

B: Exponent Laws

I: Multiplying : Dividing Powers with the Same Base.

Multiplying Powers

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

$$7^2 \times 7^4 = 7^{2+4}$$
$$= 7^6$$

$$8^5 \times 8^3 = 8^{5+3}$$
$$= 8^8$$

Examples

1. Write as a single power. Then evaluate.

a) ~~5~~ $5^4 \times 5^5$

$$= 5^{4+5}$$

$$= 5^9$$

$$= 1\,953\,125$$

b) ~~6~~ $6^3 \times 6^4$

$$= 6^{3+4}$$

$$= 6^7$$

$$= 279\,936$$

c) $(-4)^6 \times (-4)^3$

$$= (-4)^{6+3}$$

$$= (-4)^9$$

$$= -262\,144$$

d) $(-7)^4 \times (-7)^4$

$$= (-7)^{4+4}$$

$$= (-7)^8$$

$$= 5\,764\,801$$

2. Write each expression as a product of two powers : a Single Power.

a) $(5 \times 5 \times 5 \times 5) \times (5 \times 5 \times 5 \times 5 \times 5)$

$$= 5^4 \times 5^5$$

$$= 5^9$$

$$= 5^{4+5}$$

b) $(3 \times 3 \times 3 \times 3 \times 3 \times 3) \times (3 \times 3 \times 3)$

$$= 3^6 \times 3^3$$

$$= 3^{6+3}$$

$$= 3^9$$

$$c) (-10 \times -10 \times -10) \cdot (-10 \times -10 \times -10 \times -10)$$

$$= (-10)^3 \times (-10)^4$$

$$= (-10)^{3+4}$$

$$= (-10)^7$$

$$e) - (3 \times 3 \times 3) \cdot (3 \times 3)$$

$$= -3^3 \times 3^2$$

$$= -3^{3+2}$$

$$= -3^5$$

$$d) (-2 \times -2) \cdot (-2 \times -2)$$

$$= (-2)^2 \times (-2)^2$$

$$= (-2)^{2+2}$$

$$= (-2)^4$$

=

$$f) - (4 \times 4 \times 4 \times 4) \times (4 \times 4 \times 4 \times 4)$$

$$= -4^4 \times 4^4$$

$$= -4^{4+4}$$

$$= -4^8$$

$$g) (2 \times 2 \times 2 \times 2) \times (4 \times 4)$$

$$= 2^4 \times 4^2$$

Cannot write as single power!

Dividing Powers

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

$$7^9 \div 7^5 = 7^{9-5} = 7^4$$

$$\frac{a^m}{a^n} = a^{m-n}$$

$$\frac{8^3}{8^2} = 8^{3-2} = 8^1$$

Examples:

1. Write as a single power, then evaluate.

$$a) 6^6 \div 6^4$$

$$= 6^{6-4}$$

$$= 6^2$$

$$= 36$$

$$b) \frac{(-5)^7}{(-5)^3}$$

$$= (-5)^{7-3}$$

$$= (-5)^4$$

$$= 625$$

$$c) (-9)^9 \div (-9)^7$$

$$= (-9)^{9-7}$$

$$= (-9)^2$$

$$= 81$$

$$d) \frac{8^5}{8^2}$$

$$= 8^3$$

$$= 512$$

2. Write as a quotient of two powers and then as a single power.

a) $(7 \times 7 \times 7 \times 7 \times 7) \div (7 \times 7 \times 7 \times 7)$

$$= 7^5 \div 7^4$$

$$= 7^{5-4}$$

$$= 7^1$$

b) $\frac{4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4}{4 \times 4 \times 4}$

$$= 4^9$$

$$\frac{4^9}{4^3}$$

$$= 4^{9-3}$$

$$= 4^6$$

3. Write the following as multiplication or division of two powers.

a) $(-6)^{8-2}$

$$= (-6) \times (-6) \times (-6) \times (-6) \times (-6) \times (-6) \times (-6) \times (-6) \div (-6) \times (-6)$$

b) $(-2)^{3+1}$

$$= [(-2) \times (-2) \times (-2)] \cdot [(-2)]$$

4. Write as a single power then evaluate.

a) $\frac{(7 \times 7) \times (7 \times 7) \times (7 \times 7) \times (7 \times 7)}{(7 \times 7 \times 7 \times 7)} = \frac{7^{2+2+2+2}}{7^4} = 7^{8-4}$

$$= 7^4$$

$$= \frac{7^2 \times 7^2 \times 7^2 \times 7^2}{7^4}$$

$$= \frac{7^8}{7^4}$$

$$b) \frac{3 \times 3 \times 3 \times 3 \times 3 \times 3}{(3 \times 3 \times 3) \times (3 \times 3 \times 3)}$$

$$= \frac{3^6}{3^3 \times 3^3}$$

$$= \frac{3^6}{3^6}$$

$$= 3^{6-6}$$

$$= 3^0$$
$$= 1$$

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