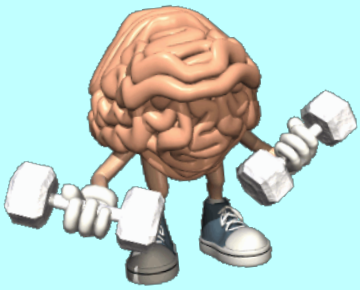

Warm Up

Express each as a radical then evaluate:

a) $(216)^{\frac{2}{3}} = \left(\sqrt[3]{216}\right)^2 = (6)^2 = 36$ (power, index)

b) $(1024)^{\frac{3}{5}} = \left(\sqrt[5]{1024}\right)^3 = (4)^3 = 64$

Express each as a power:

a) $\sqrt[4]{625} = 625^{\frac{1}{4}} = 4$

b) $\left(\sqrt[5]{32}\right)^7 = 32^{\frac{7}{5}}$

Express each in simplest radical form: (Entire → Mixed)

a) $\sqrt{405} = \sqrt{81 \times 5} = \sqrt{81} \times \sqrt{5} = 9\sqrt{5}$

b) $\sqrt[3]{500} = \sqrt[3]{125 \times 4} = \sqrt[3]{125} \times \sqrt[3]{4} = 5\sqrt[3]{4}$

Write the radical for the power and evaluate: (Use calculator but show work)

a) $64^{\frac{2}{3}} = \left(\sqrt[3]{64}\right)^2 = (4)^2 = 16$

b) $7776^{\frac{3}{5}} = \left(\sqrt[5]{7776}\right)^3 = (6)^3 = 216$

Any Homework Questions?

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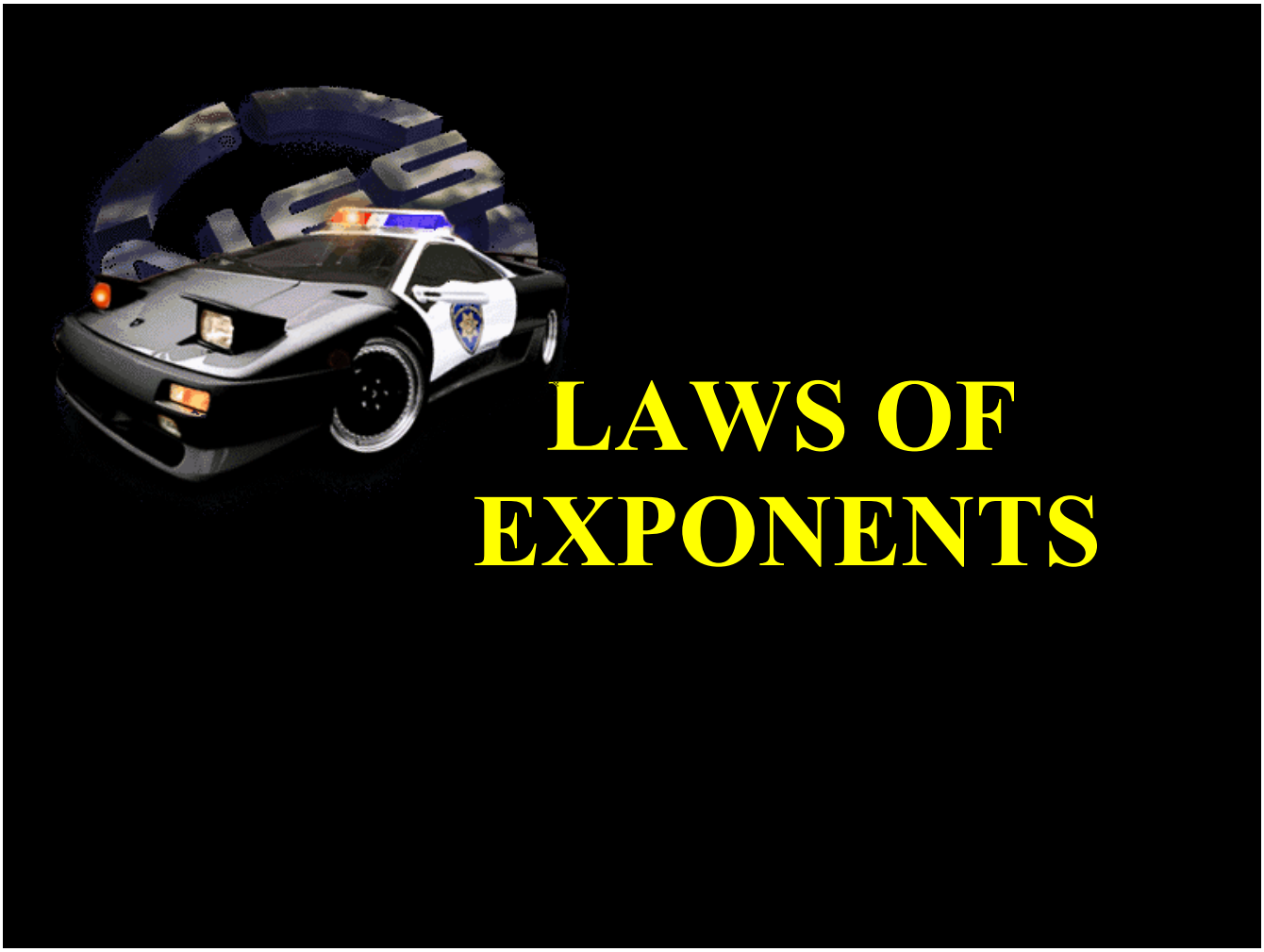
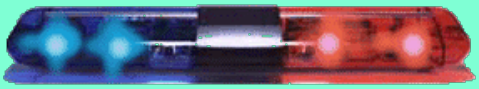
3(adf),4(acd), 5(abc), 6ac), 8a,b,c, 9, 12 (a,b,c), 15


LAWS OF
EXPONENTS

Laws Of Exponents



Law #1: Product Rule

$$b^m \times b^n = b^{m+n}$$

- when multiplying powers with the **same** base you add the exponents

Exercise:

Simplify the following using the laws of exponents

a) $3^2 \times 3^4$

3^{2+4}

3^6

b) $4^3 \times 3^4$

Base are diff so leave

c) $(q^7)(q)$

q^{7+1}

q^8

d) $p \times p^3 \times p^2$

p^{1+3+2}

p^6

e) $(2x^3)(4x^2)$

$2 \cdot 4 \cdot x^3 \cdot x^2$

$8\ x^{3+2}$

$8x^5$

f) $(3z^3)(6z^{12})$

$3 \cdot 6 \cdot z^3 \cdot z^{12}$

$3+12$

$18\ z$

$18z^{15}$

Law #2: Quotient Rule

$$b^m \div b^n = b^{m-n}$$

- when dividing powers with the **same** base you subtract the exponents

Exercise:

Simplify the following using exponent laws

a) $5^{23} \div 5^{12}$

5^{23-12}

5^{11}

b) $\frac{x^{34}}{x^{19}}$

$= x^{34-19}$

$= x^{15}$

c) $c^3 \div e^2$

1 diff base so leave

d) $\frac{12x^3}{4x}$

$= \frac{12}{4} x^{3-1}$

$3x^2$

e) $\frac{25c^{30}}{5c^{23}}$

$= \frac{25}{5} c^{30-23}$

$5c^7$

Law #3: Power Rule

when raising a power to another power...MULTIPLY the exponents."

$$(b^m)^n = b^{mn}$$

Law #4: Power of Product

when a product is raised to a power, each of the factors are raised to the power."

$$(ab)^m = a^m b^m$$

- when brackets are involved you must multiply the exponents

Exercise:

Simplify the following using Laws of Exponents

a) $(m^3)^4$

$m^{3\times4}$

m^{12}

b) $(x^2y^4)^3$

$x^{2\times3} \cdot y^{4\times3}$

$x^6 \; y^{12}$

c) $(2d^3)^3$

$2^3 \; d^{3\times3}$

$8d^9$

d) $(2m^4n)^2(m^3n^2)$

$2^2 \; m^{4\times2} \; n^{1\times2} \cdot (m^3n^2)$

$4m^8n^2 \cdot m^3n^2$

$4m^8m^3 \; n^2n^2$

$4m^{8+3} \; n^{2+2}$

$4m^{11} \; n^4$

Law #5: Power of Quotient Rule

when a quotient is raised to a power, both the divisor and the dividend are raised to the power."

$$\left(\frac{a}{b}\right)^n = \left(\frac{a^n}{b^n}\right)$$

Law #6: Zero Rule

$$b^0 = 1$$

- any power raised to the exponent 0 (zero) is equal to 1

NEW

Law #7a: Negative Reciprocals

$$x^{-n} = \frac{1}{x^n}$$

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

remember the reciprocal of

$\frac{1}{2}$ is $\frac{2}{1}$

so

2^{-1} is the reciprocal of 2^1

Examples:

$6^{-2} = \frac{1}{6^2} = \frac{1}{36}$

NEW

Law #7b: Negative Reciprocals

$$\frac{1}{x^{-n}} = x^n$$

Examples:

$$\frac{1}{5^{-3}} = 5^3$$

Law #7c: Negative Reciprocal Quotient NEW

$$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}^{n}\right)$$

Examples:

$$\left(\frac{3}{4}\right)^{-3} = \left(\frac{4}{3}\right)^{3} = \frac{4^3}{3^3} = \frac{64}{27}$$

Example 1 Evaluating Powers with Negative Integer Exponents

Evaluate each power.

a) 3^{-2} b) $\left(-\frac{3}{4}\right)^{-3}$ c) 0.3^{-4}

flip fraction

0.3

use calculator

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

$= \frac{1}{9}$

$\left(\frac{-4}{3}\right)^3$

$\frac{(-4)^3}{3^3}$

$-\frac{64}{27}$

0.3 ^ (-4)

123.456

b) $\left(-\frac{3}{4}\right)^{-3}$

Evaluate each power without using a calculator.

a) $8^{-\frac{2}{3}}$ b) $\left(\frac{9}{16}\right)^{-\frac{3}{2}}$

neg exponent so flip fraction

SOLUTION

a) $8^{-\frac{2}{3}} = \left(\frac{1}{8}\right)^{\frac{2}{3}}$ Write with a positive exponent

$= \frac{(1)^{\frac{2}{3}}}{8^{\frac{2}{3}}}$

$= \frac{\left(\sqrt[3]{1}\right)^2}{\left(\sqrt[3]{8}\right)^2}$

$= \frac{(1)^2}{(2)^2}$

$= \frac{1}{4}$

b) $\left(\frac{16}{9}\right)^{\frac{3}{2}}$

$= \frac{(16)^{\frac{3}{2}}}{\left(9^{\frac{3}{2}}\right)}$

$= \frac{\left(\sqrt{16}\right)^3}{\left(\sqrt{9}\right)^3}$

$= \frac{(4)^3}{(3)^3}$

$= \frac{64}{27}$

Homework

Page 233-234

#3a,b,c,d

#4a,c

#6a,b,c

#7a,b,c,

#9a,c,e,g

#10a,c

#12

#13a,b,d,e

3a) $\frac{1}{5^4} = 5^{-4}$ Rule 7a

b)

Test Unit 4 Probably Friday or Monday

4a) 4^2 $4^{-2} = \frac{1}{4^2} = \frac{1}{16}$

16

6a) $2^{-3} = \frac{1}{2^3}$

Write the reciprocal for each:

a) 7^{-3} b) 242 c) $\frac{1}{6}$ d) 8^{2}

Simplify the following (Leave your answer with positive exponents):

a) $(3xy^{-2})^{4}$ b) $\frac{(12r^{6}t^{3})}{(3r^{10}t^{2})}$

What is the value of $\left(\frac{a^6b^9}{a^5b^8}\right)^{-2}$ when $a = -3$ and $b = 2$?

b) $\left[\left(-\frac{3}{2}\right)^{-4}\right]^{2} \cdot \left[\left(-\frac{3}{2}\right)^{2}\right]^{3}$