

## Lesson 1.2 The Product and the Quotient of Powers

Use the product of powers property to simplify numerical expressions.

*Example*

a)  $5^8 \cdot 5$

$$5^8 \cdot 5 = \underline{5^{8+1}}$$

Use the product of powers property.

$$= \underline{5^9}$$

Simplify.

b)  $(-2)^3 \cdot (-2)^7$

$$(-2)^3 \cdot (-2)^7 = \underline{(-2)^{3+7}}$$

Use the product of powers property.

$$= \underline{(-2)^{10}}$$

Simplify.

c)  $\left(\frac{2}{3}\right)^5 \cdot \left(\frac{2}{3}\right)^3$

$$\left(\frac{2}{3}\right)^5 \cdot \left(\frac{2}{3}\right)^3 = \underline{\left(\frac{2}{3}\right)^{5+3}}$$

Use the product of powers property.

$$= \underline{\left(\frac{2}{3}\right)^8}$$

Simplify.

### Complete.

1.  $13^4 \cdot 13^9$

$$13^4 \cdot 13^9 = \underline{\hspace{2cm}}$$

Use the \_\_\_\_\_ of powers property.

$$= \underline{\hspace{2cm}}$$

Simplify.

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**Complete.**

2.  $(-7) \cdot (-7)^{11}$

$(-7) \cdot (-7)^{11} =$  \_\_\_\_\_ Use the \_\_\_\_\_ of powers property.

$=$  \_\_\_\_\_ Simplify.

3.  $0.9^2 \cdot 0.9^4$

$0.9^2 \cdot 0.9^4 =$  \_\_\_\_\_ Use the \_\_\_\_\_ of powers property.

$=$  \_\_\_\_\_ Simplify.

**Simplify each expression. Write your answer in exponential notation.**

4.  $18^{10} \cdot 18^6$

5.  $(-11)^3 \cdot (-11)^4$

6.  $1.5^6 \cdot 1.5^6$

7.  $\left(\frac{1}{5}\right)^6 \cdot \left(\frac{1}{5}\right)$

**Use the product of powers property to simplify algebraic expressions.***Example*

**a)**  $a^2 \cdot a^3$

$$a^2 \cdot a^3 = \underline{a^{2+3}}$$

Use the product of powers property.

$$= \underline{a^5}$$

Simplify.

**b)**  $(-f)^4 \cdot (-f)$

$$(-f)^4 \cdot (-f) = \underline{(-f)^{4+1}}$$

Use the product of powers property.

$$= \underline{(-f)^5}$$

Simplify.

**c)**  $(9p)^{10} \cdot (9p)^{10}$

$$(9p)^{10} \cdot (9p)^{10} = \underline{(9p)^{10+10}}$$

Use the product of powers property.

$$= \underline{(9p)^{20}}$$

Simplify.

**Complete.**

**8.**  $b \cdot b^6$

$$b \cdot b^6 = \underline{\hspace{2cm}}$$

Use the \_\_\_\_\_ of powers property.

$$= \underline{\hspace{2cm}}$$

Simplify.

**9.**  $(-q)^3 \cdot (-q)^2$

$$(-q)^3 \cdot (-q)^2 = \underline{\hspace{2cm}}$$

Use the \_\_\_\_\_ of powers property.

$$= \underline{\hspace{2cm}}$$

Simplify.

**10.**  $(4s)^8 \cdot (4s)^2$

$$(4s)^8 \cdot (4s)^2 = \underline{\hspace{2cm}}$$

Use the \_\_\_\_\_ of powers property.

$$= \underline{\hspace{2cm}}$$

Simplify.

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**Simplify each expression. Write your answer in exponential notation.**

11.  $w^{12} \cdot w^{15}$

12.  $(-k)^{41} \cdot (-k)$

13.  $(10t)^5 \cdot (10t)^4$

**Use the product of powers property to simplify algebraic expressions.**

*Example*

a)  $a^2 b^3 \cdot a^3 b^2$

$$a^2 b^3 \cdot a^3 b^2 = a^2 \cdot b^3 \cdot a^3 \cdot b^2$$

$$= a^2 \cdot a^3 \cdot b^3 \cdot b^2$$

$$= a^{2+3} \cdot b^{3+2}$$

$$= a^5 b^5$$

Rewrite the product.

Regroup factors with the same base.

Add the exponents of the factors with the same base.

Simplify.

b)  $4p^2 q^4 \cdot 2p^4 q^6$

$$4p^2 q^4 \cdot 2p^4 q^6 = 4 \cdot p^2 \cdot q^4 \cdot 2 \cdot p^4 \cdot q^6$$

$$= 4 \cdot 2 \cdot p^2 \cdot p^4 \cdot q^4 \cdot q^6$$

$$= 8 \cdot p^{2+4} \cdot q^{4+6}$$

$$= 8p^6 q^{10}$$

Rewrite the product.

Regroup numbers, and regroup factors with the same bases.

Add the exponents of the factors with the same base.

Simplify.

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**Complete.**

14.  $x^2y \cdot x^4y^3$

$x^2y \cdot x^4y^3 = \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}}$

\_\_\_\_\_ the product.

$= \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}}$

Regroup the factors with the \_\_\_\_\_ base.

$= \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}}$

\_\_\_\_\_ the exponents of the factors with the same base.

$= \underline{\hspace{1cm}}$

Simplify.

**Simplify each expression. Write your answer in exponential notation.**

15.  $c^4 d^2 \cdot c^5 d^6$

16.  $2j^3k^5 \cdot 3j^2k^7$

**Use the quotient of powers property to simplify numerical expressions.***Example*

a)  $3^5 \div 3^2$

$3^5 \div 3^2 = \underline{3^{5-2}}$

Use the quotient of powers property.

$= \underline{3^3}$

Simplify.

b)  $(-2)^8 \div (-2)^3$

$(-2)^8 \div (-2)^3 = \underline{(-2)^{8-3}}$

Use the quotient of powers property.

$= \underline{(-2)^5}$

Simplify.

c)  $2.3^9 \div 2.3^2$

$2.3^9 \div 2.3^2 = \underline{2.3^{9-2}}$

Use the quotient of powers property.

$= \underline{2.3^7}$

Simplify.

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**Complete.**

17.  $6^{19} \div 6^{14}$

$6^{19} \div 6^{14} = \underline{\hspace{2cm}}$

$= \underline{\hspace{2cm}}$

Use the \_\_\_\_\_ of powers property.

Simplify.

18.  $(-4)^7 \div (-4)^4$

$(-4)^7 \div (-4)^4 = \underline{\hspace{2cm}}$

$= \underline{\hspace{2cm}}$

Use the \_\_\_\_\_ of powers property.

Simplify.

19.  $\left(\frac{1}{3}\right)^{17} \div \left(\frac{1}{3}\right)^{11}$

$\left(\frac{1}{3}\right)^{17} \div \left(\frac{1}{3}\right)^{11} = \underline{\hspace{2cm}}$

$= \underline{\hspace{2cm}}$

Use the \_\_\_\_\_ of powers property.

Simplify.

**Simplify each expression. Write your answer in exponential notation.**

20.  $7^{15} \div 7^7$

21.  $(-6)^4 \div (-6)^3$

22.  $0.25^6 \div 0.25^4$

23.  $\left(\frac{4}{5}\right)^6 \div \left(\frac{4}{5}\right)$

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**Use the quotient of powers property to divide algebraic expressions.**

*Example*

a)  $q^4 \div q^3$

$$q^4 \div q^3 = \underline{q^{4-3}}$$

Use the quotient of powers property.

$$= \underline{q}$$

Simplify.

b)  $(-p)^3 \div (-p)$

$$(-p)^3 \div (-p) = \underline{(-p)^{3-1}}$$

Use the quotient of powers property.

$$= \underline{(-p)^2}$$

Simplify.

**Complete.**

24.  $x^9 \div x^7$

$$x^9 \div x^7 = \underline{\hspace{2cm}}$$

Use the \_\_\_\_\_ of powers property.

$$= \underline{\hspace{2cm}}$$

Simplify.

25.  $(-r)^{12} \div (-r)^2$

$$(-r)^{12} \div (-r)^2 = \underline{\hspace{2cm}}$$

Use the \_\_\_\_\_ of powers property.

$$= \underline{\hspace{2cm}}$$

Simplify.

**Simplify each expression. Write your answer in exponential notation.**

26.  $y^{14} \div y^{11}$

27.  $(-a)^{10} \div (-a)^4$