

Exponents & Logarithms

Joe James

Exponents

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$$m^3 = m \cdot m \cdot m$$

$$p^4 = p \cdot p \cdot p \cdot p$$

Laws of Exponents

1. $x^0 = 1$

2. $x^1 = x$

3. $x^{-2} = 1/x^2$

4. $x^{1/2} = \sqrt{x}$

5. $x^a x^b = x^{a+b}$

6. $x^a/x^b = x^{a-b}$

7. $(xy)^a = x^a y^a$

8. $(x^a)^b = x^{ab}$

9. $(x/y)^a = x^a/y^a$

Laws of Exponents

1. $x^0 = 1$

Zero rule

2. $x^1 = x$

3. $x^{-2} = 1/x^2$

Negative exponent rule

4. $x^{1/2} = \sqrt{x}$

5. $x^a x^b = x^{a+b}$

Product rule

6. $x^a/x^b = x^{a-b}$

Quotient rule

7. $(xy)^a = x^a y^a$

8. $(x^a)^b = x^{ab}$

Power rule

9. $(x/y)^a = x^a/y^a$

Laws of Exponents

1. $x^0 = 1$

$(\text{blob})^0 = 1$

2. $x^1 = x$

$(17x^5y^3z^{1/2})^0 = 1$

3. $x^{-2} = 1/x^2$

$(\text{my dog is lazy})^0 = 1$

4. $x^{1/2} = \sqrt{x}$

Laws of Exponents

1. $x^0 = 1$

$$(\text{blob})^1 = \text{blob}$$

2. $x^1 = x$

$$(17x^5y^3z^{1/2})^{9-8} =$$

$$17x^5y^3z^{1/2}$$

3. $x^{-2} = 1/x^2$

4. $x^{1/2} = \sqrt{x}$

Laws of Exponents

1. $x^0 = 1$

$$x^{-3} = 1/x^3$$

2. $x^1 = x$

$$1/x^{-5} = x^5$$

3. $x^{-2} = 1/x^2$

$$(5x)^{-2} = 1/(5x)^2$$

4. $x^{1/2} = \sqrt{x}$

$$5x^{-2} = 5/x^2$$

Laws of Exponents

1. $x^0 = 1$

$$x^{1/2} = \sqrt{x}$$

2. $x^1 = x$

$$z^{3/2} = \sqrt{z^3}$$

3. $x^{-2} = 1/x^2$

4. $x^{1/2} = \sqrt{x}$

Laws of Exponents

5. $x^a x^b = x^{a+b}$

$$18^2 \cdot 18^{-2} = 18^0 = 1$$

6. $x^a/x^b = x^{a-b}$

$$p^2 r \cdot p^4 r^3 = p^6 r^4$$

7. $(xy)^a = x^a y^a$

$$5s^6(3s + 7s^2) = 15s^7 + 35s^8$$

8. $(x^a)^b = x^{ab}$

9. $(x/y)^a = x^a/y^a$

Laws of Exponents

$$5. \quad x^a x^b = x^{a+b} \qquad t^2 / t^5 = t^{-3} = 1/t^3$$

$$6. \quad x^a/x^b = x^{a-b} \qquad 8u^3 / 4u^2 = 2u$$

$$7. \quad (xy)^a = x^a y^a \qquad v^2 / v^4 = v^{-2} = 1/v^2$$

$$8. \quad (x^a)^b = x^{ab}$$

$$9. \quad (x/y)^a = x^a/y^a$$

Laws of Exponents

5. $x^a x^b = x^{a+b}$

$$t^2 / t^5 = t^{-3} = 1/t^3$$

6. $x^a / x^b = x^{a-b}$

$$8u^3 / 4u^2 = 2u$$

$$\frac{8}{4} = 2$$

7. $(xy)^a = x^a y^a$

$$v^2 / v^4 = v^{-2} = 1/v^2$$

8. $(x^a)^b = x^{ab}$

9. $(x/y)^a = x^a / y^a$

Laws of Exponents

$$5. \quad x^a x^b = x^{a+b} \qquad (7w)^2 = 49w^2$$

$$6. \quad x^a/x^b = x^{a-b}$$

$$7. \quad (xy)^a = x^a y^a \qquad (-2ab)^3 = -8a^3 b^3$$

$$8. \quad (x^a)^b = x^{ab}$$

$$9. \quad (x/y)^a = x^a/y^a$$

Laws of Exponents

5. $x^a x^b = x^{a+b}$ $(7w)^2 = 49w^2$

6. $x^a/x^b = x^{a-b}$

7. $(xy)^a = x^a y^a$ $(-2ab)^3 = -8a^3b^3$

$-2^3 = -8$

8. $(x^a)^b = x^{ab}$

9. $(x/y)^a = x^a/y^a$

Laws of Exponents

5. $x^a x^b = x^{a+b}$

$$(3c^2)^{-2} = 1/9c^4$$

6. $x^a/x^b = x^{a-b}$

$$(2d^3e^4)^2 = 4d^6e^8$$

7. $(xy)^a = x^a y^a$

8. $(x^a)^b = x^{ab}$

$$(5f^4)^3 = 125f^{12}$$

9. $(x/y)^a = x^a/y^a$

Laws of Exponents

$$3^{-2} = \frac{1}{9}$$

5. $x^a x^b = x^{a+b}$ $(3c^2)^{-2} = 1/9c^4$

6. $x^a/x^b = x^{a-b}$

7. $(xy)^a = x^a y^a$ $(2d^3e^4)^2 = 4d^6e^8$

8. $(x^a)^b = x^{ab}$

9. $(x/y)^a = x^a/y^a$ $(5f^4)^3 = 125f^{12}$

Laws of Exponents

$$5. \quad x^a x^b = x^{a+b} \qquad (2/g)^3 = 8/g^3$$

$$6. \quad x^a/x^b = x^{a-b}$$

$$7. \quad (xy)^a = x^a y^a \qquad (h^3/5i^2)^2 = h^6/25i^4$$

$$8. \quad (x^a)^b = x^{ab}$$

$$9. \quad (x/y)^a = x^a/y^a$$

Exponents Practice Problems

$$h^3h^4 =$$

$$(j^2k^3)(j^2k^3) =$$

$$5m^4(3m^6) =$$

$$12n^6/4n^3 =$$

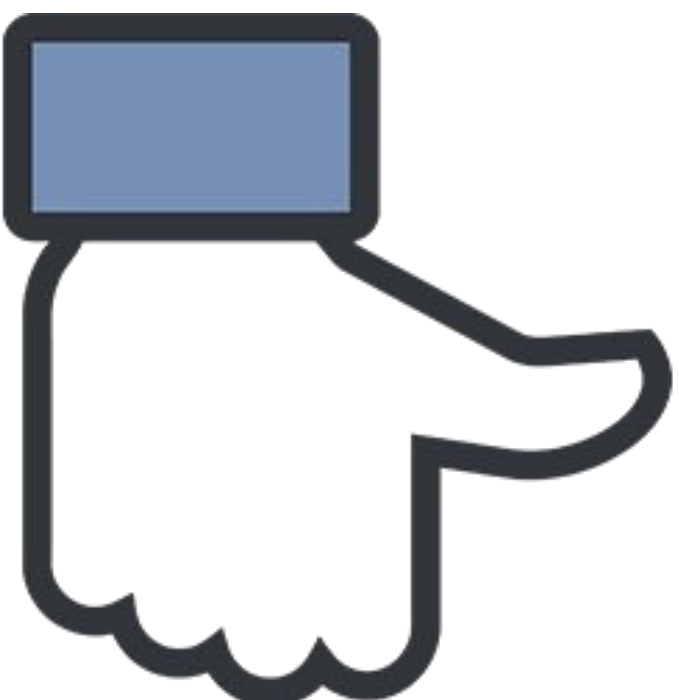
Exponents Practice Problems

$$(3p^5)^2 =$$

$$3r^2(1/3r^3) =$$

$$s^{-4}s^3s^{-1} =$$

$$4t^2 \cdot 3t^3 / 2t =$$

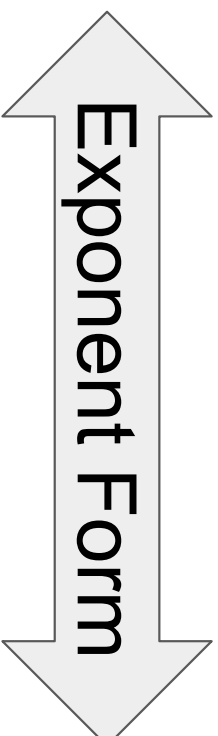


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Logarithms

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$$10^2 = 100$$



$$B^E = R$$

B is base
E is exponent
R is result

$$10^2 = 100$$

Exponent Form

$$\log_{10}(100) = 2$$

Logarithm Form

$$B^E = R$$

$$\log_B(R) = E$$

B is base

E is exponent

R is result

Logarithms Practice - Rewrite in Exponential form

1. $\log_3 81 = 4$

2. $\log_{12} 144 = 2$

3. $\log_2 128 = 7$

Logarithms Practice - Rewrite in Log form

4. $5^2 = 25$

5. $36^{1/2} = 6$

6. $m^n = k$

Natural Log

$$\ln(x) = \log_e(x)$$

Euler's Number:

$$e = 2.71828\dots$$

Logs in Industry

$\ln(x)$

Mathematicians

$\log_{10}(x)$

Engineers

$\log_2(x)$

Programmers

Laws of Logarithms

1. $\log_n 1 = 0$

2. $\log_n n = 1$

3. $\log A^x = x \log A$

4. $\log_n(n^x) = x$

5. $\log_n x + \log_n y = \log_n xy$

6. $\log_n x - \log_n y = \log_n x/y$

7. $\log_a x = \frac{\log_b x}{\log_b a}$

Laws of Logarithms

1. $\log_n 1 = 0$

$$n^0 = 1$$

2. $\log_n n = 1$

$$15^0 = 1$$

3. $\log A^x = x \log A$

$$\text{anything}^0 = 1$$

4. $\log_n(n^x) = x$

Laws of Logarithms

1. $\log_n 1 = 0$

$$n^1 = n$$

2. $\log_n n = 1$

$$26^1 = 26$$

3. $\log A^x = x \log A$

$$\text{anything}^1 = \text{itself}$$

4. $\log_n(n^x) = x$

Laws of Logarithms

1. $\log_n 1 = 0$

$$\log 10^3 = 3 \log 10 = 3$$

2. $\log_n n = 1$

$$8 \log 12 = \log 12^8$$

3. $\log A^x = x \log A$

4. $\log_n (n^x) = x$

Laws of Logarithms

1. $\log_n 1 = 0$

$$\log_5(5^2) = 2 \longrightarrow 5^2 = 5^2$$

2. $\log_n n = 1$

3. $\log A^x = x \log A$

4. $\log_n(n^x) = x$

Laws of Logarithms

5. $\log_n x + \log_n y = \log_n xy$

$$\log_2 4 + \log_2 8$$

$$= \log_2 4 \cdot 8$$

6. $\log_n x - \log_n y = \log_n x/y$

$$= \log_2 32$$

$$(2 + 3) = 5$$

7. $\log_a x = \frac{\log_b x}{\log_b a}$

Laws of Logarithms

5. $\log_n x + \log_n y = \log_n xy$

6. $\log_n x - \log_n y = \log_n x/y$

$$\begin{aligned} & \log_3 27 - \log_3 9 \\ &= \log_3 (27 / 9) \\ &= \log_3 3 \end{aligned}$$

7. $\log_a x = \frac{\log_b x}{\log_b a}$

$$(3 - 2) = 1$$

Laws of Logarithms

Calculators have two LOG buttons:

ln

log

5. $\log_n x + \log_n y = \log_n xy$

$$\log_8 30 = \log 30 / \log 8$$

6. $\log_n x - \log_n y = \log_n x/y$

$$\log_5 14 = \log 14 / \log 5$$

7. $\log_a x = \frac{\log_b x}{\log_b a}$

Logarithms Practice Problems

$$\log_8 1 =$$

$$\log_5(5^x) =$$

$$\log_4 4 =$$

$$\log 5 + \log 7 = \log ?$$

$$\log A^3 = ? \log A$$

Laws of Logarithms

1. $\log_n 1 = 0$

2. $\log_n n = 1$

3. $\log A^x = x \log A$

4. $\log_n(n^x) = x$

5. $\log_n x + \log_n y = \log_n xy$

6. $\log_n x - \log_n y = \log_n x/y$

7. $\log_a x = \frac{\log_b x}{\log_b a}$

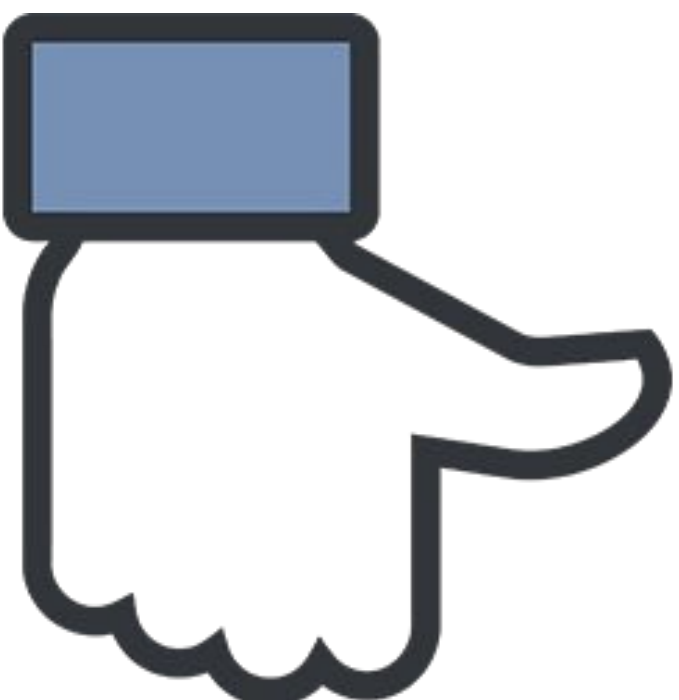
Logarithms Practice Problems

$$\log_2 27 = 3$$

$$\log_2 625 = 4$$

$$\log_6 216 = ?$$

$$\log_7 ? = 2$$



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