MATHEMATICS · GRADES 10-12

Condensing logarithmic expressions

Difficulty level: Advanced

Mathematics: Grades 10-12

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Overview of the concept

This is how scientists combine several log measurements into one single log expression they can actually solve with. Sound levels or earthquake readings often arrive as a string of separate logs, and condensing them turns that string into one tidy expression. It is the reverse of expanding a log, and it is the step that makes a log problem solvable.



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Worked examples

EXAMPLE 1

Q Condense $2 \times \log(x) + \log(y)$

SOLUTION

Use the power law in reverse: $2 \times \log(x) = \log(x^2)$

Use the product law in reverse: $\log(x^2) + \log(y) = \log(x^2 \times y)$

So the condensed form is $\log(x^2 \times y)$

EXAMPLE 2

Q Condense $\log(x) - \log(y)$

SOLUTION

Use the quotient law in reverse: $\log(x) - \log(y) = \log\left(\frac{x}{y}\right)$

There is only one step here, so check that the order is right: top minus bottom.

So the condensed form is $\log\left(\frac{x}{y}\right)$

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Practice questions

1 Condense $\log(x) + \log(y)$.

- **A** $\log(x+y)$
- **B** $\log(x \div y)$
- **C** $\log(x \times y)$
- **D** $\log(x-y)$

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2 Condense $3 \times \log(x)$.

- **A** $\log(3x)$
- **B** $\log(x^3)$
- **C** $\log(x+3)$
- **D** $\log(x \div 3)$

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3 Write log(a) - log(b) as a single logarithm.

A log(a÷b)

B log(a-b)

C log(a+b)

D log(a×b)

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4 Combine 2 × log(x) + 3 × log(y) into one logarithm.

A $\log(x^2+y^3)$

B $\log(x^3 \times y^2)$

C $\log(x^2 \div y^3)$

D $\log(x^2 \times y^3)$

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5 Condense log(x) + log(y) - log(z) into a single logarithm.

- **A** log((x×y)×z)
- **B** log((x×y) ÷ z)
- **C** log((x+y) ÷ z)
- **D** log((x÷y)×z)

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6 Write 4 × log(x) - log(y) as one logarithm.

- **A** $\log(x^4 \div y)$
- **B** $\log(x^4 \times y)$
- **C** $\log(x^4 - y)$
- **D** $\log(y^4 \div x)$

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7 Write $\log(2) + \log(5)$ as a single logarithm.

A $\log(7)$

B $\log(10)$

C $\log(3)$

D $\log(25)$

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8 Write $2 \times \log(3)$ as a single logarithm.

A $\log(6)$

B $\log(5)$

C $\log(9)$

D $\log(27)$

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9 Condense $\log(x^2) - \log(x)$ into one logarithm.

A $\log(x^2)$

B $\log(x^3)$

C $\log(2x)$

D $\log(x)$

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10 Combine $\log(a) + 2 \times \log(b)$ into a single logarithm.

A $\log(a+b^2)$

B $\log(a^2 \times b)$

C $\log(a \div b^2)$

D $\log(a \times b^2)$

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ANSWER KEY

1. $\log(x \times y)$

2. $\log(x^3)$

3. $\log(a \div b)$

4. $\log(x^2 \times y^3)$

5. $\log((x \times y) \div z)$

6. $\log(x^4 \div y)$

7. $\log(10)$

8. $\log(9)$

9. $\log(x)$

10. $\log(a \times b^2)$

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