Key Concepts to Remember

1. **Reverse the inequality sign** when multiplying/dividing by a negative number.
2. **Graphing:**
    - **< or >**: Open circle (excluded).
    - **≤ or ≥**: Closed circle (included).
3. **Word Problems:** Define variables and translate words into inequalities.

Need more practice? Try solving:

- $-4x + 7 \geq 19$
- $\frac{x+2}{5} > 3$

1. Solving Basic Inequalities

Question: Solve for x:

$$3x - 5 > 10$$

Solution:

$$\begin{aligned} 3x - 5 &> 10 \\ 3x &> 15 \quad (\text{Add 5 to both sides}) \\ x &> 5 \quad (\text{Divide by 3}) \end{aligned}$$

Answer: $\boxed{x > 5}$

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2. Inequality with Negative Coefficient

Question: Solve for x:

$$-2x \leq 8$$

Solution:

$$\begin{aligned} -2x &\leq 8 \\ x &\geq -4 \quad (\text{Divide by -2; reverse inequality sign}) \end{aligned}$$

Answer: $\boxed{x \geq -4}$

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3. Compound Inequality

Question: Solve for x:

$$4 < 2x + 2 \leq 10$$

Solution:

Split into two parts:

1. $4 < 2x + 2 \rightarrow 2x > 2 \rightarrow x > 1$
2. $2x + 2 \leq 10 \rightarrow 2x \leq 8 \rightarrow x \leq 4$

   Combined Answer: $\boxed{1 < x \leq 4}$

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4. Inequality with Fractions

Question: Solve for x:

$$\frac{x}{3} - 2 \geq 4$$

Solution:

$$\frac{x}{3} \geq 6 \quad (\text{Add 2 to both sides})$$
$$x \geq 18 \quad (\text{Multiply both sides by 3})$$

Answer: $\boxed{x \geq 18}$

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5. Word Problem (Real-Life Application)

Question: A taxi charges Ksh 200 base fare plus Ksh 50 per km. If John has at most Ksh 1,000, how far can he travel?

Solution:

Let d = distance (km).

$$200 + 50d \leq 1000$$
$$50d \leq 800$$
$$d \leq 16$$

Answer: $\boxed{d \leq 16 \text{ km}}$

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6. Inequality with Variables on Both Sides

Question: Solve for x:

$$5x - 3 \leq 2x + 9$$

Solution:

$$5x - 2x \leq 9 + 3$$
$$3x \leq 12$$
$$x \leq 4$$

Answer: $\boxed{x \leq 4}$

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7. Graphing an Inequality

Question: Graph the solution to $x - 3 < 2$ on a number line.

Solution:

$$x - 3 < 2$$
$$x < 5$$

- **Graph:** Open circle at 5, shade to the left.

  Answer: $\boxed{\text{Open circle at } 5, \text{ shaded left}}$

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8. Inequality with Distributive Property

Question: Solve for x:

$$2(x + 4) > 3x - 1$$

Solution:

$$2x + 8 > 3x - 1$$
$$8 + 1 > 3x - 2x$$
$$9 > x \quad (\text{or } x < 9)$$

Answer: $\boxed{x < 9}$

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9. No Solution or Infinite Solutions

Question: Solve for x:

$$3x + 5 \leq 3x - 2$$

Solution:

$$3x - 3x \leq -2 - 5$$
$$0 \leq -7 \quad (\text{False})$$

Answer: $\boxed{\text{No solution}}$

10. Combined Operations

Question: Solve for x:

$$\frac{2x-1}{3} < 5$$

Solution:

$$\begin{aligned} 2x - 1 &< 15 \quad (\text{Multiply both sides by } 3) \\ 2x &< 16 \\ x &< 8 \end{aligned}$$

Answer: $\boxed{x < 8}$