

## Elementary Algebra

### Skill-BUILDER # E – 3

### Applying the Distributivity over Multiplication Rule for Exponents

The following rule applies when raising a product to a positive integer.

For any nonzero real numbers  $a$  and  $b$  and a positive integer  $n$ ,

$$(ab)^n = a^n b^n.$$

The rule says that to raise a product to a positive integer  $n$ , keep the base  $a$  and distribute the exponent to each of the factors.

#### Examples

1.  $(xy)^4 = x^4 y^4$

2.  $(3abc)^2 = 3^2 a^2 b^2 c^2 = 9a^2 b^2 c^2$

We can combine the distributivity rule with the power rule.

3. Simplify:  $(2x^2y)^5$

Solution:

$$(2x^2y)^5 = 2^5 (x^2)^5 y^5 = 32x^{10}y^5$$

4. Simplify:  $(-4a^2b^5c^4)^2$

Solution:

$$(-4a^2b^5c^4)^2 = (-4)^2 (a^2)^2 (b^5)^2 (c^4)^2 = 16a^4b^{10}c^8$$

We can also combine it with the product rule and we may need to apply the commutative and associative properties.

5. Simplify:  $(2xy^6)^3 (2x^2y^4)^2$

Solution:

$$\begin{aligned} & (2xy^6)^3 (2x^2y^4)^2 \\ &= 2^3 x^3 (y^6)^3 \cdot 2^2 (x^2)^2 (y^4)^2 \\ &= 2^3 x^3 y^{18} \cdot 2^2 x^4 y^8 \\ &= (2^3 \cdot 2^2)(x^3 x^4)(y^{18} y^8) \\ &= 2^5 x^7 y^{26} \\ &= 32x^7 y^{26} \end{aligned}$$

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Simplify the following using the distributivity over multiplication rule for exponents.

1.  $(2pr)^4$

2.  $(-3abc)^3$

3.  $\left(\frac{1}{2}xy\right)^5$

Simplify each. You may need to use a combination of exponent rules as well as the commutative and associative properties for multiplication.

4.  $(b^4c^9)^8$

5.  $(2a^2d^3)^3$

6.  $(-3x^2y)^4(x^3y^6)^3$

7.  $(2a^3bc^4)^2(-a^4b^5c)^3(b^2c^6)^5$

8.  $\left(\frac{1}{3}y^5z\right)^2(-3z^4)^3(y^2z^2)^5(3yz)^2$

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Answer Key:

1.  $16p^4r^4$

2.  $-27a^3b^3c^3$

3.  $\frac{1}{32}x^5y^5$

4.  $b^{32}c^{72}$

5.  $8a^6d^9$

6.  $81x^{17}y^{22}$

7.  $-4a^{18}b^{27}c^{41}$

8.  $-27y^{22}z^{26}$

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