1.1 Polynomial Operations

Old-A Combining Like Terms

Simplify the expressions.

① $3x-6+2x-8 = 5x-14$

② $3x-7+12x+10 = 15x+3$

New-A Polynomial Operations (Add & Subtract)

Let's consider Michael's report card for school. Let's say he made the following subject grades:

AP Environment - B
Math - A
Fitness - A
American Gov't - C
English - B
Spanish - A

Report out on Michael's grades.

Michael has 3 A's, 2 B's and 1 C.

conclusion: We added grades that were "alike".

Adding Polynomials ⟹ Drop the Parenthesis & Combine Like Terms.

[Example 1]

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

$= 2x^2-4x+3+x^2+5x-1$

$= 2x^2+x^2-4x+5x+3-1$

$= 3x^2+x+2$

[Example 2]

$(6+x^3+3x)+(2x-8)$

$= 6+x^3+3x+2x-8$

$= x^3+3x+2x-8+6$

$= x^3+5x-2$

Subtracting Polynomials $\Rightarrow$ Distribute the negative & Combine Like Terms

[Example 3]

$(3a^4 + 10a^2) - (8a^2 - a^4 + 6)$

$= 3a^4 + 10a^2 - 8a^2 + a^4 - 6$

$= 3a^4 + a^4 + 10a^2 - 8a^2 - 6$

$= 4a^4 + 2a^2 - 6$

[Example 4]

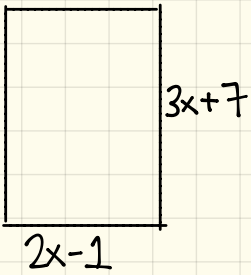
$(3m^7 + 2m^3 - 4m) - (2m^3 - m + 7)$

$= 3m^7 + 2m^3 - 4m - 2m^3 + m - 7$

$= 3m^7 + 2m^3 - 2m^3 - 4m + m - 7$

$= 3m^7 - 3m - 7$

[Example 5] Find the perimeter of the rectangle.



Perimeter is the sum of all sides.

Perimeter $= (3x+7) + (2x-1) + (3x+7) + (2x-1)$

$= 3x + 7 + 2x - 1 + 3x + 7 + 2x - 1$

$= 3x + 2x + 3x + 2x + 7 - 1 + 7 - 1$

$= 10x + 12$

Old - B Distributive Property

① $5(7x-6) = 35x-30$

② $4(2-4x)-6(x-4) = 8-16x-6x+24$

$= 8+24-16x-6x$

$= 32-22x$

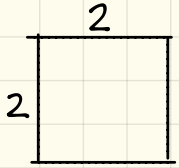
$= -22x+32$

Remember Imaginary 1 Rule:

x means $1x$, x^2 and $1x^1$.

new - B Polynomial Operations (Multiply)

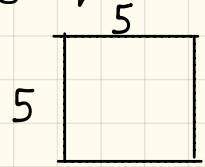
Let's consider the following squares. Find the area.



Area $= 2 \cdot 2$

$= 2^2$

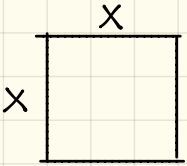
$= 4$



Area $= 5 \cdot 5$

$= 5^2$

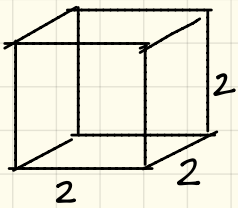
$= 25$



Area $= x \cdot x$

$= x^2$

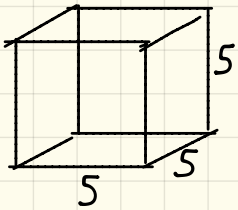
Let's consider the following cubes. Find the surface area.



Surface Area $= 2 \cdot 2 \cdot 2$

$= 2^3$

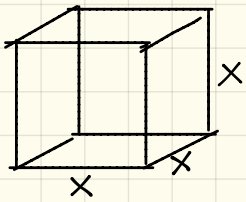
$= 8$



Surface Area $= 5 \cdot 5 \cdot 5$

$= 5^3$

$= 125$



Surface Area $= x \cdot x \cdot x$

$= x^3$

Conclusion

$x \cdot x = x^2$

$x \cdot x \cdot x = x^3$

When multiplying variables, you add the exponents.

Exponential Rule: $x^a \cdot x^b = x^{a+b}$

Multiplying Polynomials $\Longrightarrow$ Distribute, follow exponent rules & combine like terms

Case A Monomial times Binomial

[Example 6]

$x^3(7x+6) = 7x^4+6x^3$

[Example 7]

$4x(x^4+2x-10) = 4x^5+8x^2-40x$

[Example 8]

$-2x(x^2-4x+2) = -2x^3+8x^2-4x$

Case B Binomial times Binomial $\rightsquigarrow$ use FOIL Method

First
Outer
Inner
Last

[Example 9]

$(x+3)(x-3) = x^2-3x+3x-9$

$= x^2-9$

[Example 11]

$(x+2)(x-3) = x^2-3x+2x-6$

$= x^2-1x-6$

[Example 10]

$(3x-1)(2x-4) = 6x^2-12x-2x+4$

$= 6x^2-14x+4$

[Example 12]

$(2x-1)(x^2+7) = 2x^3+14x-1x^2-7$

$= 2x^3-x^2+14x-7$