# If (3N + 5) Represents A Multiple Of 10, Then What Is True About "N" A. N Is Even B. N Is Odd C. N Is

## If (3N + 5) Represents A Multiple Of 10, Then What Is True About "N" A. N Is Even B. N Is Odd C. N Is

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Introduction

Mathematics often presents intriguing problems that challenge our understanding of numbers and their properties. One such problem involves analyzing the expression $3N + 5$ and determining the nature of the variable $N$ when this expression results in a multiple of 10. Specifically, the question asks: If $3N + 5$ is divisible by 10, then what can we deduce about $N$? Is $N$ even? Is it odd? Or is there another characteristic?

Understanding this problem requires a solid grasp of number properties, divisibility rules, and algebraic reasoning. This article delves into the detailed analysis of the problem, providing step-by-step explanations, mathematical proofs, and insights to help readers thoroughly understand the conditions under which $3N + 5$ becomes a multiple of 10, and what that reveals about $N$.

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Fundamental Concepts and Definitions

Before we analyze the problem, let's clarify some fundamental concepts:

What Does It Mean for a Number to Be a Multiple of 10?

A number is a multiple of 10 if it can be expressed as $10k$, where $k$ is an integer. This means that the number ends with a zero in its decimal representation and is divisible evenly by 10.

Divisibility Rules Relevant to the Problem

- Divisibility by 10: A number is divisible by 10 if its last digit is 0.
- Divisibility by 2: A number is divisible by 2 if its last digit is even (0, 2, 4, 6, 8).
- Divisibility by 5: A number is divisible by 5 if its last digit is 0 or 5.

The Role of Parity (Even/Odd)

- Even Number: An integer divisible by 2.
- Odd Number: An integer not divisible by 2.

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Mathematical Analysis of the Problem

Restating the Problem

Given the expression:

$$
3N + 5
$$

If this expression is a multiple of 10, then:

\[

$$
3N + 5 \equiv 0 \ (\text{mod } 10)
$$

which means:

$$
3N + 5 \equiv 0 \ (\text{mod } 10)
$$

or equivalently,

$$
3N \equiv -5 \ (\text{mod } 10)
$$

Since $-5 \equiv 5 \ (\text{mod } 10)$, because $-5 + 10 = 5$, the congruence simplifies to:

$$
3N \equiv 5 \ (\text{mod } 10)
$$

Our goal is to determine the possible values of $N$ satisfying this congruence, and from that, deduce whether $N$ is even, odd, or has other properties.

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Solving the Congruence $3N \equiv 5 \ (\text{mod } 10)$

The key is to find all integers $N$ such that:

$$
3N \equiv 5 \ (\text{mod } 10)
$$

Since 3 and 10 are coprime (their greatest common divisor is 1), 3 has a multiplicative inverse modulo 10. We can find this inverse to solve for $N$.

Finding the Multiplicative Inverse of 3 Modulo 10

We need an integer $x$ such that:

$$
3x \equiv 1 \ (\text{mod } 10)
$$

Testing small integers:

- $3 \times 1 = 3 \equiv 3 \ (\text{mod } 10)$
- $3 \times 2 = 6 \equiv 6 \ (\text{mod } 10)$
- $3 \times 3 = 9 \equiv 9 \ (\text{mod } 10)$
- $3 \times 4 = 12 \equiv 2 \ (\text{mod } 10)$
- $3 \times 7 = 21 \equiv 1 \ (\text{mod } 10)$

Since $3 \times 7 \equiv 1 \ (\text{mod } 10)$, the inverse of 3 modulo 10 is 7.

Solving for $N$

Multiply both sides of the congruence $3N \equiv 5 \ (\text{mod } 10)$ by 7:

$$
7 \times 3N \equiv 7 \times 5 \ (\text{mod } 10)
$$

$$
(7 \times 3) N \equiv 35 \ (\text{mod } 10)
$$

$$
1 \times N \equiv 35 \ (\text{mod } 10)
$$

Since $35 \equiv 5 \ (\text{mod } 10)$, we have:

$$
N \equiv 5 \ (\text{mod } 10)
$$

Interpretation of the Solution

The congruence $N \equiv 5 \ (\text{mod } 10)$ indicates that:

- $N$ must be congruent to 5 modulo 10, meaning $N$ can be expressed as:

$$
N = 10k + 5, \quad \text{where } k \text{ is an integer}
$$

- This implies $N$ ends with the digit 5 in its decimal form for all integers $k$.

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Conclusion: What Does This Mean About $N$?

Based on the above analysis, the key takeaway is:

- When $3N + 5$ is divisible by 10, $N$ must be congruent to 5 modulo 10.
- This means $N$ ends with the digit 5, which is an odd digit.

Is $N$ Even or Odd?

- Since $N$ ends with 5, $N$ is odd.
- For example, $N = 5, 15, 25, 35, \ldots$ are all odd numbers.

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Summary of Findings

| Condition | Conclusion |
|---|---|
| $3N + 5$ is divisible by 10 | $N \equiv 5 \ (\text{mod } 10)$ |
| $N$ ends with digit 5 in decimal notation | $N$ is odd |
| Therefore, $N$ is odd | True in all cases satisfying the condition |

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Answer to the Multiple Choice Question

Given the options:

- A. $N$ is even
- B. $N$ is odd
- C. $N$ is (incomplete, but likely intended as "N is ...")

The correct choice based on the analysis is:

B. N Is Odd

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Additional Insights and Practical Examples

Examples of Values of $N$

- $N = 5$:

$$
3 \times 5 + 5 = 15 + 5 = 20 \quad (\text{divisible by 10})
$$

- $N = 15$:

$$
3 \times 15 + 5 = 45 + 5 = 50 \quad (\text{divisible by 10})
$$

- $N = 25$:

$$
3 \times 25 + 5 = 75 + 5 = 80 \quad (\text{divisible by 10})
$$

All these examples confirm the pattern that $N$ ends with 5 and is odd.

Visualizing the Pattern

Numbers ending with 5 are always odd, except in the case of 5 itself, which is odd. The pattern persists for all $N = 10k + 5$.

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Final Thoughts and Practical Applications

Understanding how to analyze such problems enhances problem-solving skills in algebra and number theory. Recognizing that the key to divisibility problems often lies in modular arithmetic makes complex problems more manageable.

This problem illustrates the importance of congruences and modular inverses — fundamental tools in number theory, cryptography, and computer science.

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Summary

- When $3N + 5$ is divisible by 10, then $N \equiv 5 \ (\text{mod } 10)$.
- This means $N$ ends with the digit 5.
- Numbers ending with 5 are inherently odd.
- Therefore, the correct answer is that $N$ is odd.

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Keywords for SEO Optimization

- Divisibility by 10
- Modular arithmetic
- Number theory problems
- Even and odd numbers
- Congruences in mathematics
- Solving for N in divisibility problems
- Mathematical reasoning
- Number properties and patterns
- Algebraic expressions and divisibility
- Understanding modular inverses

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Conclusion

In conclusion, the problem of determining whether \(N\) is even or odd based on the divisibility of \(3

# Frequently Asked Questions

## If (3N + 5) represents a multiple of 10, what can be said about N? A. N is even B. N is odd C. N is neither even nor odd

A. N is odd. Since 3N + 5 must be divisible by 10, and 5 is odd, N must be odd to make 3N odd or even accordingly. Testing N values shows N must be odd for the sum to be divisible by 10.

## Given (3N + 5) is a multiple of 10, which of the following is true about N? A. N is even B. N is odd C. N can be either even or odd

B. N is odd. Because 3N + 5 must be divisible by 10, and 5 is odd, N must be odd for the expression to be divisible by 10.

## If (3N + 5) is divisible by 10, what is the parity of N? A. Even B. Odd C. Cannot be determined

B. N is odd. The divisibility condition implies N must be odd for the expression to result in a multiple of 10.

## When (3N + 5) is divisible by 10, which statement is correct about N? A. N is even B. N is odd C. N is any integer

B. N is odd. Because only when N is odd does 3N + 5 become divisible by 10.

## If (3N + 5) is a multiple of 10, what type of number is N? A. Even number B. Odd number C. Prime number

B. N is an odd number. The divisibility condition requires N to be odd.

### Given the expression (3N + 5), which of the following must be true if it is divisible by 10? A. N is even B. N is odd C. N is any integer

B. N is odd. Because 3 times an odd N plus 5 results in a multiple of 10.

### If (3N + 5) is divisible by 10, then N must be: A. Even B. Odd C. Any integer

B. N is odd. Testing shows odd N satisfies the divisibility condition.

### What is the parity of N if (3N + 5) is divisible by 10? A. Even B. Odd C. Cannot be determined

B. N is odd. The divisibility condition confirms that N must be odd.

### When (3N + 5) is divisible by 10, what can be concluded about N? A. N is even B. N is odd C. N is any integer

B. N is odd, as only odd N values make the expression divisible by 10.

### If (3N + 5) is a multiple of 10, which of the following must hold true? A. N is even B. N is odd C. N can be either even or odd

B. N is odd. Because the divisibility condition is only satisfied when N is odd.

## Additional Resources

Mathematical Insight: Analyzing the Divisibility of (3N + 5) by 10

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Introduction

Mathematics often presents us with simple-looking expressions that reveal profound truths when examined carefully. One such intriguing problem asks: If (3N + 5) represents a multiple of 10, then what is true about N? This question not only challenges our understanding of divisibility rules but also invites us to explore the underlying properties of integers, their parity, and their relationships with modular arithmetic.

In this article, we will delve into this problem with the precision of a mathematical expert, providing a comprehensive analysis of the possible values of N based on the condition that (3N + 5) is divisible by 10. We will explore different scenarios, leverage modular arithmetic, and clarify misconceptions to arrive at a definitive conclusion.

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Understanding the Problem

At its core, the problem can be summarized as:

> Given: \( 3N + 5 \) is divisible by 10
> Question: What can we say about N? Is N even, odd, or does it have other properties?

Expressed mathematically, the condition is:

\[

$$
3N + 5 \equiv 0 \pmod{10}
$$

Our primary goal is to analyze this congruence to determine the nature of N.

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Theoretical Framework: Modular Arithmetic Basics

Before proceeding, let's revisit some essential concepts:

- Divisibility by 10: An integer $X$ is divisible by 10 if and only if $X \equiv 0 \pmod{10}$.
- Parity (Even/Odd): An integer N is even if $N \equiv 0 \pmod{2}$; odd if $N \equiv 1 \pmod{2}$.
- Modular Equations: Solving for N involves manipulating the congruence to isolate N modulo 10.

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Step-by-Step Analysis

Step 1: Express the condition mathematically

Given:

$$
3N + 5 \equiv 0 \pmod{10}
$$

This implies:

$$
3N \equiv -5 \pmod{10}
$$

Since $-5 \equiv 5 \pmod{10}$ (because $-5 + 10 = 5$), we have:

$$
3N \equiv 5 \pmod{10}
$$

Step 2: Simplify the congruence

The key is to solve for N in:

$$
3N \equiv 5 \pmod{10}
$$

However, because 3 and 10 are coprime ($\gcd(3,10) = 1$), we can find the modular inverse of 3 modulo 10.

Step 3: Find the modular inverse of 3 modulo 10

The modular inverse of 3 mod 10 is a number $x$ such that:

$$
3x \equiv 1 \pmod{10}
$$

Testing small integers:

- $3 \times 1 = 3 \equiv 3 \pmod{10}$ (not 1)
- $3 \times 2 = 6 \equiv 6 \pmod{10}$
- $3 \times 3 = 9 \equiv 9 \pmod{10}$
- $3 \times 4 = 12 \equiv 2 \pmod{10}$
- $3 \times 5 = 15 \equiv 5 \pmod{10}$
- $3 \times 6 = 18 \equiv 8 \pmod{10}$
- $3 \times 7 = 21 \equiv 1 \pmod{10}$

Result: $3 \times 7 \equiv 1 \pmod{10}$

Thus, the inverse of 3 modulo 10 is 7.

Step 4: Solve for N

Multiply both sides of the congruence by 7:

$$
7 \times 3N \equiv 7 \times 5 \pmod{10}
$$

Simplify:

$$
(7 \times 3) N \equiv 35 \pmod{10}
$$

Since $7 \times 3 = 21 \equiv 1 \pmod{10}$, this reduces to:

$$
1 \times N \equiv 35 \pmod{10}
$$
$$
N \equiv 35 \pmod{10}
$$

And because $35 \equiv 5 \pmod{10}$, we conclude:

$$
\boxed{
N \equiv 5 \pmod{10}
}
$$

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Interpretation of the Result

The congruence $N \equiv 5 \pmod{10}$ indicates that:

- N ends with a 5 in its decimal representation.
- N can be expressed as: $N = 10k + 5$, where $k$ is any integer.

Implication on Parity (Even/Odd)

Since $N = 10k + 5$:

- $10k$ is always divisible by 2 (even).
- Adding 5 (which is odd) results in:

$$
\text{even} + \text{odd} = \text{odd}
$$

Therefore, N must be odd.

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Summary and Key Takeaways

| Property | Explanation | Conclusion |
|---|---|---|
| Divisibility of $(3N + 5)$ by 10 | Solving the modular equation yields $N \equiv 5 \pmod{10}$ | N ends with digit 5, i.e., N ≡ 5 mod 10 |
| Parity of N | Since $N = 10k + 5$, it's odd (because 10k is even, 5 is odd) | N is odd |
| N's possible values | All integers ending with 5 (e.g., -15, -5, 5, 15, 25, ...) | Infinite set of odd integers |

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Final Verdict

Based on the detailed mathematical analysis, the statement:

> If (3N + 5) is a multiple of 10, then N is odd.

Thus, the correct answer is:

B. N Is Odd

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Additional Insights

While the core conclusion is that N must be odd, it's worth noting:

- N cannot be even because that would violate the modular congruence.
- N's form as $(10k + 5)$ makes it clear that N always ends with 5, reinforcing its odd nature.
- Applicability: This reasoning holds for all integers N satisfying the initial condition, regardless of whether N is positive, negative, or zero.

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Closing Remarks

This exploration underscores the power of modular arithmetic in solving divisibility problems. By systematically translating the problem into a modular congruence, leveraging the modular inverse, and interpreting the solution, we arrived at an elegant and definitive conclusion.

Understanding such properties not only enhances problem-solving skills but also deepens comprehension of number theory fundamentals, which are essential for advanced mathematics, cryptography, and computational algorithms.

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In conclusion, when $(3N + 5)$ is divisible by 10, N must be odd, making Option B the correct choice.

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