Simplifying Complex Expressions and Solving Equations by Factoring

Summary: Solve complex equations by factoring. To review factoring, see Precalculus Review and Algebra 2 Review topics.

Example: Simplify $x^2e^{2x} - 3xe^{2x}$

solution: There is a common factor of xe^{2x}. Factor to get $x^2e^{2x} - 3xe^{2x} = xe^{2x}(x-3)$

Example: Solve the equation $6x^2e^{-x} - 24e^{-x} = 0$.

solution: First simplify by factoring out the common factor: $6x^2e^{-x} - 24e^{-x} = 6e^{-x}(x^2-4) = 0$. Now use the zero-product property, "a product can be zero only if one of its factors is zero." Therefore, either $6e^{-x} = 0$, which is impossible, or $(x^2-4) = 0$, which makes x = -2 or x = 2.

Problems

Simplify each expression by factoring.

1. $5x^2\sin(2x) - 30\sin(2x)$

2. $2x^3(1.03)^x - 4x^2(1.03)^x$

3. $5\cos(x)\ln(x) - 5\sin(x)\ln(x)$

4. $e^{-0.3x} - xe^{-0.3x} + x^2e^{-0.3x}$

Solve each equation by factoring.

5. $e^{-3x} - \mathbf{2}xe^{-3x} + x^2e^{-3x} = \mathbf{0}$

6. $x^2\ln(x+1) - x^2 = 0$

7. $x\cos(x) = 0$ and $\mathbf{0 \le x \le 2\pi}$

8. $\dfrac{e^x}{x} - \mathbf{2}e^x = \mathbf{0}$

9. $2x^4 - 4x^3 = 0$

10. $e^{-x}\log_{10}(x) - 100e^{-x} = 0$