MATHEMATICS · GRADES 7-9

Product rule of exponents

Difficulty level: Intermediate

Mathematics: Grades 7-9

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Overview of the concept

This is how you combine repeated multiplications into one short power, like working out how many bytes a file holds when sizes multiply by the same base. A computer file that doubles in size again and again grows by powers of two, and writing that as one short power keeps it readable. A scientist counting cells that double every hour uses the same shortcut, and so does anyone working with repeated growth. Combining powers this way keeps big multiplications short and easy to read.



Rule

To multiply powers with the same base, $x^a \times x^b = x^{a+b}$. Add the exponents.

The base stays the same. For example, $x^4 \times x^3$ is x^7.

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Worked examples

EXAMPLE 1

Q Simplify $x^4 \times x^3$

SOLUTION

Picture it

Simplify $x^4 \times x^3$

Work it one step at a time, top to bottom.

Check the bases: both are x, so the product rule applies.

Add the exponents: 4 + 3 = 7

So $x^4 \times x^3 = x^7$

EXAMPLE 2

Q Simplify $2^5 \times 2^2$

SOLUTION

Picture it

Simplify $2^5 \times 2^2$

Work it one step at a time, top to bottom.

Check the bases: both are 2, so the product rule applies.

Add the exponents: 5 + 2 = 7

So $2^5 \times 2^2 = 2^7 = 128$

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Practice questions

1 Write $2^5 \times 2^3$ as a single power.

- **A** 2^5
- **B** 2^8
- **C** 2^{15}
- **D** 2^3

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2 $x^3 \times x^n = x^8$. What is n?

- **A** 5
- **B** 11
- **C** 24
- **D** 3

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3 Can $3^4 \times 2^2$ be written as a single power? Why not?

- **A** Yes, 6^6
- **B** No, the bases are different
- **C** Yes, 5^6
- **D** No, the exponents are different

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4 Which of these equals 2^8?

- **A** $2^5 + 2^3$
- **B** $2^5 \times 2^3$
- **C** $2^5 - 2^3$
- **D** $(2^5)^3$

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5 What is $5^2 \times 5^2$ as an ordinary number?

- **A** 25
- **B** 125
- **C** 625
- **D** 5

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6 Write $y^3 \times y^3 \times y^3$ as a single power.

- **A** y^3
- **B** y^6
- **C** y^9
- **D** y^{27}

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7 How many times bigger is 10^6 than 10^4?

A 2 times

B 10 times

C 100 times

D 1000 times

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8 Give $x^2 \times x^0$ as a single power.

A x^0

B x^1

C x^2

D x^3

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9 Simplify $4^5 \times 4 \times 4^2$.

- **A** 4^7
- **B** 4^8
- **C** 4^{10}
- **D** 4^{11}

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10 Write $2 \times 2 \times 2 \times 2 \times 2$ as a single power.

- **A** 2^5
- **B** 5^2
- **C** 2^2
- **D** 10^2

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ANSWER KEY

1. 2^8

2. 5

3. No, the bases are different

4. $2^5 \times 2^3$

5. 625

6. y^9

7. 100 times

8. x^2

9. 4^8

10. 2^5

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