

Law 1 of Addition

Law 2 of Subtraction

Law 3 of zero power

Law 4 of power to a power

Law 5 of negative power

Law 6 of fractional power

GCSE MATHS INDICES

SIX LAWS OF INDICES

EXPERT GUIDANCE BY MAHIMA LAROYIA

BitPaper
Share Knowledge

LAW 1

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

(Same base x and different powers m and n multiplied
Answer will be the same base and power added)

$$2^5 \times 2^3 = 2^8 ; 3^1 \times 3^{-2} = 3^{-1}$$

LAW 2

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

(Same base x and different powers m and n divided
Answer will be the same base and power subtracted)

$$2^5 \div 2^3 = 2^2 ; 3^1 \div 3^{-2} = 3^{1-(-2)} = 3^3$$

LAW 3

$$x^0 = 1$$

Any base raised to the power zero will be 1

$$2^0 = 1, 3^0 = 1, y^0 = 1$$

LAW 4

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

When a power is raised to a power to the same base, the power gets multiplied
same base x raised to the power of m and then n, the answer will be x to the
power of mn

$$(2^2)^3 = 2^6 ; (3^2)^{-5} = 3^{-10}$$

LAW 5

$$x^{-a} = \left(\frac{1}{x}\right)^a$$

Any base raised to the negative power will
turn to positive power by flipping the base

$$(2)^{-2} = \left(\frac{1}{2}\right)^2 ; \left(\frac{3}{2}\right)^{-5} = \left(\frac{2}{3}\right)^5$$

LAW 6

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

Any base raised to fractional power,
the denominator of the power will
become root and raised to the numerator power

$$4^{\frac{3}{2}} = (\sqrt{4})^3 = (2)^3 = 8$$



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

(Same base x and different powers m and n multiplied
Answer will be the same base and power added)

$$2^5 \times 2^3 = 2^8 \quad ; \quad 3^1 \times 3^{-2} = 3^{-1}$$

$$e) 5q^2 \times 3q^5 = 15q^7$$

$$f) 2ab^2 \times 3ab^3 = 6a^{2+1}b^{3+4} = 6a^3b^7$$

Questions:

$$a) m^6 \times m^3 \times m^{-1} = m^{6+3+(-1)} = m^8$$

$$b) q^2 \times q^{-5} = q^{2+(-5)} = q^{-3}$$

$$c) 2^2 \times 2^5 = 2^7$$

$$d) a^5 \times a^5 = a^8 \times a^k \quad k=2$$

Find the value of k
 $a^{10} = a^8 \times a^k$



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

(Same base x and different powers m and n divided
Answer will be the same base and power subtracted)

$$2^5 \div 2^3 = 2^2; \quad 3^1 \div 3^{-2} = 3^{1-(-2)} = 3^3$$

a) $p^8 \div p^9 = p^{8-9} = p^{-1}$

b) $15a^5 \div 3a^3 = \frac{15a^5}{3a^3} = 5a^{5-3} = 5a^2$

c) $25x^2y^3 \div 5xy^2 = \frac{25x^2y^3}{5xy^2} = 5xy$

d) $7^5 \div 7^2 = 7^3$

e) $\frac{2x^2 \times 3x^3}{3x^2} = \frac{6x^5}{3x^2} = 2x^3$

$$\frac{25x^2y^3}{5xy^2}$$

$$5xy$$



EXPERT GUIDANCE

By Mahima Laroyia

Law 3 of zero power

$$x^0 = 1$$

Any base raised to the power zero will be 1

$$\cancel{2^0} = 1, \quad \cancel{3^0} = 1, \quad \cancel{4^0} = 1$$

$$d) \frac{2x^2 \times 3x^3}{x^0} = \frac{6x^5}{1}$$

$$a) 5^0 = 1$$

$$b) 3^0 = 1$$

$$c) \begin{array}{l} x^2 \times x^5 \times x^0 \\ x^2 \times x^5 \times 1 \\ x^7 \end{array}$$



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

When a power is raised to a power to the same base, the power gets multiplied same base x raised to the power of m and then n, the answer will be x to the power of mn

$$(2^2)^3 = 2^6 \quad ; \quad (3^2)^{-5} = 3^{-10}$$

$$a) (x^2)^3 = x^6$$

$$b) (5x^3)^2 = (5)^2 (x^3)^2 = 25x^6$$

$$d) (25y^6)^{\frac{1}{2}} = (25)^{\frac{1}{2}} (y^6)^{\frac{1}{2}} = 5y^3$$

$$e) (8y^6)^{\frac{1}{3}} = (8)^{\frac{1}{3}} (y^6)^{\frac{1}{3}} = 2y^2$$

$$c) (2x^2y^3)^3 = (2)^3 (x^2)^3 (y^3)^3 = 8x^6y^9$$



$$x^{-a} = \left(\frac{1}{x}\right)^a$$

Any base raised to the negative power will turn to positive power by flipping the base

$$(2)^{-2} = \left(\frac{1}{2}\right)^2 ; \left(\frac{3}{2}\right)^{-5} = \left(\frac{2}{3}\right)^5$$

a) $(x)^{-1} = \left(\frac{1}{x}\right)$

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

c) $(2)^{-3} = \left(\frac{1}{2}\right)^3 = \frac{1 \times 1 \times 1}{2 \times 2 \times 2}$

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

e) $\left(\frac{25}{64}\right)^{-\frac{1}{2}} = \left(\frac{64}{25}\right)^{\frac{1}{2}} = \frac{\sqrt{64}}{\sqrt{25}} = \frac{8}{5}$

$\frac{\sqrt{64}}{\sqrt{25}} = \frac{8}{5}$

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

www.expertguidance.co.uk
mahima110290@gmail.com
+44 7448352272



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

Any base raised to fractional power, the denominator of the power will become route and raised to the numerator power

$$4^{\frac{3}{2}} = \left(\sqrt{4} \right)^3 = (2)^3 = 8$$

a) $(25)^{-\frac{1}{2}} = \left(\frac{1}{25} \right)^{\frac{1}{2}} = \sqrt{\frac{1}{25}} = \frac{1}{5}$

b) $\left(\frac{4}{9} \right)^{-\frac{1}{2}} = \left(\frac{9}{4} \right)^{\frac{1}{2}} = \sqrt{\frac{9}{4}} = \frac{3}{2}$

c) $\left(\frac{25}{16} \right)^{-\frac{3}{2}} = \left(\frac{16}{25} \right)^{\frac{3}{2}} = \left(\sqrt{\frac{16}{25}} \right)^3 = \left(\frac{4}{5} \right)^3 = \frac{64}{125}$



a)
$$\frac{5x^2y^6 \times 3xy}{5x^2y^2} = \frac{15xy^3}{5xy^2} = 3xy$$

c)
$$(27x^6)^{-\frac{2}{3}} = \left(\frac{1}{27}\right)^{\frac{2}{3}} x^2 = \left(\frac{1}{\sqrt[3]{27}}\right)^2 x^2 = \left(\frac{1}{3}\right)^2 x^2 = \frac{1}{9}x^2$$

b)
$$\frac{(p^2)^3 \times (p^2)^3 \times p^0}{p^2} = \frac{p^6 \times p^6 \times 1}{p^2} = \frac{p^{12}}{p^2} = p^{10}$$

d)
$$\sqrt[4]{27 \times 3 \times 10^{16}} = \sqrt[4]{(27 \times 3) \times (10^{16})^{\frac{1}{4}} \cdot \frac{1}{9}x^2} = \sqrt[4]{3 \times 10^4} \cdot \frac{1}{3}x^{\frac{1}{2}}$$



Find the value of a in the following questions:-

a) $2 \times \sqrt{2} = 2^a$
 $2^1 \times 2^{\frac{1}{2}} = 2^a$
 $2^{\frac{3}{2}} = 2^a$
 $a = \frac{3}{2}$

b) $5 \times \sqrt{125} = 5^a$
 $5 \times (5^3)^{\frac{1}{2}}$
 $5 \times 5^{\frac{3}{2}}$

c) $3^n = 81$
 $3^n = 3^4$
 $n = 4$

d) $3^{-n} = 81$

$3^{-n} = 81$
 $-n = 4$
 $n = -4$

Q1 Given $a = 3^x$; $b = 3^y$
 Express in terms of a and b

(i) $3^{x+y} = ab$

(iii) $3^{y-1} = \frac{b}{3}$

$5^{\frac{5}{2}} = 5^2$
 $a = \frac{5}{2}$

(ii) $3^{2x} = (3^x)^2 = a^2$

$3^{y-1} = 3^y$



EXPERT GUIDANCE

By Mahima Laroyia

NEXT STEP



CHECK SPECIFICATION



EXAM QUESTIONS ON THE TOPIC

SUBSCRIBE >

Get A* in GCSE and A LEVEL Science and Maths by Mahima Laroyia

Private group



Interacting as Mahima Laroyia

About

Discussion

Units

Members



CONFUSING ?

STRUGGLING TO WRITE ACCORDING TO THE MARKSCHEME?

Free

Online Consultation with Mahima Laroyia
Oxford Post Graduate with 10 years of