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.

How to Recognize Each Type:

One Solution

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

Example $3x + 5 = 20$

Subtract 5. $3x = 15$

Divide by 3. $\boxed{x = 5}$

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.

$\boxed{\text{No Solution}}$

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.

$\boxed{\text{Infinitely Many Solutions}}$

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. $2x + 5 = 17$
   $x = \square$
2. $6y - 4 = 20$
   $y = \square$
3. $3m + 8 = 3m + 8$
4. $5a + 9 = 5a + 2$
5. $4n - 7 = 13$
   $n = \square$
6. $8p + 6 = 8p + 6$
7. $9q - 3 = 9q + 1$
8. $7r + 14 = 35$
   $r = \square$

Part B – Variables on Both Sides

9. $4x + 8 = 2x + 18$
   $x = \square$
10. $6y - 5 = 6y - 5$
11. $3m + 12 = 3m + 7$
12. $5a + 4 = 2a + 19$
    $a = \square$
13. $8b - 6 = 4b + 10$
    $b = \square$
14. $9c + 3 = 9c + 3$
15. $7d - 2 = 7d + 9$
16. $10e + 15 = 5e + 40$
    $e = \square$

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Part C – Use the Distributive Property

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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