Operations with Polynomials

1. Write the polynomial $-23x^7 + x^9 - 6x^3 + 10 + 2x^2$ in standard form, and then identify the degree and leading coefficient.

Add or subtract the polynomials.

2. $(82x^8 + 21x^2 - 6) + (18x + 7x^8 - 42x^2 + 3)$

3. $(-2x + 23x^5 + 11) - (5 - 9x^3 + x)$

4. $(x^4 - 7x^3 + 2 - x) + (2x^3 - 3) + (1 - 5x^3 - x^4 + x)$

5. $(10x^2 - x + 4) - (5x + 7) + (6x - 11)$

6. $(9x - 12x^3) - (5x^3 + 7x - 2)$

7. $(15x - 121x^{12} + x^9 - x^7 + 3x^2) + (x^7 - 68x^2 - x^9)$

Find the polynomial that models the problem and use it to estimate the quantity.

8. Cho is making a garden, where the length is x feet and the width is $4x - 1$ feet. He wants to add garden stones around the perimeter of the garden once he is done. If the garden is 4 feet long, how many feet will Cho need to cover with garden stones?

9. **Business** From data gathered in the period 2008–2012, the yearly amount of U.S. exports can be modeled by the function $E(x) = -228x^3 + 2552.8x^2 - 6098.5x + 11{,}425.8$, where x is the number of years after 2008 and $E(x)$ is the amount of exports in billions of dollars. The yearly amount of U.S. imports can be modeled by the function $l(x) = -400.4x^3 + 3954.4x^2 - 11{,}128.8x + 17{,}749.6$, where x is the number of years after 2008 and $l(x)$ is the amount of imports in billions of dollars. Estimate the total amount the United States imported and exported in 2012.

10. **Explain the Error** Colin simplified $\left(16x + 8x^2y - 7xy^2 + 9y - 2xy\right) - \left(-9xy + 8xy^2 + 10x^2y + x - 7y\right)$. His work is shown below. Find and correct Colin's mistake.

$\left(16x + 8x^2y - 7xy^2 + 9y - 2xy\right) - \left(-9xy + 8xy^2 + 10x^2y + x - 7y\right)$
$= \left(16x + 8x^2y - 7xy^2 + 9y - 2xy\right) + \left(9xy - 8xy^2 - 10x^2y - x + 7y\right)$
$= \left(16x - x\right) + \left(8x^2y - 7xy^2 - 8xy^2 - 10x^2y\right) + \left(9y + 7y\right) + \left(-2xy + 9xy\right)$
$= 15x - 17x^2y^2 + 16y + 7xy$

11. The dimensions for a rectangular prism are $x+5$ for the length, $x+1$ for the width, and x for the height. What is the volume of the prism?

Perform the following polynomial multiplications.

12. $(2x+5y)(3x^2-4xy+2y^2)$
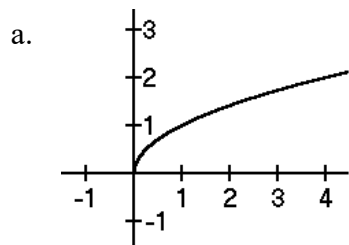
13. $(x^3+x^2+1)(x^2-x-5)$

14. **Biology** A biologist has found that the number of branches on a certain rare tree in its first few years of life can be modeled by the polynomial $b(y)=4y^2+y$. The number of leaves on each branch can be modeled by the polynomial $l(y)=2y^3+3y^2+y$, where y is the number of years after the tree reaches a height of 6 feet. Write a polynomial describing the total number of leaves on the tree.
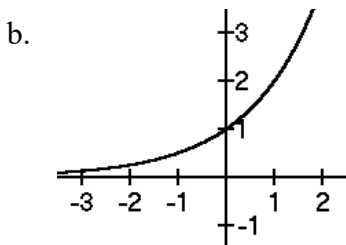
Verify the given polynomial identity.

15. $(x+y+z)^2=x^2+y^2+z^2+2xy+2xz+2yz$

Review

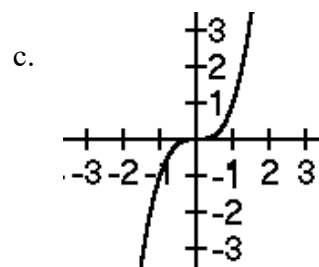16. Name and write an equation to represent each parent function.

a.

b.

c.

Name:
Equation:

Name:
Equation:

Name:
Equation: