



Common Mistakes One Must Avoid in Remainders

The topic of remainders has a very wide range of application in the GMAT examination. One may get direct questions as well as questions as an application of the conceptual learnings of remainders.



This is the first of the 2 articles where we will discuss the important applications of the concept of remainders, along with the common mistakes that students make while these questions and the best possible way to solve them.

Objective of this article

With such a wide range of application, we researched through the different types of questions, primarily available as official resources, and the responses of students in solving those questions. From the responses, we have shortlisted the major areas of concern that students face. In this article, we are going to discuss 2 of those major areas of concern, with the help of proper examples. In the workout, we will show the common errors that students make, along with the best possible approaches to solve the question.

In both examples, we will discuss the common errors related to Data Sufficiency questions, and the correct approach to solve them. So, let's get started.

Mistake 1:

Example 1

[e-GMAT](#) example with explanation

-  The number N is expressed as $100^p + q$, where p and q are positive integers. What is the remainder when N is divided by 9.
1. $2p^2 = 8$
 2. $3q^2 = 27$
- A. Statement (1) ALONE is sufficient, but statement (2) alone is not sufficient.
B. Statement (2) ALONE is sufficient, but statement (1) alone is not sufficient.
C. BOTH statements TOGETHER are sufficient, but NEITHER statement ALONE is sufficient.
D. EACH statement ALONE is sufficient.
E. Statements (1) and (2) TOGETHER are NOT sufficient.

 [Solution:](#)

Understanding the Question:

In this question, we are given that,

- N is a number, which can be expressed as $100^p + q$.
- Both p and q are positive integers.

We need to find out:

- The remainder, when N is divided by 9.

Common Mistakes Made by Students

As we need to find the remainder when N is divided by 9, first we need to determine the value of N .

Once we know what N is, we can divide N by 9 to determine our answer.

Now, to find the value of N , we need to know both p and q .

As per the information given in statement 1,

- $2p^2 = 8$
Or, $p^2 = 4$

As p is a positive integer, we can say $p = \sqrt{4} = 2$.

But from this statement, we can't determine the value of q .

Hence, statement 1 is not sufficient to answer the question.

Now, if we consider statement 2 individually, we can say

- $3q^2 = 27$
Or, $q^2 = 9$

As q is a positive integer, we can say $q = \sqrt{9} = 3$.

But, from this statement only, we can't determine the value of p .

Hence, statement 2 is not sufficient to answer the question.

As we could not find sufficient information from the individual statements, let's now combine both of them.

- From statement 1, we can say $p = 2$.
- From statement 2, we can say $q = 3$.

Hence, we can replace p and q to find N , and determine our answer.

Therefore, the correct answer choice is option C.

If you have also marked C as the answer, then you are wrong.

The error and the Correct Approach:

Now, some of you may wonder what is wrong with the above approach!

Well, while solving any data sufficiency question, we must do a pre-analysis of the question stem first, before analyzing the individual statements. It helps us figure out what exact information we need to know to answer the question.

Now, as per the question stem, we need to determine the remainder, when $100^p + q$ is divided by 9.

- We can find the remainder in two steps:
 - First divide 100^p and q individually by 9, to find the individual remainder.
 - Next, add the individual remainders, to determine the final answer.
- Now, irrespective of the value of p , if we divide 100^p by 9, we will always get the remainder 1 – hence, our final answer doesn't depend on the value of p .
 - Therefore, do we really need to know what is p ?
 - No, right?
- So, if we know the value of q only, we can find the remainder.
 - As per our analysis, we can find q only from statement 2 only.

Hence, the correct answer choice is option B.

Mistake 2:

Example 2

e-GMAT example with explanation

 **N is the sum of two positive integers p and q. Is N divisible by 8?**

1. Neither p nor q is divisible by 8.
 2. Both p and q are individually divisible by 4.
-
- A. Statement (1) **ALONE** is sufficient, but statement (2) alone is not sufficient.
 - B. Statement (2) **ALONE** is sufficient, but statement (1) alone is not sufficient.
 - C. **BOTH** statements **TOGETHER** are sufficient, but **NEITHER** statement **ALONE** is sufficient.
 - D. **EACH** statement **ALONE** is sufficient.
 - E. Statements (1) and (2) **TOGETHER** are **NOT** sufficient.

 **Solution:**

Understanding the Question:

In this question, we are given that,

- N is the sum of p and q, where both p and q are positive integers.
 - Hence, we can write $N = p + q$

We need to determine whether N is divisible by 8 or not.

As we do not any other information regarding N or p or q, let's move forward and analyze the statements.

Common Mistakes Made by Students

As per the information given in statement 1, neither p nor q is divisible by 8.

- If p is not divisible by 8, it will produce a non-zero remainder, when divided by 8.
- Similarly, q is also not divisible by 8. Therefore, it will also produce a non-zero remainder, when divided by 8.

As neither p nor q is divisible by 8, their sum is also not divisible by 8.

Hence, statement 1 is sufficient to answer the question.

Now, let's move forward and the second statement individually.

As per the second statement, both p and q are individually divisible by 4.

- Because p , as well as q , is divisible by 4, their sum must be divisible by 8.

Hence, statement 2 is also sufficient to answer the question.

As each individual statement is individually sufficient to answer the question, we can say the correct answer is choice D.

If you have also marked D (or A or B) as the answer, then you are wrong.

The Errors:

There are multiple errors in the explanation provided above. These are the most frequently committed errors made by the students while solving this type of question.

Let's discuss each of them separately.

Error 1:

While analyzing the 1st statement, we concluded that the sum of p and q is not divisible by 8, as individually neither p nor q is divisible by 8. However, this is not necessarily true every time.

- Consider a case where p is 15 and q is 17. Although none of p and q are individually divisible by 8, their sum is 32, which is a multiple of 8.
- Alternatively, if p is 23 and q is 27, $p + q$ is 50. In this scenario, none of p or q or $(p + q)$ are divisible by 8.

Thus, we can see that depending on the value of p and q , their sum can be either divisible by 8 or not. As we can't find a unique answer, we can say statement 1 is not sufficient to answer the question.

Error 2:

While analyzing the 2nd statement, we concluded that because both p and q are individually divisible by 4, their sum must be divisible by 8. However, this is also not necessarily true every time.

- Consider a case where p is 32 and q is 36. Although both p and q are divisible by 4, their sum is 68, which is not divisible by 8.
- Alternatively, if p is 60 and q is 20, $p + q$ is 80. In this scenario, both p and q are individually divisible by 4 and $(p + q)$ is divisible by 8.

Thus, we can see that depending on the value of p and q , their sum can be either divisible by 8 or not. As we can't find a unique answer, we can say statement 2 is not sufficient to answer the question.

Error 3:

When we termed the individual statements as sufficient, we derived the following conclusions from each of the statements:

- From statement 1, we concluded that the sum of p and q is not divisible by 8.
- From statement 2, we concluded that the sum of p and q is divisible by 8.

Now, in GMAT data sufficiency questions, if both statements are individually sufficient to answer the question, the answers must be same from both the statements. In this case, we can see a clear contradiction in the results derived from the statements, which actually indicates that there must be some error in our calculations.

The Correct Approach:

Let us now look into the correct solution of the given question.

From statement 1, we know that neither p nor q is divisible by 8.

- If we assume that when p is divided by 8, the remainder as R_1 , then we can express p as $8x + R_1$, where R_1 can take any integer value from 0 to 7.
- Similarly, if we assume that when q is divided by 8, the remainder is R_2 , then we can express q as $8y + R_2$, where R_2 can take any integer value from 0 to 7.
- So, $p + q$ becomes $8x + R_1 + 8y + R_2 = 8(x + y) + R_1 + R_2$.
- Now, $p + q$ will be divisible by 8, only when $R_1 + R_2$ will be divisible by 8, as $8(x + y)$ is always divisible by 8.

As we don't have any information about the exact values of R_1 or R_2 or $R_1 + R_2$, we can't say whether $p + q$ is divisible by 8 or not.

Therefore, statement 1 is not sufficient to answer.

From statement 2, we know that both p and q are individually divisible by 4.

- Hence, we can write $p = 4a$ and $q = 4b$, where a and b are integers.
- So, $p + q$ will be equal to $4(a + b)$.
- Now, $p + q$ will be divisible by 8, only when $a + b$ will be an even number, as any even multiple of 4 is also a multiple of 8.

As we don't have any information about the exact values of a or b or $a + b$, we can't say whether $p + q$ is divisible by 8 or not.

Therefore, statement 2 is not sufficient to answer.

Now, if we combine the information obtained from the individual statements, we can say

- Both p and q are individually divisible by 4 but none of them are divisible by 8.
- Hence, we can say $p = 8x + 4$ and $q = 8y + 4$. So, $p + q = 8x + 8y + 4 + 4 = 8(x + y) + 8$

Now, irrespective of the value of $x + y$, the number $8(x + y) + 8$ is always divisible by 8. So, $p + q$ is also divisible by 8.

Hence, by combining the statements, we can answer the question.

Therefore, the correct answer choice is option C.

Key Takeaways from the article

- In a data sufficiency question, we must do pre-analysis of the question stem first, before analyzing the actual statements. This will help us in figuring out what exact information we need to answer the question.
 - For example, in the first question, we saw that to determine the value of N , we need to know both p and q . However, to determine the answer to our question, we only need the value of q – hence, statement 2 becomes individually sufficient, and we don't need to combine them to determine the answer.
- Also, in any data sufficiency question, we should consider all the possible cases first, before concluding whether a statement is sufficient or not. If we get more than one possible case from any of the statements, we cannot derive a unique answer from that statement, and it becomes individually insufficient.
- Finally, when we get both individual statements as sufficient, we must ensure that the answer is the same. If we get different answers from the statements individually, then we must cross-check once to find the error in our solution.



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