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GMAT PREP

Course Documents

Word Problems Review

Word Problems Review

1 Lesson 1: Translations

Translations Overview

This section covers "translations" in word problems, which are a catch-all for problems not fitting other categories. They often overlap with fractions, percents, and ratios (FPR) content, frequently involving money and percentages. Recognizing them can be tricky due to this overlap. However, the exact classification is less important than recognizing that translation and FPR questions often reward the same approaches: working backwards, choosing smart numbers, and using traditional math. Translation questions tend to favor traditional math, while FPR questions often favor smart numbers or working backwards.

Money Translations

Money is the main theme for translation questions and a reliable way to recognize them. The GMAT tests money translations in three key ways:

- **Profit:** Profit is calculated as Revenue - Cost. Revenue is revenue per unit times number of units, and cost is cost per unit times number of units. Be mindful of fixed and variable costs.

> Example 1: Profit
>
> **Retailer sells cans for \$2 each, purchased cases of 12 cans for \$5. Gross profit from 6 cases: P = 2(72) - 5(6).**

> Example 2: Profit with Fixed/Variable Cost & Percentage
>
> **Company spent \$200,000 on R&D (fixed cost), \$25 per unit to produce (variable cost). Sells each unit for 200% more than production cost. Minimum units to turn a profit: $(300/100)(25)(q) > 25q + 200{,}000$) (Note: 200% more means 300% of).**

Fixed Cost + Variable Cost: Involves adding a constant fixed cost with the product of a rate per unit and a number of units (variable cost).

Example :

Cab company A charges $3 for the first mile and $0.25 per mile for each additional mile. Cab company B charges $5 for the first mile and $0.15 for each additional mile. To find how many miles for fares to be the same: 3 + 0.25(d-1) = 5 + 0.15(d-1). When variable cost applies after a certain threshold, subtract that threshold from the total number of units (e.g., d-1).

Overtime Pay: Generally involves adding money earned at the regular rate and money earned at the overtime rate.

Example :

Jack makes normal wage for first 40 hours, 1.5x normal wage for hours beyond 40. Worked 50 hours, made $2500. To find normal wage (w): 40w + 10(1.5w) = 2500. (Using 3/2w for 1.5w can be easier without a calculator).

Fuel Consumption Translations

Fuel consumption questions are less common and tend to be easier. The main task is choosing the correct equation:

- **Equation 1:** (miles/gallon)(gallons) = miles
  - Use when solving for the number of miles traveled.
- **Equation 2:** (gallons/miles)(miles) = gallons
  - Use when solving for the number of gallons of fuel used.

Example : Car A gets 30 mpg highway, 10 mpg non-highway. Trip is 75 miles highway, 15 miles non-highway. Gallons needed:

- **Highway: (1/30)(75) = 2.5 gallons**
- **Non-Highway: (1/10)(15) = 1.5 gallons**
- **Total = 2.5 + 1.5 = 4 gallons**

Non-Traditional Approaches

While traditional math is often effective for translation questions, sometimes smart numbers or working backwards are better options.
- **Smart Numbers:** Consider when there are variables in the answers.
- **Working Backwards:** Consider if the answers are easy numbers.
- **Tables:** Can be a helpful secondary strategy to organize information, especially for questions involving multiple time periods. Use different time periods as columns.

Problem Solving Steps
For practice problems, follow these steps:
1. **Step 1: Identify the question type.** For translation problems, look for keywords like "money" or "fuel consumption," or if the problem requires translating information into algebraic terms even if it doesn't fit other word problem subtypes.

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2. **Step 2: Plan your strategy.**
   - **Traditional Math:** Often the best choice, especially when concrete values are given and no variables are in the answers.
   - **Working Backwards:** Feasible if numbers in answers are easy to work with. Not ideal if you need to solve for a combination of variables (e.g., profit = revenue - cost).
   - **Smart Numbers:** Only applicable if there are variables in the answers.
3. **Step 3: Solve the problem.** Execute your chosen strategy. Remember to use descriptive variables (e.g., 'w' for wage, 'q' for quantity) to avoid confusion.

Lesson 2: Rates

Combined Rates
Combined rate questions involve two things working together or against each other to accomplish a task.

Direction Signals
- **Working Together (Add Rates):** If two or more things work to accomplish a task, their rates are added. This is common when objects are moving towards each other to meet, or moving away from each other to create distance.

> Example 1:
>
> **Two trains move towards each other from opposite ends of a track to meet. (Working together)**

> Example 2:
>
> **Two trains leave from the same station, one traveling east and one traveling west, to put distance between them. (Working together)**

- **Working Against (Subtract Rates):** If two or more things work against one another to accomplish a task, their rates are subtracted. This applies when one object is trying to catch another moving object in the same direction.

> Example 3:
>
> **A car leaves and 30 minutes later a second car follows the same route to catch the first. (Working against)**

Rate Table Approach
The "rate table" is a versatile approach for solving rate questions.
- **Columns:** Always Rate - Time - Work/Distance.
- **Rows (Combined Rates):** Vary based on the problem, but for combined rates, they represent each entity and their combined effort (e.g., Train X, Train Y, Train X + Train Y, or Car A, Car B, Car A - Car B).
- **Equations:**
  - Each row sets up: (Rate) x (Time) = (Work/Distance).
  - In combined rate questions, the **rate column** also sets up an equation (e.g., Rate X + Rate Y = Combined Rate).
- **What NOT to Combine:** You **cannot** add down the time or distance/work columns in combined rate questions. Only rates are combined.
- **Smart Numbers:** Often, you can choose a "smart number" for the total work that is easily divisible by the given times or rates to simplify calculations.

Lesson: Rates - Changing the Number of Workers (CNW)
These questions involve a certain number of workers completing a task and then ask about a different number of workers.Rate Table Set Up: Find the Rate for Each Worker

The key is to determine the rate for a single worker.
Columns: Rate - Time - Work.
Rows:
- **First Row:** The initial given number of workers (e.g., 4s for 4 servers).
- **Middle Row:** Always "1 worker" (e.g., 1s for 1 server) to find the individual worker's rate. The time and work cells for this row are usually not relevant.
- **Last Row:** The number of workers the question asks about (e.g., 6s for 6 servers, or "X workers" if unknown).

Smart Numbers: Often, you can choose a "smart number" for the total work that is easily divisible by the given times or rates to simplify calculations.

Lesson: Rates - Average Speed (AS)
Average speed questions are a common variant. Even if a question doesn't fit a specific category, the rate table is still useful.Simple Average Trap
- **ALWAYS use:** Average Speed = Total Distance / Total Time.
- **NEVER just average the given rates.** This only works if the time traveled at each speed is the same, which is rarely the case in GMAT questions.
- GMAT often tries to trick you by stating that the distance traveled at each speed is the same, which means you cannot simply average the speeds.

Rate Table Set Up
- **Columns:** Rate - Time - Distance.
- **Rows:**
  - Each leg of the journey should have its own row (e.g., "There," "Back," "Climb," "Cross," "Descent").
  - Always include a "Total" row at the bottom.
- **What to Combine**: In average speed rate tables, the **time and distance columns add down** to the total time and total distance. The rate column does not add down.
- **Smart Numbers:** If the distance is not given, choose a "smart number" for the distance that is divisible by the given rates to simplify calculations.
- **Weighted Average Insight:** Average speed is a weighted average, weighted by the time spent at each speed. If distances are equal, the average speed will always be closer to the slower speed. This can help in eliminating answer choices.

3 Lesson 3: Overlapping Sets

Two Overlapping Sets
Overlapping sets questions feature multiple data sets that overlap, meaning an item or person can belong to more than one set simultaneously (e.g., students taking both math and history classes). These situations can be visualized with Venn diagrams, but the "double set matrix" is a more effective solving method for GMAT problems.WP Lesson 2 Double-Set Matrix

The double-set matrix is a table-based setup for questions with two overlapping data sets.

How to set up the double-set matrix:
1. Draw a 3x3 grid (three horizontal lines and three vertical lines).
    i. This is the basic structure:

2. Determine categories for each axis. The categories on each axis must be mutually exclusive.
3. Add "Total" rows and columns.
    - The intersection of "Total" rows and columns represents the overall total.
4. If percentages are given without a concrete total, use a "smart number" (e.g., 100) for the overall total.
5. Star the box that the question asks you to solve for.
6. Fill in the numbers and work your way to the solution. You may not need to fill the entire table.

Overlapping Sets Language Traps
1. Two common language traps in overlapping sets questions:
    b. **"Percent of" Trap:** Be careful when percentages are given. Not all percentages may be of the overall total; some might refer to a subcategory.
        - Example: "20% of the students who take the exam more than once receive a failing score." This 20% refers to a subcategory, not the overall total.
    c. **"Implied Zero" Trap:** The question might imply, without explicitly stating, that a certain category is empty (contains zero).
        - Example: "300 students at a Roosevelt high school take French, Spanish, or both." This implies that zero students take neither language. The implied zero usually goes in the "neither" box of the matrix.

Three Overlapping Sets
For questions with three overlapping sets, the double-set matrix cannot be used. Instead, formulas are necessary. While three-set questions are rare, it's good to be prepared.WP Lesson 5 Overlapping Sets Formulas

There are two main formulas for three overlapping sets:
 1. **Primary Three-Set Formula:**
    Total = (Set A) + (Set B) + (Set C) - (Exactly Two Sets) - 2(All Three Sets) + (No Sets)
    - This formula accounts for people counted multiple times when individual sets are added.
        - -(Exactly Two Sets) removes the double counts for people in two sets.
        - -2(All Three Sets) removes the two extra counts for people in all three sets (who were triple-counted).
        - (No Sets) refers to those not in any of the specified sets (often zero).
 2. **Secondary Three-Set Formula (useful when asked for "only 1 set"):**
    Total = (Everyone in Only 1 Set) + (Everyone in Exactly 2 Sets) + (Everyone in All 3 Sets) + (Everyone in None of the Sets)

General approach for three-set problems:
    a. Identify the three overlapping sets.
    b. Use the appropriate formula.
    c. Plug in the given values and solve for the unknown. Algebraic relationships may be needed if relative values are given (e.g., "twice as many people in X as in Y").

4 Lesson 4: Statistics

Statistics Overview

Statistics questions are prevalent and have many subtypes. This lesson focuses on average/sum and median. While traditional math is often effective, smart numbers or working backward can sometimes be useful.

Average-Sum

Average/sum questions involve creative uses of the standard average formula:

Standard Average Formula: Average = Sum/Number of Terms

More commonly, these questions require finding the sum:

Adjusted Average Formula: Sum=(Average)(Number of Terms)

The key idea is that working with the sum is often easier than working with the average.

> Example:
>
> **Jordan scored 95, 98, and 96 on the first three of four tests. To average at least 95, she needs a total of 95 * 4 = 380 points.**
> **Required score on the fourth test: 380 - 95 - 98 - 96 = 91.**

An alternative method involves calculating the difference from the target average for each score. For example, if Jordan was 3 points above 95 on one test and 1 point above on another, she has 4 extra points, meaning she can be 4 points below 95 on the last test (95 - 4 = 91).

Median

The median of a set is the middle term when numbers are listed from least to greatest.
- **Odd number of terms:** The median is the single middle term.
  - **Example:** Set: 3, 7, 14. Median = 7
- **Even number of terms:** The median is the average of the two middle terms.
  - **Example:** Set: 3, 7, 14, 20. Median=7+142=10.5

The key is to identify the median term(s) based on the total number of terms.
- **Example 1:** In a set of 25 terms, the 13th term is the median.
- **Example 2:** In a set of 30 terms, the average of the 15th and 16th terms is the median.

Weighted Averages

Weighted averages (also known as mixture questions) calculate the average of values that have different weights or contributions to the total.

Tug-of-War

The "Tug-of-War" method is a visual approach that works well for weighted average questions with **exactly two components.**

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How it works:
1. Draw a line. Place the two components and their respective concentrations/values at each end.
2. Place the desired mixture concentration on the line, closer to the component that has a greater "pull" or weight. This visually indicates which component contributes more to the mixture.
3. Calculate the differences between the desired concentration and each component's concentration.
4. These differences, when "flipped" (the difference from component A goes to component B's ratio, and vice-versa), represent the ratio of the components in the mixture.
5. Add a "Total" to the ratio to help solve for actual amounts when given a total quantity.

> Example:
>
> **A 7-ounce martini is 36% alcohol, made from 16% vermouth and 44% gin.**
>
> - **The 36% target is closer to 44% (gin), meaning there's more gin.**
> - **Difference from 16% to 36% = 20. Difference from 36% to 44% = 8.**
> - **Ratio of Vermouth:Gin is 8:20 (simplified to 2:5). Total parts = 2+5 = 7.**
> - **Since the total cocktail is 7 ounces, there are 2 ounces of vermouth and 5 ounces of gin.**

Sneaky Weighted Averages

These are rare questions where a weighted average isn't explicitly mentioned but can be inferred.
- **Clue:** Two variables or expressions that sum to 1 (representing "parts of a whole" or weights).
- These variables are multiplied by coefficients and added together.
- **Key:** Recognize that the variables are weights in a weighted average. The sum of the weighted terms will fall between the two coefficients.

> Example:
>
> **An expression like 100x + 200y, where x+y=1.**
>
> - **If x is close to 1 and y is close to 0, the value is close to 100.**
> - **If x is close to 0 and y is close to 1, the value is close to 200.**
> - **Thus, the possible values for the expression are between 100 and 200.**

Standard Deviation

Standard deviation is a measure of how spread out the numbers in a set are.
- Small standard deviation: Numbers are close together.
- Large standard deviation: Numbers are spaced far apart.

Changing the Standard Deviation:
1. **Adding or subtracting a value** to each term in a set **WILL NOT change** the set's standard deviation.

> Example:
>
> - **If set A (2, 4, 6) has SD = n, then set B (2+2, 4+2, 6+2) or (4, 6, 8) still has SD = n. The spacing remains the same.**

2. Multiplying or dividing a value by each term in a set **WILL change** its standard deviation by whatever was multiplied or divided.

> Example:
>
> **If set A (1, 2, 3) has SD = n, then set B (1*3, 2*3, 3*3) or (3, 6, 9) has SD = 3n. The spacing triples.**

> Example:
>
> **If set A (a, b, c) has SD = n, then set B (a/2, b/2, c/2) has SD = n/2. The spacing is halved.**

Min-Max Overview

Min/max questions ask for the biggest or smallest possible value for a specific term in a set.
- Key Idea: Minimizing one term usually means maximizing all other terms, and vice versa.

Draw Slots

The "slots" method is effective for min/max questions.
- **Process:**
  a. Draw slots to represent each term in the set.
  b. Fill in any given term values.
  c. To minimize one term, maximize the others (within any given constraints, like median or mean). To maximize one term, minimize the others.
  d. Often, an equation will need to be set up and solved after filling in the slots.

> Example:
>
> **To maximize the longest piece of rope in a set, you would minimize all other pieces of rope, adhering to constraints like mean and median. The terms to the right of the median cannot be smaller than the median but can be equal. The terms to the left of the median cannot be smaller than the shortest piece but can be equal.**

5 Lesson 5: Evenly-Spaced Sets

Evenly-spaced set questions involve sets of numbers where the spacing between each term is the same (e.g., consecutive integers, multiples of 5). These questions typically reward the use of traditional math formulas and tend to be one-dimensional, focusing on understanding four key rules/formulas.Formulas

Most evenly spaced set questions ask to calculate the sum of a large, evenly spaced set. Since adding all terms isn't feasible, leverage key properties using these helpful rules/formulas:

1. Sum = (average)(number of terms)
- This formula works for ANY set of numbers, not just evenly spaced sets.
- It is particularly useful for calculating the sum of large sets.
- In evenly spaced sets, shortcuts can be used to find the average without first finding the sum

2. In Evenly-Spaced Sets, Mean = median
- In any evenly spaced set, the mean and the median are equal.
- Note: some non-evenly spaced sets can also have an equal mean and median, so this rule cannot prove a set is evenly spaced, but if a set is known to be evenly spaced, then its mean and median are equal.

3. In Evenly-Spaced Sets, Average of set = average of biggest and smallest terms
- This is a frequently used formula to calculate the average of an evenly spaced set.
- This shortcut allows finding the average without knowing the sum first, which is helpful in questions asking for the sum of a large evenly spaced set.

4. In Evenly-Spaced Sets, Number of Terms = Range/Spacing +1
- Range: The difference between the biggest and smallest numbers in the set.
- Spacing: The difference between each successive term in the set (e.g., if consecutive, spacing is 1; if multiples of 3, spacing is 3).
- Remember to add 1 at the end of the calculation.

Identifying Evenly Spaced Sets
- Correct Identification: If you have a starting point and each subsequent number increases by a consistent amount (e.g., increases by 1 for consecutive integers), it is an evenly spaced set question. Most evenly spaced set questions involve a set of consecutive integers.

Approach to Solving
- Traditional math (using formulas) is the most appropriate approach when given concrete values and no variables in the answers. Smart numbers and working backward are typically not suitable.

Selecting Formulas
- The most reliable way to calculate the sum of a set of numbers is to multiply the average by the number of terms.
- To find the average of an evenly spaced set, use either:
  - Smallest+Biggest/2 is often the easiest
  - Mean = median
- The "Number of Terms" formula Range/Spacing +1 is not needed if the number of terms is already provided.

6 Lesson 6: Combinatorics

What are Combinatorics Questions?
Combinatorics questions ask us to figure out how many combinations we can make. This could involve choosing groups, creating PINs, or arranging letters in a word. The core idea is always to determine the number of possible combinations.

The "Slots Diagram" Approach
An effective way to solve combinatorics problems is by using a "slots diagram." You draw a slot for each selection that needs to be made and then fill in the number of different ways each selection can be made.

Order Matters vs. Order Doesn't Matter
A crucial aspect of combinatorics is determining whether the order of selections matters. The question to ask is: "Do different arrangements of the same selections produce different outcomes?"
- **Order Matters:** If different orderings of the same selections produce different outcomes, the order matters.
  - **Examples:** Races (1st, 2nd, 3rd place), lineups, PINs/codes, anagrams with all different letters.
  - **Calculation:** Multiply the numbers in your slots. (e.g., for 6 options and 4 selections where order matters: 6 x 5 x 4 x 3).

- **Order Doesn't Matter:** If different orderings of the same selections do NOT produce different outcomes, the order does not matter.
  - Examples: Forming a group, team, or committee; anagrams where some letters are repeated.

- Calculation: Multiply the numbers in your slots, then divide by the factorial of the number of selections made for which order doesn't matter (e.g., for 6 options and 4 selections where order doesn't matter: 6x5x4x3/4!
  - A factorial (n!) means n multiplied by every positive integer less than n (e.g., 4! = 4 x 3 x 2 x 1).

Combinatorics with Multiple Scenarios
- **Combine by Adding (OR situations):**
  - Used when there are multiple distinct ways to achieve a successful outcome, and these ways are mutually exclusive (i.e., one OR the other can happen).
  - **Approach:** Split the problem into different scenarios, solve each scenario using the slots diagram, and then ADD the results from each scenario to find the total number of combinations.
  - **Clue:** Look for "OR" in the problem description (e.g., "if the second digit is even THEN... BUT if the second digit is odd THEN...").

- **Combine by Multiplying (AND situations):**
  - Used when an entity must contain multiple subgroups (i.e., one subgroup AND another subgroup are required).
  - **Approach:** Divide the selections into separate sub-problems for each subgroup. Solve each sub-problem using the slots diagram (considering if order matters within that subgroup). Then, MULTIPLY the results from each sub-problem to find the total number of combinations.
  - **Clue:** Look for "AND" in the problem description (e.g., "board must contain two female members AND two male members").

7 Lesson 7: Probability

Probability Review

Probability questions can vary in difficulty. Recognizing when a question requires combinatorics is crucial.

Probability Basics

The fundamental probability formula is:

Probability. = Number of Successful Outcomes/Number of Total Outcomes

Probabilities always fall between zero and one.

For multiple events:
- **OR scenarios (addition):** If calculating the probability of one event OR another occurring, ADD the probabilities of each event.
  - P(Event 1 OR Event 2) = P(Event 1) + P(Event 2)
- **AND scenarios (multiplication):** If calculating the probability of one event AND another occurring, MULTIPLY the probabilities of each event.
  - P(Event 1 AND Event 2) = P(Event 1) x P(Event 2)

Key Takeaway: In both combinatorics and probability, "OR" implies addition, and "AND" implies multiplication.

No Combinatorics

For probability questions that do not require combinatorics, use a "slots" diagram for each event. Fill the probability of each event onto its slot. The final calculation (addition or multiplication) depends on whether it's an "AND" or "OR" scenario.

> Example:
>
> **If two marbles are pulled simultaneously (treat as one after the other without replacement), and you want the probability that both are red:**
> - **Probability of first red: 6/15**
> - **Probability of second red (given first was red): 5/14**
> - **Since both must be red (AND scenario), multiply: (6/15) * (5/14) = 1/7**

Combinatorics Hybrids

These questions combine probability with combinatorics.
- We'll need to use combinatorics twice - once to calculate the number of successful outcomes and once to calculate the number of total outcomes.
- **Strategy:** Start by calculating the number of possible outcomes (denominator). This often helps eliminate answer choices.
- Use combinatorics techniques (like slot diagrams and adjusting for order) to find both successful and possible outcomes.

Multiple Paths and At Least

Multiple Paths

In some probability situations, there are multiple distinct ways to achieve a successful outcome.
- Calculate the probability of each successful path separately.
- ADD all those probabilities to get the final answer.
- **Key Challenge:** Recognizing that multiple paths exist.
- **Simultaneous Selection:** Choosing items simultaneously is mathematically equivalent to choosing them one at a time without replacement.

> Example:
>
> **A jar has 6 red and 4 blue marbles. If two are drawn simultaneously, what's the probability one is blue and one is red?**
> - **Path 1 (Blue then Red): P(Blue first) * P(Red second) = (4/10) * (6/9) = 24/90**
> - **Path 2 (Red then Blue): P(Red first) * P(Blue second) = (6/10) * (4/9) = 24/90**
> - **Since either path is a success (OR scenario), ADD the probabilities: 24/90 + 24/90 = 48/90 = 8/15**

At Least

"At least" questions are a specific type of multiple paths to success.
- They define a successful outcome as "at least X things."
- **Strategy:** Instead of calculating the probability of all successful outcomes (which can be numerous), calculate the probability of the unsuccessful outcome(s) and subtract it from 1.
  - P(Success) = 1 - P(Failure)
- **Rationale:** There are usually far fewer ways to fail than to succeed in "at least" scenarios.

> Example:
>
> **If a fair coin is tossed four times, what is the probability it lands heads up at least once?**
> - **Failure: The only way to fail is to get no heads, meaning four tails (TTTT).**
> - **P(Tails) = 1/2**
> - **P(Four Tails) = (1/2) * (1/2) * (1/2) * (1/2) = 1/16**
> - **P(At least one Heads) = 1 - P(Four Tails) = 1 - 1/16 = 15/16**

⑧ Lesson 8: Unit Conversions

This review covers the key concepts and methods for performing unit conversions, as discussed in WP Lesson 6.

Introduction to Unit Conversions

Unit conversions involve changing one unit of measurement to another (e.g., miles to kilometers). The recommended method for performing unit conversions uses diagrams rather than the traditional fraction-canceling approach.One-Part Conversions

One-part conversions require changing only one part of a measurement (e.g., converting miles per hour to feet per hour, where only the distance unit changes).

Method:
1. **Set up the diagram:** Write the starting measurement and the converted measurement with a question mark for the unknown value.
   - Example: 9 miles / 30 minutes → ? feet / 30 minutes
2. **Draw an arrow:** Connect the unit you are converting (e.g., miles to feet) and write how you will perform the conversion (multiplication or division).
3. **Determine the operation:**
   - Think about which measurement there is "more of" in a given amount of what that thing measures.
   - If there are more of the new unit (e.g., more feet than miles in a given distance), you will multiply.
   - If there are fewer of the new unit, you would divide (though not explicitly shown in examples, this is the logical inverse).
4. **Perform the calculation:** Multiply or divide by the appropriate conversion factor.
   - Example: To convert miles to feet, multiply by 5280 (since 1 mile = 5280 feet).

> Example:
>
> **If Michael can run at 18 miles per hour, how many feet can he run in half an hour?**
> - **First, determine the distance run in half an hour: 9 miles.**
> - **Convert 9 miles to feet: 9 miles * 5280 feet/mile = 47,520 feet.**

Two-Part Conversions

Two-part conversions require changing both parts of a given measurement (e.g., converting kilometers per hour to meters per second, where both distance and time units change).

Method:

1. **Set up the diagram:** Similar to one-part conversions, draw the starting and converted measurements.
2. **Draw arrows for both conversions:** Indicate the conversion for the first part of the measurement (e.g., kilometers to meters) and the second part (e.g., hours to seconds).
3. **Determine operations for each part:** For each conversion (distance and time), determine whether to multiply or divide using the "more of" rule.
   - **Distance (Kilometers to Meters):** There are more meters than kilometers in a given distance (1 km = 1000 meters), so **multiply** by 1000.
   - **Time (Hours to Seconds):** There are more seconds than hours in a given amount of time (1 hour = 60 minutes * 60 seconds/minute = 3600 seconds), so multiply by 3600.
4. **Perform the calculations and simplify:** Perform the multiplications for both parts of the conversion and then simplify the resulting fraction.

Example:

A greyhound can run at approximately 65 kilometers per hour. What is a greyhound's approximate top speed in meters per second?

- **Distance Conversion: 65 kilometers * 1000 meters/kilometer = 65,000 meters**
- **Time Conversion: 1 hour * 3600 seconds/hour = 3600 seconds**
- **Result: 65,000 meters / 3600 seconds**
- **Simplify: 65000/3600 reduces to 650/36, and then to 325/18, which is approximately 18 meters per second.**

This diagram-based method aims to make unit conversions easier to conceptualize and apply consistently.