	Expanded Form	Simplified
1. $a^5 \cdot a^2$	$a\,a\,a\,a\,a \cdot a\,a$	a^7
2. $(a^5)^2$	$a^5 \cdot a^5$	a^{10}
3. $(4a^2)^3$	$4a^2 \cdot 4a^2 \cdot 4a^2$	$64a^6$
4. $(3a^2b^3)^4$	$3a^2b^3 \cdot 3a^2b^3 \cdot 3a^2b^3 \cdot 3a^2b^3$	$81a^8b^{12}$

$3 \cdot 4^2 = 3 \cdot 16$
$= 48$

$(3 \cdot 4)^2 = 3^2 4^2$
$= 9 \cdot 16$
$= 144$

$(-3 \cdot 4)^2 = (-3)^2 (4)^2$
$= 9 \cdot 16$
$= 144$

$-(3 \cdot 4)^2 = -(3^2 4^2)$
$= -144$

Rules for Multiplying Monomials

Product of Powers	$a^m \cdot a^n$	a^{m+n}
Power of a Power	$(a^m)^n$	a^{mn}
Power of Products	$(ab)^m$	$a^m b^m$
Power of a Monomial	$(a^m b^n)^p$	$a^{mp} b^{np}$

Examples- Simplify the following:

5. $\left(\frac{1}{2}a^2b\right)^3 = \left(\frac{1}{2}\right)^3 a^6 b^3$ $= \frac{1}{8}a^6 b^3$	6. $(2a^4)(3a^3b)(-4a^2b^3)^2$ $= 6a^7b(16a^4b^6)$ $= 96a^{11}b^7$
7. $9\left(\frac{1}{3}a^3b^4\right)^2 = 9\left(\frac{1}{3}\right)^2 (a^6 b^8)$ $= 9(1/9)a^6 b^8$ $= a^6 b^8$	8. $(-4x^5)^3$ $= (-4)^3 x^{15}$ $= -64x^{15}$
9. $(-5a^3)^2 + (3a)^3$ $25a^6 + 9a^3$	10. $(5a^3)^2 + (2a^2)^3$ $25a^6 + 8a^6$ $33a^6$

	Expanded Form	Simplified
11. $\frac{a^5}{a^3}$	$\frac{a\,a\,a\,a\,a}{a\,a\,a}$	a^2
12. $\frac{a^3}{a^5}$	$\frac{a\,a\,a}{a\,a\,a\,a\,a}$	$\frac{1}{a^2}$
13. $\frac{4a^2b^3}{8ab^5}$	$\frac{4\,a\,a\,b\,b\,b}{8\,a\,b\,b\,b\,b\,b}$	$\frac{a}{2b^2}$
14. $\frac{a^4}{a^4}$	$\frac{a\,a\,a\,a}{a\,a\,a\,a}$	1

Rules for Dividing Monomials

Quotient of Powers	$\frac{a^m}{a^n}$	a^{m-n}
Zero Exponent	a^0	1
Negative Exponent	a^{-1}	$1/a$

Examples- Simplify the following:

15. $\frac{144x^5y^{-3}z^4}{12x^6y^2z^4}$

$= \frac{12}{x\,y^5}$

16. $\frac{(3x^5)^2}{(-2x^3)^{-3}} = (9x^{10})(-2x^3)^3$

$= (9x^{10})(-8x^9)$

$= -72x^{19}$

17. $\frac{x^5y^2}{xy^3} = \frac{x^4}{y}$

18. $\left(\frac{2a^3}{b^{-4}}\right)^{-2} = \frac{(2a^3)^{-2}}{(b^{-4})^{-2}}$

$= \frac{1}{(2a^3)^2 b^8} = \frac{1}{4a^6b^8}$

19. $\frac{(x^4y^{-7})^0}{(-3)^2} = \frac{1}{9}$

20. $\frac{1}{x^0 + y^0} = \frac{1}{2}$

Degree of a Polynomial: the degree of the monomial with the greatest degree.

What is the degree of:

$f(x) = 6x^7 + 9x^2 + 3x^{10}$ 10th degree	$f(x) = x^2 + 2x^3 - x$ 3rd degree

Simplify:

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

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

2. $(-4x^3 + 6x^2 - 3) - (3x^4 + 4x^2 + 7x + 12)$

$= -4x^3 + 6x^2 - 3 - 3x^4 - 4x^2 - 7x - 12$

$= -3x^4 - 4x^3 + 2x^2 - 7x - 15$

Multiplying Polynomials: Distribute, combine like terms, and write in descending order.

3. $(x - 5)(x^2 - 2x + 3)$ $= x(x^2 - 2x + 3) + (-5)(x^2 - 2x + 3)$

$= x^3 - 2x^2 + 3x - 5x^2 + 10x - 15$

$= x^3 - 7x^2 + 13x - 15$

4. $(2x^3 + 5x^2 - 6x + 1)(3x - 2)$

$= 3x(2x^3 + 5x^2 - 6x + 1) + (-2)(2x^3 + 5x^2 - 6x + 1)$

$= 6x^4 + 15x^3 - 18x^2 + 3x + -4x^3 - 10x^2 + 12x - 2$

$= 6x^4 + 11x^3 - 28x^2 + 15x - 2$