

Multiplying and Dividing Monomials

Multiplication:

$$3^2 = 3 \cdot 3 = 9 \qquad 4 \cdot 4 = 4^2 = 16 \qquad 4^3 = (4)(4)(4) = 64 \qquad (5)(5)(5)(5)(5)(5) = 5^6 = 15,625$$

The same goes for variables:

$$x \cdot x = x^2$$

$$x^2 \cdot x^3 = (x)(x) \cdot (x)(x)(x) = x^5$$

(The only difference is you can't simplify x^2 like you did $3^2 = 9$. You must leave it as x^2 .)

When multiplying monomials you must deal with the coefficients.

Coefficients: **Multiply the coefficients.**

Variables: When multiplying the **variables** of monomials you **keep the base and add the exponents**. (Remember if there is no exponent written, the exponent is 1.)

Look at the previous example: $x^1 \cdot x^1 = x^{(1+1)} = x^2$

Simplify: $(3xy^5)(4x^2y^3)$

$$(3xy^5)(4x^2y^3) = (3)(4)(x)(x^2)(y^5)(y^3) = 12 [x^{(1+2)}][y^{(5+3)}] = \mathbf{12x^3y^8}$$

Do now:

1) $(-6x^2y^7)(-9x^5y)$

2) $(-4x^3y^5)^2$

3) $(-2xy^8)^3$

Division:

$$6^4/6^2 = \frac{(6)(6)(6)(6)}{(6)(6)} \rightarrow \text{cancel} \rightarrow \frac{\cancel{(6)}\cancel{(6)}(6)(6)}{\cancel{(6)}\cancel{(6)}} = (6)(6) = 6^2 = 36$$

$$x^3/x = \frac{(x)(x)(x)}{(x)} \rightarrow \text{cancel} \rightarrow \frac{(x)(x)\cancel{(x)}}{\cancel{(x)}} = (x)(x) = x^2$$

Just like multiplying, when dividing monomials you must deal with the coefficients.

Coefficients : **Divide the coefficients.**

Variables: When dividing the **variables** of monomials you **keep the base and subtract the exponents.**

Look at the previous example: $x^3/x = x^{3-1} = x^2$

Simplify: $(12xy^5)/(4xy^3) =$

$$12/4 = 3 \quad x^{1-1} = x^0 \quad y^{5-3} = y^2$$

What is x^0 equal to? : _____ Any number or variable with an exponent of 0 = ? _____

Final answer = _____

Do Now:

4) $\frac{48x^5y^{12}z^5}{64x^3y^5z^5}$

5) $\frac{35x^2y^5z}{20x^4y^3z^2}$

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6) $\frac{(3x^4y^5z)^3}{18x^3y^{14}z^7}$

7) $(2x^5yz^6)^5(-3x^2y^{-3}z^{-15})^2$

Show all steps!

1) Multiply:

a) $(5x^3y^2z^{11})(12xy^7z^{-4})$

b) $(9x^5y^2z^4)^3$

c) $(4x^3y^7z^6)^4(3x^8y^{-5}z^{-12})^2$

2) Multiply:

a) $(6x^3y^2z^{-12})(11x^5y^{-3}z^7)$

b) $(8x^5y^{-2}z^4)^4$

c) $(3x^6y^5z^8)^3(5x^{-9}y^5z^{-15})^2$

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3) Divide:

a) $\frac{27x^3y^2z^5}{9x^3y^5z^4}$.

b) $\frac{(4x^4y^5z)^3}{16x^4y^{13}z^4}$

c) $\frac{(2x^5yz^6)^5}{(4x^{11}y^5z^{14})^2}$

4) Divide:

a) $\frac{45x^3y^9z^5}{18x^6y^5z}$.

b) $\frac{24x^8y^{12}z^9}{72x^{10}y^{12}z^8}$

c) $\frac{32x^5y^{12}z^{28}}{8x^7y^{12}z^{14}}$

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$$5) \frac{(3x^5y^8z^5)^5}{(9x^{14}y^{20}z^{12})^2}$$

$$6) \frac{(6x^5y^4z^6)^3}{(12x^7y^8z^9)^2}$$

$$7) 5a(8a^2 - 6a + 3) - 3a(11a^2 - 10a - 5)$$

$$8) 8b(7b^2 - 4b + 2) - 5(6b^2 + 3b - 1)$$

$$9) 7x(4x^2 - 11x + 3) - 4x(8x^2 - 18x + 5)$$

$$10) 5x(7x^2 - 6x + 4) - 3x(10x^2 - 7x - 1)$$

$$11) 6y^2(5y^3 - 4y^2 + 8y - 7) - 8y(3y^3 + 6y^2 - 5y - 9)$$

When MULTIPLYING monomials you _____ the coefficients and _____ the exponents.

When DIVIDING monomials you _____ the coefficients and _____ the exponents.

1) $(3x^9y)(6x^{11}y^4)$

2) $\frac{36x^9y^6z^5}{12x^{-9}y^6z^4}$

3) $(7x^2yz^3)^3$

4) $\frac{45x^4y^3z^7}{18x^6y^{-3}z^5}$

5) $\frac{(4x^5yz^3)^3}{(2x^3y^6z^{-2})^5}$

6) $(5x^2y^2z^{-4})(2x^{-5}y^3z)^3$

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7) $(6x^7y^4z^3)^2(2x^{-5}y^3z)^3$

8) $\frac{(9x^2y^5z^{-11})^2}{(3x^{-2}y^2z^4)^5}$

9) $\frac{(6x^2y^5z^3)^2}{(2x^{-3}y^2z^2)^5}$

10) $4x(9x^2 - 15x - 12) - 12x(3x^2 + 5x - 4)$ 11) $3y^2(5y^3 - 4y^2 + 8y - 7) - 7y(3y^3 + 6y^2 - 5y - 9)$

Q1 Quiz 7 Review:

Multiplication

1) $(10x^3y^{11}z^8)(-11xy^7z^3)$

2) $(7x^3yz^6)^3$

3) $(2x^3y^5z^6)^4(5x^6y^9z^{-12})^2$

4) $(-6x^4y^2z^{-5})^3(-8x^5y^{-3}z^8)^2$

5) $(4xy^4z^8)^3(9x^9y^5z^{-10})^2$

Division:

6) $\frac{42x^5y^4z^5}{63x^{-5}y^4z^9}$

7) $\frac{(4x^2yz^5)^3}{16x^7y^{-3}z^{10}}$

8) $\frac{(2x^4y^2z^6)^5}{(4x^7y^3z^{10})^3}$

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$$9) \frac{(9x^3y^5z^8)^2}{(3xy^2z^{-3})^5}$$

$$10) \frac{(8x^{-6}y^4z^5)^3}{(10x^9y^{-6}z^2)^2}$$

$$11) 10x(3x^2 - 5x + 6) - 6x(5x^2 + 8x + 10) \quad 12) 3x(7x^2 + 6x - 4) - 8(10x^2 - 7x - 1)$$

Multiplying binomials:

We have a special way of remembering how to multiply binomials called FOIL:

F: first $x \cdot x = x^2$

$(x + 7)(x + 5)$

O: outer $x \cdot 5 = 5x$

I: inner $7 \cdot x = 7x$

$x^2 + 5x + 7x + 35$ (then simplify)

L: last $7 \cdot 5 = 35$

$x^2 + 12x + 35$

1) $(x - 5)(x + 4)$

2) $(x - 6)(x - 3)$

3) $(x + 4)(x + 7)$

4) $(x + 3)(x - 7)$

5) $(3x - 5)(2x + 8)$

6) $(11x - 7)(5x + 3)$

7) $(4x - 9)(9x + 4)$

8) $(x - 2)(x + 2)$

9) $(x - 2)(x - 2)$

10) $(x - 2)^2$

11) $(5x - 4)^2$

12) $(3x + 2)^2$

Multiplying a *TRINOMIAL* by a binomial:

$$13) (4x^2 - 3x + 6)(2x - 7)$$

Method 1: Split, distribute, and combine like terms:

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

Method 2: Box Method:

$$\begin{array}{r} 4x^2 - 3x + 6 \\ \hline 2x - 7 \end{array}$$

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Do now:

14) $(5x^2 + 6x - 8)(9x + 4)$

15) $(7x^2 - 3x - 4)(6x^2 + 2x - 5)$

16) $(4x - 3)^3$

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Multiplying Binomials: Use all three methods (Double Distribute, FOIL, and “boxes”) to find the product:

1) $(3x - 2)(4x + 7)$:
Double Distribute

FOIL

Boxes

2) $(9x - 2)(x + 7)$
Double Distribute

FOIL

Boxes

3) $(7x - 3)^2$
Double Distribute

FOIL

Boxes

4) $(2x + 9)^2$
Double Distribute

FOIL

Boxes

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Multiplying Polynomials

1) $(5x + 8)(9x - 7)$

2) $(6x - 5)(4x - 3)$

3) $(5x - 2)^2$

3) $(5x - 2)^3$

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

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5) $(2x^2 + 5x + 4)(8x + 3)$

6) $(6x^2 - 4x - 3)(2x^2 - 3x - 1)$

7) $(5x^2 - 6x + 1)(4x^2 - 9)$

8) $(7x^2 - 6x + 4)(8x^2 + 5x - 2)$

Q1 Quiz 8 Review:

1) $6x(9x^2 - 4x + 8) + 4x(6x^2 + 12x - 9)$ 2) $8x^2(7x^2 - 3x - 12) - 6x(4x^2 - 16x - 3)$

3) $(x + 8)(x - 7)$

4) $(x - 9)(x - 12)$

5) $(x - 4)(x + 7)$

6) $(x - 11)^2$

7) $(5x - 4)^2$

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8) $(3x + 4)^3$

9) $(3x^2 - 5x + 3)(5x - 4)$

10) $(4x^2 - 7x + 2)(10x^2 - 3x - 5)$

11) $(3x + 2)^3$