# Example 1: Solving a Linear Equation

Problem:  
Solve for x:

5x−7=3x+5

Solution:

1. Subtract 3x from both sides:

5x−3x−7=3x−3x+5 ⇒ 2x−7=55x - 3x - 7 = 3x - 3x + 5 \quad \Rightarrow \quad 2x - 7 = 55x−3x−7=3x−3x+5⇒2x−7=5

1. Add 7 to both sides:

2x−7+7=5+7⇒2x=122x - 7 + 7 = 5 + 7 \quad \Rightarrow \quad 2x = 122x−7+7=5+7⇒2x=12

1. Divide both sides by 2:

2x2=122⇒x=6\frac{2x}{2} = \frac{12}{2} \quad \Rightarrow \quad x = 622x​=212​⇒x=6

# Example 2: Solving a Quadratic Equation by Factoring

Problem:  
Solve for xxx:

x2−7x+12=0x^2 - 7x + 12 = 0x2−7x+12=0

Solution:

1. Factor the quadratic expression:

(x−3)(x−4)=0(x - 3)(x - 4) = 0(x−3)(x−4)=0

1. Set each factor equal to zero:

x−3=0orx−4=0x - 3 = 0 \quad \text{or} \quad x - 4 = 0x−3=0orx−4=0

1. Solve for xxx:

x=3orx=4x = 3 \quad \text{or} \quad x = 4x=3orx=4

# Example 3: Solving a Linear Equation with Distribution

Problem:  
Solve for yyy:

3(y−2)=2y+63(y - 2) = 2y + 63(y−2)=2y+6

Solution:

1. Distribute 3 on the left side:

3y−6=2y+63y - 6 = 2y + 63y−6=2y+6

1. Subtract 2y2y2y from both sides:

3y−2y−6=2y−2y+6⇒y−6=63y - 2y - 6 = 2y - 2y + 6 \quad \Rightarrow \quad y - 6 = 63y−2y−6=2y−2y+6⇒y−6=6

1. Add 6 to both sides:

y−6+6=6+6⇒y=12y - 6 + 6 = 6 + 6 \quad \Rightarrow \quad y = 12y−6+6=6+6⇒y=12

# Example 4: Solving a Cubic Equation

Problem:  
Solve for xxx:

x3−4x2+x=0x^3 - 4x^2 + x = 0x3−4x2+x=0

Solution:

1. Factor out xxx:

x(x2−4x+1)=0x(x^2 - 4x + 1) = 0x(x2−4x+1)=0

1. Set each factor equal to zero:

x=0orx2−4x+1=0x = 0 \quad \text{or} \quad x^2 - 4x + 1 = 0x=0orx2−4x+1=0

1. Solve the quadratic equation x2−4x+1=0x^2 - 4x + 1 = 0x2−4x+1=0 using the quadratic formula:

x=−(−4)±(−4)2−4(1)(1)2(1)=4±16−42=4±122=4±232=2±3x = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)} = \frac{4 \pm \sqrt{16 - 4}}{2} = \frac{4 \pm \sqrt{12}}{2} = \frac{4 \pm 2\sqrt{3}}{2} = 2 \pm \sqrt{3}x=2(1)−(−4)±(−4)2−4(1)(1)​​=24±16−4​​=24±12​​=24±23​​=2±3​

1. Therefore, the solutions are:

x=0,x=2+3,x=2−3x = 0, \quad x = 2 + \sqrt{3}, \quad x = 2 - \sqrt{3}x=0,x=2+3​,x=2−3​

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