

Worksheet: Equations with Infinitely Many or No Solutions

Equations with Infinitely Many or No Solutions

When solving an equation, you may find that it has:

- **One Solution** – There is exactly one value that makes the equation true.
- **No Solution** – There is **no value** that makes the equation true.
- **Infinitely Many Solutions** – **Every value** of the variable makes the equation true.

One Solution

If the variable can be isolated, there is one solution.

Example $3x + 5 = 20$

Subtract 5. $3x = 15$

Divide by 3. $x = 5$

How to Recognize Each Type:

No Solution

After simplifying, the variables cancel and you are left with a **false statement**

Example: $4x + 7 = 4x + 2$

Subtract $4x$ from both sides. $7 = 2$

Since **7 is not equal to 2**, the equation is never true.

No Solution

Infinitely Many Solutions

After simplifying, the variables cancel and you are left with a **true statement**.

Example: $5x + 10 = 5(x + 2)$

Distribute: $5x + 10 = 5x + 10$

Subtract $5x$: $10 = 10$

This statement is always true.

Infinitely Many Solutions

Part A – Solve Each Equation

Determine whether the equation has **one solution**, **no solution**, or **infinitely many solutions**. If there is one solution, solve for the variable.

1. $2x + 5 = 17$

$x = \boxed{}$

4. $5a + 9 = 5a + 2$

7. $9q - 3 = 9q + 1$

2. $6y - 4 = 20$

$y = \boxed{}$

5. $4n - 7 = 13$

$n = \boxed{}$

8. $7r + 14 = 35$

$r = \boxed{}$

3. $3m + 8 = 3m + 8$

6. $8p + 6 = 8p + 6$

Part B – Variables on Both Sides

9. $4x + 8 = 2x + 18$

$x = \boxed{}$

12. $5a + 4 = 2a + 19$

$a = \boxed{}$

15. $7d - 2 = 7d + 9$

10. $6y - 5 = 6y - 5$

13. $8b - 6 = 4b + 10$

$b = \boxed{}$

16. $10e + 15 = 5e + 40$

$e = \boxed{}$

11. $3m + 12 = 3m + 7$

14. $9c + 3 = 9c + 3$

Part C – Use the Distributive Property

17. $3(x + 2) = 3x + 6$

20. $5(a + 4) = 5a + 18$

23. $8(q - 2) = 8q - 16$

18. $4(y - 5) = 4y - 12$

21. $6(n - 3) = 6n - 18$

24. $9(r + 4) = 9r + 40$

19. $2(m + 7) = 2m + 14$

22. $7(p + 1) = 7p + 5$

Part D – Mixed Practice

For each equation:

- Solve if there is **one solution**.
- Write **No Solution** if none exists.
- Write **Infinitely Many Solutions** if the equation is always true.

25. $5x + 15 = 3x + 25$

29. $8b - 16 = 4(b - 4)$

26. $6y + 12 = 6(y + 2)$

30. $3c + 18 = 3(c + 6)$

27. $4m - 8 = 4m + 8$

31. $2d + 5 = 2d - 7$

28. $7a + 14 = 2a + 34$

32. $9e - 27 = 3(3e - 9)$
