Exponent Laws

Product Property:

→ $a^m \times a^n = a^{m+n}$

Quotient Property:

→ $a^m \div a^n = a^{m-n}$

Power to a Power:

→ $(a^m)^n = a^{mn}$

Power of Zero:

→ $a^0 = 1$

Any base raised to the power of zero is equal to 1.

Exponent Simplified Form:

1) No negative exponents
2) No zero exponents
3) Variable only used once with one exponent
4) Simplify all numbers with exponents

Simplify

a $11^5 \times 11^3$ b $a^4 \times a^5$ c $x^4 \times x^a$

11^8 a^9 x^{4+a}

Simplify

a $\frac{7^8}{7^5}$

7^3

b $\frac{b^6}{b^m}$

b^{6-m}

Simplify $x^5 \div x^3$

x^2

Simplify $(x^5)^3$

x^{15}

Expand $(2xy^2)^3$

$8x^3y^6$

Simplify

a $(3a)^2$

$9a^2$

a $(3a^3b)^4$

$81a^{12}b^4$

Simplify

b $\left(\frac{2x}{y}\right)^3$

$\frac{8x^3}{y^3}$

b $\left(\frac{x^2}{2y}\right)^3$

$\frac{x^6}{8y^3}$

Simplify using the index laws:

a $3x^2 \times 5x^5$

$15x^7$

b $\dfrac{20a^9}{4a^6}$

$5a^3$

c $\dfrac{b^3 \times b^7}{(b^2)^4}$

b^2

Simplify $x^2 \div x^2$

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

Practice

Exercise 4A

1 Simplify

a $x^3 \times x^2$ **b** $3p^2 \times 2p^4q^2$ **c** $\frac{1}{2}(xy^2) \times \frac{2}{3}(x^2y)$ **d** $(x^3y^2)(xy^4)$

2 Simplify

a $x^5 \div x^2$ **b** $2a^7 \div 2a^3$ **c** $2a^7 \div (2a)^3$ **d** $\frac{4x^3y^5}{2xy^2}$

3 Simplify

a $(x^3)^4$ **b** $(3t^2)^3$ **c** $3(x^3y^2)^2$ **d** $(-y^2)^3$

More Exponent Laws

Fractional exponents:

$$\sqrt[n]{a} = a^{\frac{1}{n}}$$

Roots to exponents:

$$\sqrt[n]{a^m} = \left(\sqrt[n]{a}\right)^m = \left(a^m\right)^{\frac{1}{n}} = a^{\frac{m}{n}}$$

Negative Exponents:

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

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

Simplify $x^{\frac{1}{2}} \times x^{\frac{1}{2}}$

x

Simplify $\sqrt[3]{x^6}$

x^2

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

Simplify $x^3 \div x^5$

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

Simplify using the exponent laws

a $36^{\frac{1}{2}}$

6

b $\left(\frac{1}{27}\right)^{\frac{4}{3}}$

$\frac{1}{81}$

a 6^{-2}

$\frac{1}{36}$

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

$\frac{16}{9}$

a $5d^0$

5

b $6x^{-3} \div (2x^2)^3$

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

c $\sqrt[3]{27a^6}$

$3a^2$

d $\left(\frac{9v^2}{16w^4}\right)^{-\frac{1}{2}}$

$\frac{4w^2}{3v}$

Homework

Chapter 4.1

4B: All

4C: All