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Chapter 1: Introduction and Study Plan

Hello future GMAT test takers!

In this GMATTERS Quant Summary audio, I hope to give you a summary of GMAT quant concepts that you might encounter on the GMAT focus edition. I'll start with test taking tips to remember before getting into the quant concepts.

Chapter 2: Test Taking Strategies and Tips

2 Good test taking strategies:

1. Capping your question time at 2 minutes, make an educated guess if you have to, and hope you have time to come back to it.
2. Avoid leaving questions blank by following the recently stated 2 minute rule. If you somehow forget about the 2 minute rule on the test and you notice the clock ticking down, it is best to quickly guess on everything you have left than to leave answers blank.

Here are 8 test taking Tips:

1. GMAT questions are designed to be solvable in 2 minutes or less. If your math is taking longer than this, you're either not doing it correctly or not using the math rules that you could be using.
2. Always read the whole question and make sure you understand what it's asking you to solve for.
3. There are Two Kinds of Problems on the GMAT quant section - "Just Do It" problems and then "Words into equations" problems. In "Just Do It" problems, the equation or equations to solve are laid out in the question and you simply need to solve them. In "Words into Equations" problems, you need to turn the question text into equations that can then be solved for. Most problems are these "words into equations" problems.
4. Once you read the whole question and turn text into equations or visuals, spend the first 5-10 seconds game planning how to solve it. If you can't come up with a game plan, then you can start trying things with your equations and see if a strategy jumps out to you. But you should ideally be solving problems with a game plan in mind.
    a. An example of turning text into equations is turning the text "Charlotte has 4 rabbits and Pinocchio has 3x as many rabbits as Charlotte" into "C=4 and P=3C".
5. Sometimes it can help to briefly look at the question answer choices to see what kind of answer you should be looking for.
6. Keep question times to about 2 minutes and learn to tell if you're ahead or behind on the clock. My personal strategy for this was writing the question number down first and then next to it, the time remaining I should have after solving the question.
    a. Ex. I would right quote Question #1 and write 43 next to it, because after spending 2 minutes on Question #1, the 45 minute quant section clock should

read 43 minutes. Then for Question #2 I wrote 41 next to it. And so on for each question.

7. There are two ways to solve every question:
    a. 1. Solve the question first and see if any of the answers match.
    b. 2. Try plugging in the provided answers to the question to see which works.
    c. Generally I would recommend the first approach… but it's important to remember the second option because for a small amount of problems this is the best way to solve it.
8. A large amount of GMAT quant questions are about turning text into equations. You should write down all the equations you can… but you know you have enough equations if your number of equations is equal to or greater than the number of variables you need to solve.

Now with test taking tips out of the way we can start on the actual quant prep:

Chapter 3: Basic Number Rules

- Basics of Number Rules:
    - An integer is a whole number (ex. 3 or +4). Anything with a non-zero decimal or fraction is not an integer (ex. 2.1 or ⅓).
    - Positive numbers are greater than negative numbers (ex. +2 is greater than -2).
    - A less negative number is greater than a more negative number (ex. -2 > -5)
    - Prime numbers are any positive number that has no positive divisors other than itself and the number 1.
        - The first 12 prime numbers are: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37…
    - An absolute value is the positive version of a number no matter if the number is positive or negative. So the absolute value of both +4 and -4 is +4.
        - In an equation, this could mean solving the equation in two separate ways. One way treating it as positive and the other way treating the term as negative.

Chapter 4: Odds and Evens

- Odds and Evens:
    - Addition and subtraction rules:
        - odd + odd = even
        - even + even = even
        - odd + even = odd
    - Multiplication and division rules:
        - odd * odd = odd
        - even * even = even
        - even * odd = even

Chapter 5: Basic Math (Decimals, Multiplication, and Simple Equations)

- Basic Math (Decimals, Multiplication, and Simple Equations)
  - You should be able to quickly add decimals - the simplest ones should even be able to be done in your head. (ex. 3.2 + 5.9 = 9.1).
  - Multiplying and dividing decimals is more complicated and really shouldn't have to be done much on the GMAT except in simple cases (ex. 8.4 / 2 = 4.2).
  - Know your times tables of 1-10 quickly and know how to do mental math quickly for higher numbers.
    - Ex. 3 * 6 = 18
    - Ex. 9*7 = 63
    - Ex. 125 * 4 = 250 * 2 = 500
  - Basics of Equations:
    - If you have an equation y = x + 3 and you want to know what y is when x=2, then you simply plug x=2 into that equation to get y = 2+3 = 5

Chapter 6: US Currency

- US Currency
  - Some problems will require you to know basic values of US coins and dollars and know what that means. These problems frequently rely on the units digit.
  - Common coins: 1 cent penny, 5 cent nickel, 10 cent dime, and 25 cent quarter.
  - Common dollars: $1 bill, $5 bill, $10 bill, $20 bill, $50 bill, and $100 bill.
  - Ex. If you need to make $35 in bills, you need at least one $5 bill.

Chapter 7: Ratios, Percentages, and Fractions

- Ratios, Percentages, and Fractions.
  - All 3 of these are used to describe relative relationships. I.e. expressing something in terms of something else.
  - Percentages:
    - A percent is a decimal times 100. And inversely, a % can be turned into a decimal by dividing by 100.
      - Ex. 40% in decimal terms is 0.4.
    - The equation to solve for percent increase or decrease:
      - ((New - original) / original)*100 = % increase or decrease.
    - Important note about percentages: The fact that 80 is 20% less than 100 does not mean that 100 is 20% greater than 80. 100 is actually 25% greater than 80.
    - A useful trick with percentages is that percentages are reversible:
      - Ex. 6% of 20 is the same as 20% of 6, which is 6/5 or 1.2.
  - Ratios:
    - A ratio is the relationship between two things.
      - Ex. The ratio of chickens to eggs is 2 to 1. Meaning for every 2 chickens you have, you also have one egg.
    - You use ratios to set up equations to solve in the GMAT.
  - Fractions:

- Fractions, like percentages, are used to describe a portion of a whole.
    - Ex. Of the entire middle school class, 2 out of every 10 students play the tuba.
- You can use fractions to set up equations to solve as well:
- Common fraction-to-decimal conversions to memorize:
    - ½ = 0.5
    - ⅓ = 0.33333
    - ¼ = 0.25
    - ⅕ = 0.2
    - ⅙ = 0.166667
    - 1/7 ~ 0.146…
    - ⅛ = 0.125
    - 1/9 = 0.111111
    - 1/10 = 0.1
    - Tip: Use these base fractions to solve others:
        - ex. 3/7 = 1/7 * 3 or 0.146 * 3 which is approximately 0.44.
- Fraction rules:
    - Simplifying fractions:
        - It is usually in your best interest to simplify fractions (ex. 6/8 = ¾)
        - A fraction is as simplified as it can be if the numerator and denominator can no longer each be divided evenly by the same number.
    - The only time simplifying fractions may not be in your best interest is if you are trying to create a common denominator to add or subtract fractions.
        - Fractions can be added and subtracted easily as long as their denominators are equal. Just add or subtract the numerators and leave the common denominator alone.
        - If the denominators are not equal, you'll need to create a common denominator by multiplying the numerator and denominator of fractions as necessary:
        - If two factions only share a common numerator and not a common denominator, they CANNOT be added and subtracted in their current forms.
    - Multiplying and Dividing fractions:
        - To multiply fractions, simply multiply the numerators together and the multiply the denominators together:
        - To divide by a fraction, know that dividing by a fraction is the same multiplying by the inverse of that fraction.
    - Fraction tip: Something divided by that same thing is always 1.
        - Ex. -8 / -8 = 1
    - An equation written in fractions can easily be inverted.

        - Ex. y/x = -3/2 can be re-written by inverting both sides to x/y = -⅔.
        - Note the whole quantity of each side gets inverted. If one side were z + 2, inverting that gives 1 / (z+2) NOT 1/z + ½
    - A number that is part integer and part number is called a mixed number.
        - Ex. 8 ¾ or 2 ½
- Comparing Fractions and decimals.
    - fraction and decimals should be converted to the same form (i.e. all fractions or all decimals).
    - Fractions can easily be compared if they have a common denominator.

Chapter 8: Unit conversions

- Unit conversions:
    - Common unit conversions to know:
        - 60 seconds = 1 min
        - 60 min = 1 hr
        - 100 cm = 1 m
        - 1000 m = 1 km
    - When converting units (ex. Seconds to hours) set up the fractions such that the numerator unit of the 1st term is canceled out by the denominator unit of the next term. Continue this until you arrive at the unit you desire in the numerator.
    - Rule: when adding/subtracting/dividing/multiplying numbers, make sure they are in the same unit.
    - Tip: problems often give you values with units different than what you need to solve for. To solve these you must convert the values to the proper units.

Chapter 9: Scientific Notation is Essentially part of Unit Conversion.

- Scientific notation is essentially part of units conversion:
    - To solve some problems easily, you'll have to convert between decimals and scientific notation.
    - Scientific notation is just a way to write any number such that it in the form z * 10^y where z is between 1.0000 inclusive and 9.99999 inclusive. Note how every number in between here has only one number in front of the decimal.
        - Ex. 7 in exponential notation is 7 * 10^0
        - Ex. 0.005 in exponential notation is 5 * 10^(-3)
    - The trick to converting between numbers in "normal" notation and scientific notation is knowing how 10^y moves the decimal.
    - When you read numbers in scientific notation, it is quite obvious whether numbers are larger or smaller than each other by first comparing powers and then comparing the coefficients (i.e. the numbers in front) if the powers are the same.
        - Ex. 4.88 * 10^5 is greater than 9.33 * 10^4
        - Ex. 3.4 * 10^(-6) is less than 2.3 * 10^(-4)

            - Ex. 4.35 * 10^(-5) is less than 5.3*10*(-5)

Chapter 10: Rounding

- Rounding:
    - Numbers should be rounded up or down if asked according to the following rules:
        - If the next number is 4 or lower then round down.
        - If the next number is 5 or higher then round up.
    - If you need to round, the place to round to will be specified. You'll need to know the names of places (ex. Thousands place, hundreds place, ones place, tenths place, hundredths place, thousandths place, etc.)

Chapter 11: Basics of Equations

- Equations:
    - The basic forms for equations are linear, quadratic, and cubic.
    - The difference between these equations is simply the highest exponent on a variable within the equation.
        - Ex. Y = x is linear. Y = X^2 is quadratic. And Y = X^3 is cubic.
        - The visual appearance of each kind of equation is:
            - Linear: a line
            - Quadratic: a parabola or u-shape facing either up or down
            - Cubic: an s shape
    - The common form for a linear expression is y=mx+b where m is the slope and b is the y-intercept.
    - The common forms for a quadratic expression are the standard and factored forms which are often interchangeable. But in both forms one side of the expression must equal zero.
        - Ex. Standard quadratic form: x^2 + 5x + 4 = 0
        - Ex. Factored quadratic form: (x+4)(x+1) = 0
    - There are also some basic equations that you should know what they look like graphically or at least be able to quickly deduce what they look like graphically:
        - Ex. y = 1/x or y = 1/x^2. Both look like a ramp down in the top right quadrant of a 4 quadrant graph. 1/x looks like a ramp down in the bottom left quadrant. 1/x^2 looks like a ramp up in the upper left quadrant.

Chapter 12: Averages / Arithmetic Means

- Averages (aka arithmetic mean)
    - The average of a given set of values is the sum of those given values divided by the number of values.
    - Note: a word problem may have you set up an equation with this formula to solve for a variable within it.
    - Rules with averages:
        - If all numbers in a dataset have the same number added to them or the same number subtracted from them, the new mean is the old mean shifted by that addition or subtraction value.

        - If all numbers in a dataset are multiplied or divided by the same number, the new mean is the old mean multiplied or divided by that value.

Chapter 13: Ranges, Modes, Medians, and Standard Deviation

- Ranges, Modes, Medians, and Standard Deviation.
    - A range is the difference between the highest value and the lowest value in a data set.
    - A couple of tricks with ranges:
        - Adding the same number to all numbers in the dataset does not change the range
        - The same “range stays constant” rule applies to subtracting the same number to all numbers in a dataset.
        - However, this rule does NOT apply to multiplication and division. If there is a starting range to a dataset and the dataset is multiplied or divided by some number, then the new range is just the old range multiplied or divided by that same number.
    - A mode is the most common number in a data set.
    - A median is the middle number in a data set.
    - Standard deviation is a measure of the spread in a data set.

Chapter 14: Basic Math Laws

- Basic Math Laws:
    - Commutative Property:
        - A + B = B + A
        - A * B = B * A
    - Associative Property:
        - (A + B) + C = A + (B + C)
        - (A * B) * C = A * (B * C)
    - Distributive Property:
        - A *(b + c) = ab + ac
        - Note this is the basics of FOILing later on for quadratic equations.

Chapter 15: Remainders and Quotients

- Remainders and quotients:
    - A remainder is what is left over after dividing a bigger number by a smaller number:
    - Therefore, the quotient is how many times a smaller number fits evenly into a bigger number.
    - The remainder and quotient combine to form the equation: y = x*q + r where y is some larger number, x is a smaller number, q is the quotient, and r is the remainder.

Chapter 16: Divisors, Multiples, and Least Common Multiples

- Divisors, Multiples, and Least Common Multiples:
  - Note: this whole chapter talks about integers only:
  - Multiples and divisors are opposite sides of the same coin.
    - A smaller number times an integer creates a multiple (ex. 3*6 = 18, so 18 is a multiple of 3).
    - A divisor is the opposite. 3 has only 2 divisors: 3 and 1. But 18 has many divisors: 1, 2, 3, 6, and 9 because all of these fit perfectly into 18.
    - So 18 is a multiple of 3 and 3 is a divisor of 18.
    - This can be written out with the equation y=x*q. Note how this is similar to the quotient-and-remainder equation except the remainder is r=0.
  - 3 common ways to solve divisor/multiple problems:
    - 1. Turn it into an equation (example y=x*q as above)
    - 2. Write out the first n number of terms to see the pattern (often 10 terms is sufficient).
    - 3. Using Prime factorization.
      - Any positive integer 2 or greater can be re-written as a prime factorization.
      - Ex. 9 has the prime factorization of 3*3 or 3^2
      - Ex. 22 has the prime factorization 11*2
      - Prime factorization is useful to easily decide if numbers can be multiples or divisors of each other. If the prime factorization of smaller A is contained within the larger number B, then B is a multiple of A and A is a divisor of B.
  - The least common multiple or LCM of 2 numbers is the smallest number that is a multiple of both numbers.
    - For simple numbers like 6 and 8, you can just figure out mentally that 24 is the Least Common Multiple.
    - But for harder numbers, you need to do the prime factorization of both and then combine them in a specific way.

Chapter 17: Solving complicated fractions

- Solving complicated fractions:
  - Solve the most "buried" fractions first and then simplify.
  - This could involved turning a mixed number into a single fraction:
    - ex. 2 + ¾ = 8/4 + ¾ = 11/4
  - Note: the most buried terms could be in the numerator or denominator

Chapter 18: Manipulating Equations

- Manipulating Equations:
  - You simplify equations by manipulating them. Often this means manipulating them to solve for one variable.
  - First we'll discuss equations with an equals sign:

        - As long as the same thing is done to both sides of an equation, the equation is still true.
        - Using this style of manipulation, you can solve an equation by getting the desired term on one side and everything else on the other side.
    - For inequalities (i.e. greater than sign or less than sign), there becomes one more rule:
        - Addition and subtraction can still be done freely to both sides.
        - Multiplication and division of POSITIVE numbers can also be done freely to both sides, however multiplication or division of NEGATIVE numbers flips the inequality sign.
    - Sometimes the GMAT is tricky and the form of the equations in the answers are not exactly how you solved it. In rare scenarios you may need to multiply out your equation to put it in a different form.

Chapter 19: Simplifying Equations

- Simplifying equations:
    - 2 common ways to simplify forms of equations:
        - 1) Combine like terms
            - ex. Z+2+4 = z+6
            - Ex. 4x + 3x = 7x
        - 2) Pulling out factors.
            - (ex. x^2 + 3x = x(x+3)
            - (ex. 300x + 1200 = 100(x +12).

Chapter 20: Inequalities

- Inequalities:
    - Inequalities are simply equations that use the greater than sign or less than sign. These signs look like chevrons pointing to the left or right.
    - Inequalities are almost as helpful as equations and give bounds to variables.
    - Multiple inequalities can be used to learn things about a variable. If you have 2 inequalities that you know are true, then you can use the most restrictive parts of both of them to learn more about the variable.

Chapter 21: Quadratic Equations

- Quadratic equations:
    - In quadratic equations, there are 2 common forms: standard and factored. FOILing takes you from factored to standard. While factoring is the opposite, and takes you from standard to factored.
    - Ex. Standard form = x^2 +5x +4 = 0
    - Ex. Factored form = (x+2)(x+1) = 0
    - To find the roots (i.e. the x-intercepts) of the quadratic equation:
        - in the standard form, use the quadratic formula: x = (-b +/- sqrt(b^2 - 4ac))/2a

        - In the factored form, solve each equation in the parentheses for zero (ex. X+2 = 0).
    - In both forms, the equation is equal to zero. Graphically a quadratic equation is U shaped either upside down or right side up, and solving when a quadratic equation equals zero tells you where the graph intercepts the x-axis.
        - So if you see an equation that looks like it should be quadratic but one side is not equal to 0, then manipulate the equation such that one side equals zero.
    - FOIL converts factored form to standard form. FOIL stands for First, Outside, Inside, Last.
    - Factoring converts standard form to factored form. (Ex. 0 = x^2 +2x - 8 to 0= (x+2)(x-4)).
    - Three special quadratic simplification opportunities to recognize:
        - (x+y)(x-y) = x^2 + y^2
            - Notice how the standard is simpler?
        - (x+y)^2 = x^2 + 2xy + y^2
            - Notice how the factored form is simpler with the square?
        - (x-y)^2 = x^2 - 2xy + y^2
            - Notice how the factored form is simpler?

Chapter 22: Solving Multiple Equations

- Solving multiple equations:
    - Many GMAT questions involve solving multiple equations. Often this involves pulling equations from word problems such that you can solve the system.
    - There are 2 ways to solve multiple equations on the GMAT:
    - Method 1) Substitution Method:
        - To do this, manipulate one equation to solve for a variable that you want and then plug that into the other equation.
    - Method 2) Combination Method.
        - To use the combination method, you manipulate one or both equations such that when adding or subtracting them to each other, one of the variables in the equations cancels out.
    - Last thing on solving a system of equations, watch out for duplicate equations. If a system of equations is composed of duplicate equations, then it cannot be solved.
        - ex. X + y = 2 is the same as 2x + 2y = 4. So really you only have one equation with two variables which cannot be solved for.

Chapter 23: Functions

- Functions:
    - Sometimes equations will be written as f(x) = x^2 instead of y = x^2. In this equation f(x) and y are interchangeable. However where the f(x) notation can be helpful is if you are asked to see how the equation changes if x^2 is used in place

of x. Then the function becomes $f(x^2) = x^4$. Writing it out this way makes it clear you replaced x with x^2 in the original function.

Chapter 24: Domain and Range of a Function

- Domain and range of a function:
    - Domain is the set of input values that could go into a function
    - Range is the set of output values.

Chapter 25: Exponents and Roots

- Exponents and Roots.
    - There are two parts to an exponent, the base and the power. In the example 2 exponent 3, this is read as 2 to the power of 3.
    - The basics of an exponent means you are multiplying the base number times itself the power number of times.
        - Ex. 2^3 = 2 times itself 3 times = 2*2*2
    - Exponents rules:
        - For a positive power: the base number times itself power number of times.
            - Ex. 2^3 = 2*2*2
            - This means a number to the power of 1 just equals the number itself.
                - Ex. (-9)^1 = -9
            - Be aware that if the base is greater than 1 and the power is greater than 1, then the resulting product is larger than its base alone.
                - Ex. 4^2 = 16 is greater than the base of just 4.
            - But also be aware that a base between 0 and 1 will keep getting smaller the more you multiply it by itself.
                - Ex. 0.8^2 = 0.64 is less than the base of 0.8.
        - For a Negative power, apply the formula 2^(-x) = 1 / 2^x
            - This is kind of like turning it into a fraction.
        - For a Power of 0, know that it always equals 1.
            - 100^0 = 1
    - Simplifying exponents
        - Shared base multiplication: add the powers.
            - Ex. 3^2 * 3^4 = 3^(2+4) = 3^6
        - Shared base division: subtract the powers.
            - 3^2 / 3^4 = 3^(2-4)=3^(-2)
        - Exponent to a power: multiply the powers:
            - (2^3)^4 = 2^(3*4) = 2^12
            - This is especially helpful with fractional powers: x^(y/z) = (x^y)^(1/z) = (x^(1/z))^y
        - Shared power:

            - Multiplication: (x^z)*(y^z) = (xy)^z
            - Division: (x^z)/(y^z) = (x/y)^z
        - If the base is not shared and the power is not shared, there is no simplification that can be done. With that being said, watch out scenarios where one of the exponent terms can be rewritten to match the other:
            - Ex. (16^4) can be re-written as (4^2)^4.
        - Anything to the zero power is 1
            - Ex. 43^0 = 0
    - You may need to use exponent rules to simplify equations or make one side of the equation look like the other. If 3^(X + Y) = 9, you can rewrite as 3^2 so 3^(x+y) = 3^2. Now it is clear that X+Y = 2.
    - Tens and Decimal Places.
        - Know how to write out and convert 10 to any power (positive or negative)
            - 10^1 = 10. 10^2 = 100. 10^3 = 1000. 10^4 = 10000.
            - 10^(-1) = 0.1. 10^(-2)=0.01, 10^(-3) = 0.001.
    - Roots:
        - The most common roots of a number are the square root and the cubic root.
            - The square root of a number is the number that, if squared, gives the number in question.
                - Ex. the square root of 64 is 8, because 8*8=64.
            - Negative numbers do not have a real square root because two of the same number cannot give a negative number. One needs to be positive and one needs to be negative.
            - For positive numbers greater than one, the square root of a number is smaller than the original number (ex. 10 is the square root of 100). However for numbers between 0 and 1, the square root of a number is larger than the original number. (ex. 0.5 is the square root of 0.25).
        - Common square roots to know:
            - You should memorize the squares 0 through 15. Therefore you should also have the square roots memorized.
                - 0^2 = 0
                - 1^2 = 1
                - 2^2 = 4
                - 3^2 = 9
                - 4^2 = 16
                - 5^2 = 25
                - 6^2 = 36
                - 7^2 = 49
                - 8^2 = 64
                - 9^2 = 81
                - 10^2 = 100
                - 11^2 = 121

                - 12^2 = 144
                - 13^2 = 169
                - 14^2 = 196
                - 15^2 = 225
            - While you only have to memorize up to 15^2, you should know how to calculate it for larger multiples of 10.
                - Ex. 20*20=400
            - You also should memorize the approximate decimal values for the following 2 square roots:
                - sqrt(2) = 1.41
                - sqrt(3) = 1.73
            - While sqrt(2) and sqrt(3) are the only decimal values you need to memorize, you should also know how to estimate the square root of any number. If I asked you the square root of 87 is between 9 and 10.
        - Square root of a number is the same as raising that number to the ½ power.
        - Raising to the ⅓ power is called the cubed root.
    - You also should be able to quickly calculate 2^0 to 2^10.
        - 2^0 = 1. 2^1 = 2. 2^2=4. 2^3=8 and so on for 16, 32, 64, 128, 256, 512, 1024 (2^10), etc.

Chapter 26: Rate, Distance, and Time Equation

- Rate = Distance / Time is the fundamental equation. By manipulating the equation you can rearrange it into distance = rate * time and time = distance / rate.

Chapter 27: Density Equation

- Density:
    - density = mass / volume
- Note that this equation can also be rearranged to solve for mass or volume depending on what is needed by a problem.

Chapter 28: Profit Equation

- Profit
    - For an organization: Profit = revenue - expenses
    - For a single item: Profit = price - cost

Chapter 29: Rules of Squares

- Rules of squares:
    - A squared term is ALWAYS positive or zero.

Chapter 30: Missing Value Problems

- Missing Value Problems:

    - These kinds of problems give you multiple pieces of information about a problem and tell you to use the values you know to find an unknown value.
    - These kinds of problems ultimately come down to turning the text and pieces of information into equations. But setting up these equations can often best be done in 2 different ways. Table form or venn diagram.
        - 1. Table form.
        - 2. Venn Diagram
        - Practicing these types of questions will help you learn which set up is best for the problem - but as a last resort both can quickly be set up to see which is easier to work with.

Chapter 31: Estimation

- Estimation:
    - Complex multiplication, division, etc. of 2 numbers likely means you only need to estimate the answer.
    - ex. 3^x=32 is very difficult to solve by hand, but x must be between 3 and 4 because 3^3=27 and 3^4=81.
    - Ex. 3.004 / 5.0667 is approximately $\frac{3}{5}$.

Chapter 32: Solving Problems by Using your Own Numbers

- Solving Problems by using your own numbers:
    - Some problems may be just flat out confusing to read or see how to start solving - if that's the case then it can be a great approach to plug in numbers yourself and deal with actual quantities rather than comparative statements.
    - Tip: Use simple numbers when plugging in your own numbers.
    - Note: this approach works for questions dealing with ratios, percentages, and fractions (i.e. relationships where A relates to B via this ratio/percentage/fraction). If a question gives you an actual value and not just a relationship then you can't just go making your own values as that changes the question.

Chapter 33: Finding a Trick to Solve the Problem

- If a problem looks like it would take way too long to solve (i.e. 3+ minutes), know something is up and you need to find the trick.
- Or if the problem gives you an equation that looks far too long to solve quickly, try simplifying the equation.

Chapter 34: Rule for Units Digit of a Square

- The units digit of a square is determined by the units digits of its root.
    - ex. 3^2 = 9. 13^2 = 169 which has a units digit of 9..
    - ex. If you know x^2 has a units digit of nine, then the units digit of x must be either 3 or 7 (3^2 = 9 and 7^2 = 49)

Chapter 35: Laws of Nature

- Laws that may be helpful to know:

- conservation of mass
- conservation of energy
- sometimes conservation of volume (NOT always true)

Chapter 36: Mixtures

- Mixtures:
  - Mixture problems often involve setting up equations based on the conservation of mass.
  - Total Mass = Mass of A + mass of B
  - You can get to this in 2 common ways:
    - 1) Mass = density * volume
    - 2) Mass of A = mass of mixture * percentage of that mixture that is A.
  - The conservation volume can apply in some cases as well (ex. Mixing colors of sand).

hapter 37: Probability

- Probability:
  - Probability is the odds that something will occur and is expressed in a decimal or percent. So if something has a 40% chance probability of occurring, this is expressed as p=0.4. Something with a 100% chance probability of occurring is p=1.0.
  - An important fact about probabilities is that the probability of event A occurring is just 1 - (the probability of event A not occurring).
  - Probabilities can be multiplied under certain conditions.
    - If events A are independent, P(A and B) = P(A) * P(B).
    - Independent means the two events are unrelated. Put another way, the probability that event A occurs has NO impact on the probability that event B occurs or vice versa (ex. Rolling dice).
    - Dependent events are events where the probability of one event occurring impacts the probability of the other (ex. Pulling cards from a desk without replacement)
      - However, even though events are dependent the probability of two events occurring CAN still be calculated if you account for these dependencies. (ex. pulling 2 cards from a deck and both being 8s is (4/52)*(3/51).
  - Logically, you can come up with formulas for solving questions like What is the probability events A or B occur, but not both. This can be visually shown with a venn diagram.
    - P(A or B but not both)h = P(A)+P(B)-P(A and B) which is the probability of A occurring plus the probability of B occurring minus the probability that both events A and B occur.

Chapter 38: Combinations and Permutations

- Combinations and Permutations:

- Basic definitions:
    - Permutation: number of ways to choose/arrange items in a set in a specific order
    - Combination: number of ways to choose items in a set (order doesn’t matter)
    - In summary: both permutations and combinations are about ways to choose items from a larger set, but in permutations order matters and in combinations orders does not matter.
- A factorial means the multiplying that positive integer by all of its preceding integers
    - Ex. 5! (written 5 exclamation point, but read as 5 factorial)
    - $5! = 5*4*3*2*1=120$
    - Usually you won’t have to solve for anything over 6! On GMAt, and if you do you are probably missing some cancellations.
- Basic equations:
    - $nPr = n!/(n-r)!$
    - $nCr = n!/[r!\ (n-r)!]$
        - Note how this is nearly the exact same equation as the permutation equation, except there is an extra r! In the denominator. This term simply accounts for order not mattering.
    - In these permutation and combination equations, it is important to know how to simplify easily. If you end up with the fraction 9!/7!, this simplifies to $9*8 = 72$.
    - Common factorials to know:
        - $1! = 1$
        - $2! = 2$
        - $3! = 6$
        - $4! = 24$
        - $5! = 120$
    - Tip: $(n+1)! = (n+1)*n!$.
- Besides the permutation equation, there is another way to think about how find the number of permutations: Number of permutations of a set of things = (# choices for 1st slot) * (# choices for 2nd slot) * (# choices for 3rd slot)* etc.
    - This is actually just a different way to think about the permutation equation $nPr = n!/(n-r)!$
    - ex. If finding number of ways to order 3 unique letters of ABCDE: the first slot could be any of the 5 letters * the second slot could be any of the 4 remaining letters * the third slot could be any of the remaining 3 letters = $5*4*3 = 60$ permutations.
    - Watchout: in the above examples order matters (ex. ABC difference from BCA), but if order doesn’t matter you could use the combinations equation nCr.

Chapter 39: Work

- Work:
  - Work is the amount of something done in a set time (ex. Washing 10 dishes in 5 minutes. Note this can also be written as 2 dishes per minute).
  - The fundamental work equation is:
    - $1/A + 1/B = 1/C$
    - Where A and B are the amounts of time it takes to do one unit of something
    - Where C is the amount of time it takes for A and B to perform the same task while working together.

Chapter 40: Simple and Compounding Interest

- Interest:
  - Interest is the small % paid to you for investing your money. If you invest $100 at 10% interest annually, then you get 10$ that first year. Compounding interest is when your next interest payment is based on both your original investment (your principal) and any accrued interest. So your payment in year 2 is 10% of $110 now, meaning your interest payment is $11 now.
  - The equation for compounding interest is M = P * (1+r)^n where the interest rate is in decimal form. This equation often has t (time) in place of n as this is easiest for annually compounding problems, but using t can often be troublesome to remember if the interest is not compounding annually.
  - Usually interest compounds annually, but sometimes it has a different compounding frequency.
  - There is also simple interest which does not compound:
    - M = P*(1+r*n))
      - Where M = total money, P = principal, r = interest rate as a decimal, and n = number of interest cycles
    - Note simple interest is 1+r*n while compounding is (1+r)^n
  - Problems will tell you if they are simple interest or compounding interest.

Chapter 41 (the final chapter): Sequences and Series

- Sequences, series, and sums:
  - A sequence is a defined set of numbers and is written as an equation where the inputs of the equations are all positive integers (i.e. 1, 2, 3, 4, etc.)
    - Ex. f(n) = n + 4 for n=1, 2, 3, 4, etc.
  - The sum of x terms of a sequence is called a series. Typically series problems are either quick math or noticing a pattern such as canceling fractions or being able to pull out a common factor.

And with that - these are the summarized basics you need to solve any quant question on the GMAT Focus. Many of these concepts can also help out with the Data Insights section. I encourage you to re-listen to this audio to really comprehend everything as the best GMAT studying is mastering the basics and then practice applying them.