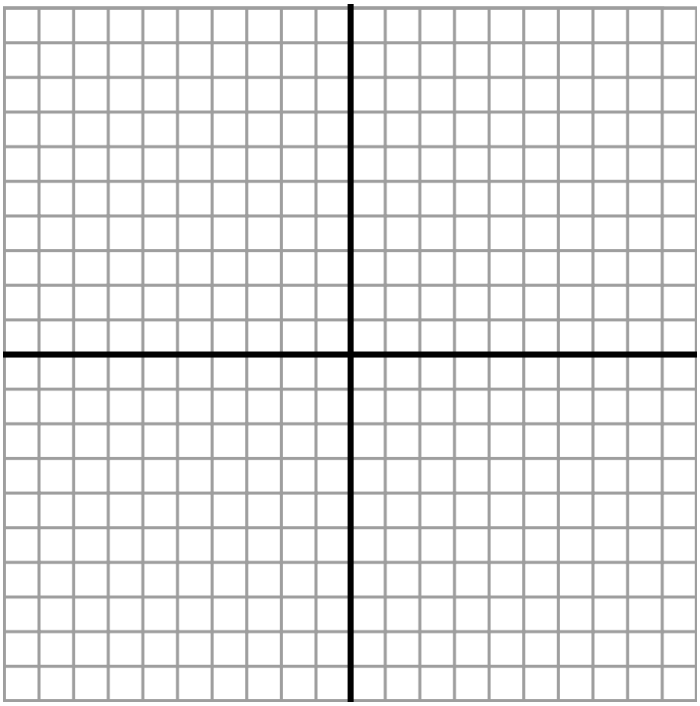
21. Systems of Inequalities:

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.

i. Write a system of inequalities to represent this situation for the number of children tickets, x, and adult, y, sold.

ii. Graph these inequalities on the axes below. Label the solution set S.

iii. Would selling 30 children tickets and 75 adult tickets help the concert hall reach their goal? Explain based on your graph.