Undoing Operations: Solving for x

The one idea: to get x on its own, do the *opposite* operation to both sides. Addition ↔ subtraction. Multiplication ↔ division. Whatever you do to one side, do to the other.

Opposites: the opposite of + is − · the opposite of − is + · the opposite of × is ÷ · the opposite of ÷ is ×

Worked examples

1. Undo a multiplication. Solve $3x = 12$.

x is multiplied by 3, so do the opposite: divide both sides by 3.

$3x \div 3 = 12 \div 3 \rightarrow$ **x = 4**

2. Undo a division. Solve $x/2 = 5$.

x is divided by 2, so do the opposite: multiply both sides by 2.

$(x/2) \times 2 = 5 \times 2 \rightarrow$ **x = 10**

3. Undo an addition. Solve $x + 7 = 12$.

7 is added, so do the opposite: subtract 7 from both sides.

$x + 7 - 7 = 12 - 7 \rightarrow$ **x = 5**

4. Two steps. Solve $3x + 4 = 19$.

Undo the **+4** first (subtract 4): $3x = 15$

Then undo the **×3** (divide by 3): **x = 5**

Rule of thumb: undo *adding/subtracting* before *multiplying/dividing*.

5. Two steps with a fraction. Solve $x/2 - 3 = 4$.

Undo the **−3** first (add 3): $x/2 = 7$

Then undo the **÷2** (multiply by 2): **x = 14**

Your turn

1. Solve $5x = 35$
2. Solve $x/4 = 3$
3. Solve $x - 9 = 2$
4. Solve $2x + 6 = 20$
5. Solve $x/3 + 1 = 5$
6. Solve $4x - 5 = 23$

Answer key: 1) x = 7 · 2) x = 12 · 3) x = 11 · 4) x = 7 · 5) x = 12 · 6) x = 7