Section 6.1
Monomials: Multiplication and Division

In its most simple form, a monomial is a single combination of *coefficient*, *base*, and *exponent*. Also called a term, an example of a monomial would be the expression

coefficient → $2x^3$ ← exponent (3), ← base (x)

where x is the base, 2 the coefficient of x, and 3 the exponent.

For practical purposes, when the coefficient or exponent is one (1), the ONES are there, but we do not show them. Thus, if you write

x it means $1x^1$

The coefficient of x is 1 and the exponent is 1

MULTIPLYING MONOMIALS

Every time we multiply the coefficients of monomials, the exponents of identical bases must be added.

Example:

exponents: 4 + 5 = 9

$$(3x^4)(4x^5) = 12x^9$$

coefficients: (3)(4) = 12

If the bases are not the same, we may multiply the coefficients, but we cannot add the exponents.

Example:

exponents: 4 and 5 cannot be added

$$(3x^4)(4y^5) = 12x^4y^5$$

coefficients: (3)(4) = 12

Example: Multiply $(5x^2)(2xy)(3y^5) = 30x^3y^6$

Multiplying the coefficients $(5 \times 2 \times 3)$ produces an answer of 30. Adding the exponents $(2 + 1 = 3)$, the answer is 3 for x, and $(1 + 5 = 6)$ for y.

DIVIDING MONOMIALS

Because multiplication and division are inverse operations, in division exponents get subtracted.

Example:

$6 - 4 = 2$

$24 \div 3 = 8$

$$\frac{24x^6}{3x^4} = 8x^2$$

Example: $\frac{18x^2y^5z^7}{9xy^2} = 2xy^3z^7$

Dividing the coefficients 18 and 9, we get 2. Subtracting the exponents, we get (2 –1 = 1) for *x*, and (5 – 2 = 3) for *y*. The exponent for *z* stays the same

Another way of looking at division

Example: $\frac{21a^8b^6c^2}{3a^{10}b^2c^4} = \frac{21aaaaaaaabbbbbbcc}{3aaaaaaaaaabbcccc} = \frac{7b^4}{a^2c^2}$

21 divided by 3 is 7. The exponents of *a* are 8 in the numerator and 10 in the denominator. Cancelling them leaves 2 in the denominator only. For *b*, the exponents are 6 in the numerator and 2 in the denominator; cancelling them leaves 4 in the numerator. For *c*, like for *a*, there are more of them in the denominator than in the numerator, therefore, the balance of c^2 is found in the denominator.

Practice:

Multiply

1. $(x)(2x)$
2. $(y)(3y)(2y)$
3. $(2x^2)(4x^2)$
4. $(2y^3)(4y^3)(y^2)(3y^3)$
5. $(z^2)(2z)(z^4)(3z^2)(5z^5)$
6. $(2xy^4)(6x^2y^3)(2xy^2)(x^3y^3)$
7. $(3x^2)(5x^6)(3x)(2x^4)$
8. $(5a^2)(3a^7)(2a^6)(5a^2)$
9. $(4b^2)(2b^6)(3b^5)(5b^4)(3b^2)$
10. $(3c)(5c^3)(2c^3)(2c^2)$
11. $(3x^4)(4x^2)(2x)(x^3)(4x^5)$
12. $(2y^3)(3y^7)(6y^3)$
13. $(d)(3d^4)(d^2)(6d^3)(4d)$
14. $(5v^4)(4v^4)(v^7)(3v^2)(2v)$
15. $(5g^3)(g^7)(4g^6)(2g^5)(g^3)$
16. $(2a)(3a^5)(4a^4)(a^3)$
17. $(5b)(3b^4)(2b^3)(b)$
18. $(z^5)(3z^8)(4z^7)(z^6)(2z^4)$
19. $(3x^4)(x^4)(2x^3)(x^2)(2x)$
20. $(5a^2b^7)(4a^3b^3)(a^2b^4)$
21. $(5s^3t^3)(3s^4t^4)(s^2t^3)(2st^2)$
22. $(3h^5)(h^4)(h^3)(2h^2)(5h)$
23. $(2cd)(3c^5d^3)(c^4d^6)(2c^2d^5)$
24. $(2x)(x^4)(4x^6)(3x^2)(2x^3)$
25. $(3b^4)(4b^8)(b^7)(b^6)(4b^4)$
26. $(2y)(5y^4)(2y^3)(6y^2)(y)$
27. $(p^2q^4)(pq^8)(3p^3q^6)(3p^4q^6)$
28. $(2x^4)(3x^8)(6x^6)(x^7)(x^4)$
29. $(ab)(3a^2b^4)(2a^4b^3)(2a^3b^3)$
30. $(3c^5)(c)(7c^4)(2c^3)(c^2)$

Divide

31. $\frac{8a^4}{2a^2}$
32. $\frac{34x^5}{17x^4}$
33. $\frac{24x^2y^4}{8xy^3}$
34. $\frac{18a^6b^7}{9a^2b^6}$
35. $\frac{16c^8d^3}{2c^4d^3}$
36. $\frac{49x^7y^8}{7x^2y^7}$
37. $\frac{36x^6y^3z^5}{12x^4y^3}$
38. $\frac{9a^5b^9c^6}{9a^7b^8c^4}$
39. $\frac{120x^{12}yz}{12x^6y}$
40. $\frac{32ab^8c^6}{8abc^2}$
41. $\frac{16x^5y^9z^8}{12x^5y^2z^5}$
42. $\frac{30x^9y^7z^4}{15x^8y^6z}$
43. $\frac{28x^6y^3z^5}{14x^6yz^4}$
44. $\frac{44ab^2c^4}{11abc}$
45. $\frac{54m^{30}n^{24}p^{18}}{9m^{25}n^{23}p^{16}}$