4.1 Combining Functions

SWBAT combine functions through addition, subtraction, and multiplication to create new functions.

Standard Form: When a polynomial is ordered from the variable with the highest exponent down to the lowest.

Degree of a Polynomial: The highest exponent of a function when it is in standard form.

	Example 1: $-x^3+x^4+x$	Example 2: $5a^2+3a^3+1$	Example 3: $3+12x^4$	Example 4: $7x^3-10x^3+x^3$
Standard Form:	x^4-x^3+x	$3a^3+5a^2+1$	$12x^4+3$	$-2x^3$
Number of Terms:	3	3	2	1
Degree:	4 → quartic	3 → cubic	4 → quartic	3 → cubic
Name:	quartic trinomial	cubic trinomial	quartic binomial	cubic monomial

Example 5: Hypothesize what type of function will be created when you combine the following functions in the manner listed.

Statement	Example	Hypothesis	Conclusion
a) Adding two linear functions together will create a...	$(x + 1) + (x - 3)$		Linear
b) Multiplying two linear functions together will create a...	$(x + 1)(x - 3)$		quadratic
c) Adding a linear and a quadratic function together will create a...	$(x + 1) + (x^2 + 3)$	Answers will vary!	quadratic
d) Multiplying a linear and a quadratic function together will create a...	$(x + 1)(x^2 + 3)$	Answers will vary!	cubic
e) Subtracting a linear function from a quadratic will create a...	$(x^2 + 3) - (x + 1)$	Answers will vary!	quadratic
f) Dividing a cubic function by a linear function will create a...	$\dfrac{x^3}{x}$		quadratic
g) Dividing a cubic function by a quadratic function will create a...	$\dfrac{x^3}{x^2}$		Linear

When combining functions, you may see a variation of the following:

Addition	Subtraction	Multiplication	Division
$f(x) + g(x)$	$f(x) - g(x)$	$f(x) \cdot g(x)$	$\dfrac{f(x)}{g(x)}$
$(f + g)(x)$	$(f - g)(x)$	$(f \cdot g)(x)$	$\left(\dfrac{f}{g}\right)(x)$

Example 6: Solve the following problems given the functions below:

$f(x) = -x + 4$ $\qquad\qquad$ $g(x) = x - 1$ $\qquad\qquad$ $h(x) = x + 5$

$m(x) = x^2 + 2x + 1$ $\qquad$ $n(x) = 3x^3 - 3x^2 + 3x - 1$ $\qquad$ $p(x) = 3x + 1$

1. $f(x) + g(x)$

$(-x + 4) + (x - 1)$

$\boxed{= 3}$

Linear

2. $f(x) - h(x)$

$(-x + 4) - \overparen{(x + 5)}$

$-x + 4 - x - 5$

$\boxed{-2x - 1}$

Linear

3. $f(x) + p(x)$

$(-x + 4) + (3x + 1)$

$\boxed{2x + 5}$

Linear

4. $g(x) + h(x)$

$(x - 1) + (x + 5)$

$\boxed{2x + 4}$

Linear

5. $m(x) + g(x)$

$(x^2 + 2x + 1) + (x - 1)$

$\boxed{x^2 + 2x}$

quadratic

6. $n(x) + m(x)$

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

$\boxed{3x^3 - 2x^2 + 5x}$

cubic

7. $m(x) - g(x)$

$(x^2 + 2x + 1) - \overparen{(x - 1)}$

$x^2 + 2x + 1 - x + 1$

$\boxed{x^2 + 1x + 2}$

quadratic

8. $f(x) \cdot g(x)$

$(-x + 4)(x - 1)$

$-x^2 + 1x + 4x - 4$

$\boxed{-x^2 + 5x - 4}$

quadratic

9. $g(x) \cdot m(x)$

$(x - 1)(x^2 + 2x + 1)$

	x^2	$+2x$	$+1$
x	x^3	$2x^2$	$1x$
-1	$-x^2$	$-2x$	-1

$\boxed{x^3 + 1x^2 - 1x - 1}$

cubic