My final is on _____ at _____

Information about the Final Exam

- The final exam is cumulative, covering previous mathematic coursework, especially Algebra I.
- All problems will be multiple choice with one correct answer out of 4.
- You will be allowed to use a notecard (3" x 5" or 4" x 6") and you may put anything on it. You will turn in the index card on the day of the final exam.
- **Calculators are permitted on the Guide and on the Final Exam.**
- The study guide below has all of the topics we have covered and you will be working selected review problems. The problems may not cover every concept, so a good strategy is to study those topics you do not immediately know.
- You will be working on the study guide review problems every day at school and for homework.
- Each day we will review any questions that you have generated from the day before, and then you will work on the next chapter test.
- All Exam Prep work is to be done on separate paper with only the answer written in the space provided.
- On the Final Exam, write the answer corresponding to the letter of the correct answer with **BLOCK CAPITAL LETTERS.**
- You will turn in the packet with all corresponding work on the day of the final exam. The packet will be worth 10% of your final exam grade.
- The final exam accounts for 20% of your total semester average. While your grade is not just a numeric computation, your average does play a huge part in determining your grade.

Study Aids/Resources

- Notes
- Chapter quizzes/tests
- Homework assignments
- Textbook (Chapters 6, 7, 8, 10, 11, and 15)
- Peers
- Internet Resources such as Khan Academy (https://www.khanacademy.org/)

Final Exam Dates & Times

- Period 2: Tuesday, May 22nd at 10:30 a.m. (You may start at 10:05 but you MUST finish by 12:15)
- Period 3: Wednesday, May 23rd at 8:15 a.m. (You may start at 8:00 but you MUST finish by 10:00)
- Period 4: Wednesday, May 23rd at 10:30 a.m. (You may start at 10:05 but you MUST finish by 12:15)
- You MUST be present on the specified day and time. There will NOT be any make-ups!
- **You must return your textbook on the day of your exam.**
- BRING A PENCIL, **YOUR TEXTBOOK**, ***COMPLETED EXAM REVIEW PACKET WITH ANSWER SHEET,*** AND SOMETHING TO DO WHEN YOU FINISH!!!

Chapter 6: Irrational and Complex Numbers

- **Sections 6-1 and 6-2: Simplifying Radicals (square, cube, and higher order roots)**
  - A solution of an equation $x^n = b$ is called an nth root of b.
  - The radical $\sqrt[n]{b}$ denotes the *principal* n^{th} root of b.
    - $\left(\sqrt[n]{b}\right)^n = b$ $\qquad \sqrt[n]{b^n} = \begin{cases} b \text{ if } n \text{ is odd} \\ |b| \text{ if } n \text{ is even} \end{cases}$
  - An expression containing nth roots is in ***simplest radical form*** if:
    - No radicand contains a factor (other than 1) that is a perfect nth power, and
    - Every denominator has bee rationalized, so that no radicand is a fraction and no radical is in a denominator.

- **Sections 6-3 and 6-4: Arithmetic with Radical Expressions (+, -, x, ÷)**
  - Radical expressions with the same index and radicand can be added in the same way as like terms.
  - Binomials containing radicals are multiplied using the BOX and/or FOIL method.
    - $a\sqrt{b} + c\sqrt{d}$ and $a\sqrt{b} - c\sqrt{d}$ are called ***conjugates***.
      - When multiplied, they act like Differences of Squares ($a^2b - c^2d$), so their product is always a rational number.

- **Section 6-5: Solving Radical Equations**
  - To solve a *radical equation* involving square roots, first isolate the radical term and then square both sides of the equation. Repeat this process if necessary. Be sure to check all possible solutions in the original equation to determine if any extraneous roots were introduced.

- **Section 6-6: Rational and Irrational Numbers**
  - A real number that can be expressed as a quotient of two integers is ***rational***. Otherwise it is ***irrational***.
  - Convert a fraction into a decimal and identify as terminating or non-terminating
  - Convert a terminating or repeating decimal into a rational fraction.
  - Find a rational and an irrational number between two given numbers.

- **Section 6-7: The Imaginary Number i**
  - A *complex number* is a number of the form a + bi, where "a" and "b" are real numbers and $i = \sqrt{-1}$. The number "a" is called the *real part* of the complex number, and "b" is called the *imaginary part*.
  - Use the pattern of i $\left(i = \sqrt{-1},\ i^2 = -1,\ i^3 = -\sqrt{-1},\ i^4 = 1\right)$ to simplify expression containing imaginary numbers.
  - The complex conjugate of a + bi is a – bi. The product of these complex conjugates is the real number $a^2 + b^2$.
  - To simplify an expression containing square roots of negative numbers, first rewrite each radical using i.
  - Know how to simplify radical expression that result in imaginary numbers or that involve imaginary numbers
  - Know how to solve simple quadratic equations that result in imaginary solutions

- **Section 6-8: The Complex Number**
  - Understand the entire hierarchy of numbers, starting with the complex set.
  - Add, subtract, multiply, and divide complex numbers.

Chapter 7: Quadratic Equations and Functions

- **Section 7-1:** Solve a quadratic equation $ax^2 + bx + c = 0$ by ***completing the square***
- **Section 7-2: The Quadratic Formula**
  - Be able to derive the quadratic formula from the equation $ax^2 + bx + c = 0$ by completing the square.
  - Solve a quadratic equation using the ***quadratic formula.***
  - Know how to find the roots of a quadratic equation using the quadratic formula. The coefficients may be integers, imaginary numbers, or irrational (e.g. square roots).
  - Be able to approximate roots with a calculator and correctly round to a given number of decimal places.
  - Know how to setup and solve word problems involving quadratic equations
- **Section 7-4: Equations in Quadratic Form**
  - Know how to solve an equation in quadratic **form** using a variable substitution "y = ____". For example, in the equation $x^4 - 3x^2 + 5 = 0$, let $y = x^2$ and the equation becomes $y^2 - 3y + 5 = 0$. Find the y roots, and then use the variable substitution to find the x roots.
  - If the variable substitution contains a radical, you MUST check for extraneous roots. They are easy to spot. Remember, $\sqrt{x} = -b$ has NO SOLUTION for $b > 0$ because the square root represents a positive number!
  - Also remember that the number of roots is the same as the highest power of the polynomial.
- **Section 7-5: Graphing $y - k = a(x - h)^2$**
  - Graph parabolic equations in vertex form: $y - k = a(x-h)^2$. This is really just the graph of $y = ax^2$ starting at the "new origin" (h, k), which is **the vertex** of the parabola.
    - **The vertex** is the parabola shifted h units horizontally and k units vertically.
  - Know how to create an equation in vertex form when given information about the parabola such as its vertex and another piece of information (e.g. y-intercept, or an x-intercept).
  - Find the vertex, axis of symmetry, x-intercepts, and y-intercept when given an equation in vertex form.
- **Section 7-6: Quadratic Functions**
  - Know how to convert a ***general form*** function $f(x) = ax^2 + bx + c$ into a ***standard form*** function $f(x) = a(x-h)^2 + k$ and back into **vertex form** $y - k = a(x-h)^2$.
  - Know how to find the vertex, maximum or minimum, axis of symmetry, domain, range, and zeros of a quadratic function in general form by converting it into standard form (complete the square).

Chapter 8: Polynomial Equations

- **Section 8-3: Dividing Polynomials**
  - Divide polynomials using long division
  - To divide one polynomial by another, find the quotient and remainder using the division algorithm: $\frac{Dividend}{Divisor} = Quotient + \frac{\text{Re}mainder}{Divisor}$.
  - Use the division algorithm to find missing parts of a division problem.
- **Section 8-4: Synthetic Division**
  - Divide a polynomial by a first-degree binomial $x - c$ using synthetic division.
- **Section 8-5: The Remainder and Factor Theorems**
  - Remainder theorem: When $P(x)$ is divided by $(x - c)$, the remainder is $P(c)$.
  - Evaluate polynomial functions at $x = c$ using synthetic substitution
  - Factor theorem: If $P(x)$ has $(x - r)$ as a factor, then r is a root of $P(x) = 0$.
  - Determine if a given binomial $(x - c)$ is a factor of $P(x)$ by synthetic division
  - Create a polynomial equation with integer coefficients using given roots.
  - Solve a third-degree polynomial given one of its roots using synthetic division.

Chapter 10: Exponential and Logarithmic Functions

- **Section 10-1: Rational Exponents**
  - Express $b^{\frac{m}{n}}$ in radical form: $\sqrt[n]{b^m} = \left(\sqrt[n]{b}\right)^m$
  - Convert a radical expression into exponential form
  - Convert an exponential expression into radical form
  - Solve equations in fractional exponential form using rational roots

- **Section 10-2: Real Number Exponents**
  - Simplify expressions having irrational exponents
  - Define the exponential function: b^x and know its properties: $b \neq 1$, $b > 0$, one-to-one
  - Solve exponential equations using the one-to-one property

- **Section 10-4: Definition of Logarithms**
  - Define the logarithmic function $\log_b N = k$ as the inverse of the exponential function $b^k = N$
    - Because these are inverses, we get $b^{\log_b x} = x$ and $\log_b\left(b^x\right) = x$.
  - Recognize the logarithmic function as giving the exponent for the base to generate a number N: if $\mathbf{b^k = N}$, then $\mathbf{\log_b N = k}$. ***The log and exponent functions "undo" each other!***
  - Write a logarithmic expression in exponential form and an exponential expression in logarithmic form
  - Simplify logarithms by writing in exponential form
  - Solve simple logarithmic equations

- **Section 10-5: Laws of Logarithms**
  - Use the three laws of logarithms (product rule, quotient rule, and power rule) to "expand" and "condense" logarithm expressions
  - Solve logarithm equations using the one-to-one property of logarithms
    - Evaluate a logarithm using the three rules and known values of logarithms.
    - Solve logarithmic equations by applying the three rules and converting into exponential form.

- **Section 10-7: Exponential Growth and Decay**
  - Solve word problems related to compound interest: future value, time to double (or triple, etc.), and amount to invest.
  - Solve word problems related to doubling time or half-life: future amount and time to double/half.
  - Evaluate logarithms using the change of base formula.

- **Section 10-8: The Natural Logarithm Function**
  - Define the number e as the value that $f(x) = \left(1 + \frac{1}{x}\right)^x$ reaches when x gets very large.
  - Do everything above for the logarithm base e, written as $\ln x$.

Chapter 11: Sequences

- **Section 11-1: Type of Sequences**
  - A ***sequence*** is a set of numbers arranged in a defined order according to their position in the list.
  - Each value in the sequence is a ***term***.
  - A ***finite*** sequence has a limited number of terms and an ***infinite*** sequence has an unlimited number of terms.
  - Sequences can be arithmetic, geometric, or neither.

- **Section 11-2: Arithmetic Sequences**
  - If there is a *common difference d* between any two successive terms, then the sequence is arithmetic.
  - In any arithmetic sequence with first term t_1 and common difference d, the nth term is given by $t_n = t_1 + d(n - 1)$.
  - The ***arithmetic mean*** of two numbers is simply the average of the two numbers. If there is more than one arithmetic mean between two numbers, find them by creating a system of linear equations.

- **Section 11-3: Geometric Sequences**
  - If ratio of successive terms is constant, then the sequence is geometric. The ratio is the *common ratio* and is denoted as *r*.
  - In any geometric sequence with first term t_1 and common ratio r, the nth term is given by $t_n = t_1 \times r^{(n-1)}$.
  - The ***geometric mean*** of two numbers "a" and "b" is $\sqrt{ab}$ (if a, b > 0) or $-\sqrt{ab}$ (if a, b < 0). If there is more than one geometric mean between two numbers, find them by creating a system of linear equations.

Chapter 15: Statistics and Probability

- **Section 15-1: Presenting Statistical Data**
  - Know how to create and read all forms of statistical data display tools, including frequency tables, bar graphs, circle graphs, line graphs, line plots, histograms, stem-and-leaf plots, two-way frequency tables, and box-and-whiskers plots.

- **Section 15-2: Analyzing Statistical Data**
  - **Measures of Central Tendency** are values that describe the typical value in the distribution of data
    - The three most common are: Mean, Median, and Mode.
      - The **Mean** of a set of data is the average value of all the numbers. It is derived by taking the sum of the data and dividing it by the number of pieces of data.
      - The **Median** is number in the middle when the data are arranged in order. When there are two middle numbers, the median is their mean. This occurs if there are an even number of data in the set.
      - The **Mode** of a set of data is the number or item that appears most often. There can be one mode, more than one mode, or no mode in the data set.
  - **Measures of Variation** are quantities that describe the spread of the values in a set of data.
    - The **Range** of a set of data is the difference between the largest and smallest values. It is the size of the smallest interval which contains all the data and provides an indication of **statistical** dispersion.

- The **Quartiles** of a data set are the values that separate the data into four equal subsets, each containing one-fourth of the data.
    - The **median** separates the data into two equal parts, so Q2 is the median.
    - The **Lower Quartile** (Q1 or LQ) divides the lower half of the data into two equal parts.
    - The **Upper Quartile** (Q3 or UQ) divides the upper half of the data into two equal parts.
    - The **Interquartile Range** (IQR) is the difference between the upper and lower quartiles.
- An **Outlier** is a value that is much smaller or larger than most of the other values in a set of data.
    - **Outliers** are defined as any element of a set of data that is at least 1.5 interquartile ranges less than the lower quartile or greater than the upper quartile.

- **Section 15-3: Variance and Standard Deviation**
    - Standard Deviation
        - The most common measure of spread that relates to the mean is called the standard deviation.
        - The basic idea is to find out how far, on average, a data point is from the mean.
        - The process of finding the standard deviation is:
            - 1. Calculate the mean.
            - 2. Find each deviation from the mean.
            - 3. Square the deviations.
            - 4. Add up the squares of the deviations.
            - 5. Divide the sum by n – 1, where n is the number of data points.
            - 6. Take the square root.
        - Variance is the Standard Deviation Squared.

- **Section 15-4: Scatter Plots and Correlation**
    - A **Scatter Plot** is a graph that shows the general relationship between two sets of data.
        - It is the graph of a series of ordered pairs in a coordinate plane.
        - There are three possible relationships between the two sets of data.
            - A Positive Correlation
            - A Negative Correlation
            - No Correlation
    - Lines of Best Fit
        - When two variables are linearly related, you can use a line to describe their relationship.
        - This line is known as the Linear Model.
        - You can also use the equation of the line to predict the value of the y-variable based on the value of the x-variable.
        - Residuals
            - One way to think about how useful a line is for describing a relationship is to use the line to predict the y-values for the points in the scatter plot. These predicted values could then be compared to the actual y-values.
            - This prediction error is called a **residual**.
            - **Residual = actual-value − predicted–value.**

- ❖ When you use a line to describe the relationship between two numerical variables, the best line is the line that makes the residuals as small as possible overall.
  - The most common choice for the best line is the line that makes the sum of the squared residuals as small as possible.
  - The line that has a smaller sum of squared residuals for this data set than any other line is called the **least squares line**.
  - This line can also be called the **best-fit line** or the **line of best fit** (or **regression line**)
- Correlation Coefficient
  - ❖ The correlation coefficient is a number between −1 and +1 (including −1 and +1) that measures the strength and direction of a linear relationship.
  - ❖ The correlation coefficient is denoted by the letter r.
  - ❖ When a line of best fit is produced, it usually comes with a correlation coefficient that tells us "how good is the best".
  - ❖ The closer the points are to being on the line, the closer the correlation coefficient is to ±1.

- **Section 15-5: Fundamental Counting Principle**
  - An **outcome** is the result of a single trial of an experiment.
  - The **sample space** is the list of all possible outcomes.
  - An **event** is any collection of one or more outcomes.
  - There are two ways to determine the sample space: Tree Diagrams and the Fundamental Counting Principle
  - Know how to use the fundamental counting principle to solve "number of ways" problems
  - Know how to find "number of ways" for mutually exclusive situations using the addition principle.

- **Sections 15-6 and 15-7: Permutations and Combinations**
  - Find the number of permutations of *n* objects taken *n* at a time: ${}_nP_n = n!$
  - Find the number of permutations of *n* objects taken *r* at a time ${}_nP_r = \frac{n!}{(n-r)!}$
  - Find the number of permutations when there are multiple identical items: $P = \frac{n!}{n_1! \cdot n_2! \Lambda}$
  - Find the number of combinations of *n* objects taken *r* at a time: ${}_nC_r = \frac{n!}{r!\,(n-r)!}$

- **Sections 15-8 and 15-9: Sample Space and Events and Probability**
  - **Experiment**: An action for which the outcome is ***uncertain***.
  - **Outcome**: The result of an experiment.
  - **Sample Space**: The set of all possible outcomes.
  - **Event**: A sub-set of the sample space. It is usually something in which we are interested
  - Find the sample space for an experiment and the number of elements in an event
  - Find the probability of an event occurring: $P = \frac{\textit{items in event}}{\textit{items in sample space}} = \frac{n(E)}{n(S)}$.