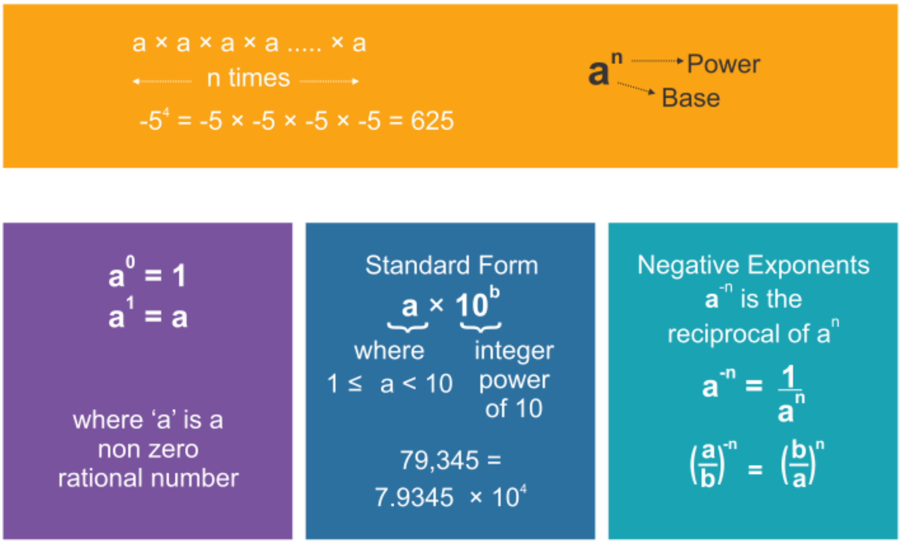
Exponents
Exercise 5A



$\underbrace{a \times a \times a \times a \ldots\ldots \times a}_{n \text{ times}}$

$-5^4 = -5 \times -5 \times -5 \times -5 = 625$

a^n → Power, Base

$a^0 = 1$

$a^1 = a$

where 'a' is a non zero rational number

Standard Form

$\underbrace{a}_{\text{where } 1 \leq a < 10} \times \underbrace{10^b}_{\text{integer power of } 10}$

79,345 = 7.9345 × 10^4

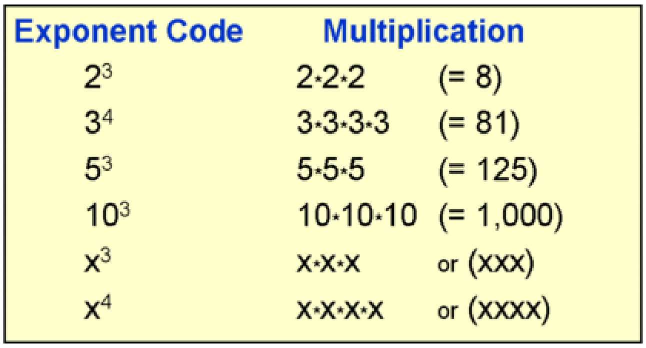
Negative Exponents

a^{-n} is the reciprocal of a^n

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

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

Rules of Exponents or Laws of Exponents	
Multiplication Rule	$a^x \times a^y = a^{x+y}$
Division Rule	$a^x \div a^y = a^{x-y}$
Power of a Power Rule	$\left(a^x\right)^y = a^{xy}$
Power of a Product Rule	$\left(ab\right)^x = a^x b^x$
Power of a Fraction Rule	$\left(\frac{a}{b}\right)^x = \frac{a^x}{b^x}$
Zero Exponent	$a^0 = 1$
Negative Exponent	$a^{-x} = \frac{1}{a^x}$
Fractional Exponent	$a^{\frac{x}{y}} = \sqrt[y]{a^x}$



Exponent Code	Multiplication	
2^3	2⋆2⋆2	(= 8)
3^4	3⋆3⋆3⋆3	(= 81)
5^3	5⋆5⋆5	(= 125)
10^3	10⋆10⋆10	(= 1,000)
x^3	x⋆x⋆x	or (xxx)
x^4	x⋆x⋆x⋆x	or (xxxx)

Q1

Answer :

(i) $\frac{5}{7} \times \frac{5}{7} \times \frac{5}{7} \times \frac{5}{7} = \left(\frac{5}{7}\right)^4$

(ii) $\left(\frac{-4}{3}\right) \times \left(\frac{-4}{3}\right) \times \left(\frac{-4}{3}\right) \times \left(\frac{-4}{3}\right) \times \left(\frac{-4}{3}\right) = \left(\frac{-4}{3}\right)^5$

(iii) $\left(\frac{-1}{6}\right) \times \left(\frac{-1}{6}\right) \times \left(\frac{-1}{6}\right) = \left(\frac{-1}{6}\right)^3$

(iv) $(-8) \times (-8) \times (-8) \times (-8) \times (-8) = (-8)^5$

Q2

Answer :

(i) $\frac{25}{36} = \frac{5^2}{6^2}$ [since 25 = 5^2 and 36 = 6^2]

$= \left(\frac{5}{6}\right)^2$

(ii) $\frac{-27}{64} = \frac{(-3)^3}{4^3}$ [since −27 = $(-3)^3$ and 64 = 4^3]

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

(iii) $\frac{-32}{243} = \frac{(-2)^5}{3^5}$ [since −32 = $(-2)^5$ and 243 = 3^5]

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

(iv) $\frac{-1}{128} = \frac{(-1)^7}{2^7}$ [since $(-1)^7$ = −1 and 128 = 2^7]

$= \left(\frac{-1}{2}\right)^7$

Q3

Answer :

(i) $\left(\frac{2}{3}\right)^5 = \frac{(2)^5}{(3)^5} = \frac{2\times2\times2\times2\times2}{3\times3\times3\times3\times3} = \frac{32}{243}$

(ii) $\left(\frac{-8}{5}\right)^3 = \frac{(-8)^3}{(5)^3} = \frac{(-8)\times(-8)\times(-8)}{5\times5\times5} = \frac{-512}{125}$

(iii) $\left(\frac{-13}{11}\right)^2 = \frac{(-13)^2}{(11)^2} = \frac{(-13)\times(-13)}{11\times11} = \frac{169}{121}$

(iv) $\left(\frac{1}{6}\right)^3 = \frac{(1)^3}{(6)^3} = \frac{1\times1\times1}{6\times6\times6} = \frac{1}{216}$

(v) $\left(\frac{-1}{2}\right)^5 = \frac{(-1)^5}{(2)^5} = \frac{(-1)\times(-1)\times(-1)\times(-1)\times(-1)}{2\times2\times2\times2\times2} = \frac{-1}{32}$

(vi) $\left(\frac{-3}{2}\right)^4 = \frac{(-3)^4}{(2)^4} = \frac{(-3)\times(-3)\times(-3)\times(-3)}{2\times2\times2\times2} = \frac{81}{16}$

(vii) $\left(\frac{-4}{7}\right)^3 = \frac{(-4)^3}{(7)^3} = \frac{(-4)\times(-4)\times(-4)}{7\times7\times7} = \frac{-64}{343}$

(viii) $(-1)^9 = -1$ [Since $(-1)^{\text{an odd natural number}} = -1$]

Q4

Answer :

(i) $(4)^{-1} = \left(\frac{4}{1}\right)^{-1} = \left(\frac{1}{4}\right)^{1} = \frac{1}{4}$ [since $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$]

(ii) $(-6)^{-1} = \left(\frac{-6}{1}\right)^{-1} = \left(\frac{1}{-6}\right)^{1} = \frac{-1}{6}$ [since $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$]

(iii) $\left(\frac{1}{3}\right)^{-1} = \left(\frac{3}{1}\right)^{1} = \frac{3}{1}$ [since $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$]

(iv) $\left(\frac{-2}{3}\right)^{-1} = \left(\frac{3}{-2}\right)^{1} = \frac{-3}{2}$ [since $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}$]

Q5

Answer :

We know that the reciprocal of $\left(\frac{a}{b}\right)^{m}$ is $\left(\frac{b}{a}\right)^{m}$.

(i) Reciprocal of $\left(\frac{3}{8}\right)^{4} = \left(\frac{8}{3}\right)^{4}$

(ii) Reciprocal of $\left(\frac{-5}{6}\right)^{11} = \left(\frac{-6}{5}\right)^{11}$

(iii) Reciprocal of 6^7 = Reciprocal of $\left(\frac{6}{1}\right)^{7} = \left(\frac{1}{6}\right)^{7}$

(iv) Reciprocal of $(-4)^3$ = Reciprocal of $\left(\frac{-4}{1}\right)^{3} = \left(\frac{-1}{4}\right)^{3}$

Q6

Answer :

(i) $8^0 = 1$
(ii) $(-3)^0 = 1$
(iii) $4^0 + 5^0 = 1 + 1 = 2$
(iv) $6^0 \times 7^0 = 1 \times 1 = 1$

Note: $a^0 = 1$

Q7

Answer :

(i) $\left(\frac{3}{2}\right)^{4} \times \left(\frac{1}{5}\right)^{2} = \frac{3^4}{2^4} \times \frac{1^2}{5^2} = \frac{81 \times 1}{16 \times 25} = \frac{81}{400}$

(ii)
$$\left(\frac{-2}{3}\right)^{5} \times \left(\frac{-3}{7}\right)^{3} = \frac{(-2)^5}{(3)^5} \times \frac{(-3)^3}{(7)^3}$$
$$= = \frac{(-2)^5}{(7)^3} \times \frac{(-1)(3)^3}{(3)^5} \qquad \left[since\ 3^{-2} = \frac{1}{9}\right]$$
$$= \frac{-32 \times -1 \times 3^{3-5}}{343}$$
$$= \frac{-32 \times -1 \times 3^{-2}}{343}$$
$$= \frac{-32 \times -1 \times 1}{343 \times 9}$$
$$= \frac{32}{3087}$$

(iii)
$$\left(\frac{-1}{2}\right)^{5} \times 2^3 \times \left(\frac{3}{4}\right)^{2} = \frac{(-1)^5}{2^5} \times 2^3 \times \frac{3^2}{4^2}$$
$$= \frac{(-1)^5}{2^5} \times 2^3 \times \frac{3^2}{(2^2)^2}$$
$$= \frac{-1 \times 2^3 \times 3^2}{2^5 \times 2^4}$$
$$= \frac{-1 \times 2^3 \times 3^2}{2^9} = -1 \times 2^{3-9} \times 3^2 = -9 \times 2^{-6} = \frac{-9}{2^6} = \frac{-9}{64}$$
$$\left[since\ \left(\frac{a}{b}\right)^{-1} = \left(\frac{b}{a}\right)^{1}\right]$$

(iv)
$$\left(\frac{2}{3}\right)^{2} \times \left(\frac{-3}{5}\right)^{3} \times \left(\frac{7}{2}\right)^{2} = \frac{2^2}{3^2} \times \frac{(-3)^3}{5^3} \times \frac{7^2}{2^2}$$
$$\frac{-1 \times 3^{3-2} \times 7^2}{5^3} = \frac{-1 \times 3^1 \times 7^2}{5^3} = \frac{-1 \times 3 \times 49}{125} = \frac{-147}{125}$$

(v) $\left\{\left(\frac{-3}{4}\right)^{3}-\left(\frac{-5}{2}\right)^{3}\right\}\times 4^{2}=\left\{\left(\frac{-3^{3}}{4^{3}}\right)-\left(\frac{-5^{3}}{2^{3}}\right)\right\}\times 4^{2}$

$$=\left\{\left(\frac{-27}{64}\right)-\left(\frac{-125}{8}\right)\right\}\times 16$$
$$=\left\{\frac{-27}{64}+\frac{125}{8}\right\}\times 16$$
$$=\left(\frac{-27+1000}{64}\right)\times 16$$
$$=\left(\frac{973}{64}\times 16\right)=\frac{973}{4}$$

Q8

Answer :

(i) $\left(\frac{4}{9}\right)^{6}\times\left(\frac{4}{9}\right)^{-4}=\left(\frac{4}{9}\right)^{6+(-4)}$ $\left[since\ \mathrm{a^{n}}\times\mathrm{a^{m}}=\mathrm{a^{n+m}}\right]$

$=\left(\frac{4}{9}\right)^{2}=\frac{(4)^{2}}{(9)^{2}}=\frac{4\times4}{9\times9}=\frac{16}{81}$

(ii) $\left(\frac{-7}{8}\right)^{-3}\times\left(\frac{-7}{8}\right)^{2}=\left(\frac{-7}{8}\right)^{(-3)+2}$ $\left[since\ \mathrm{a^{n}}\times\mathrm{a^{m}}=\mathrm{a^{n+m}}\right]$

$=\left(\frac{-7}{8}\right)^{-1}$

$=\left(\frac{8}{-7}\right)^{1}$ $\left[since\ \left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$

$=\left(\frac{8\times-1}{-7\times-1}\right)=\frac{-8}{7}$

(iii) $\left(\frac{4}{3}\right)^{-3}\times\left(\frac{4}{3}\right)^{-2}=\left(\frac{4}{3}\right)^{(-3)+(-2)}$ $\left[since\ \mathrm{a^{n}}\times\mathrm{a^{m}}=\ \mathrm{a^{n+m}}\right]$

$=\left(\frac{4}{3}\right)^{-5}$

$=\left(\frac{3}{4}\right)^{5}$ $\left[since\ \left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$

$=\frac{(3)^{5}}{(4)^{5}}=\frac{3\times3\times3\times3\times3}{4\times4\times4\times4\times4}=\frac{243}{1024}$

Q9

(i) $5^{-3}=\left(\frac{5}{1}\right)^{-3}=\left(\frac{1}{5}\right)^{3}=\frac{(1)^{3}}{(5)^{3}}=\frac{1}{125}$

(ii) $(-2)^{-5}=\left(\frac{-2}{1}\right)^{-5}=\left(\frac{1}{-2}\right)^{5}=\frac{(1)^{5}}{(-2)^{5}}=\frac{1\times-1}{-32\times-1}=\frac{-1}{32}$

(iii) $\left(\frac{1}{4}\right)^{-4}=\left(\frac{4}{1}\right)^{4}=\frac{(4)^{4}}{(1)^{4}}=\frac{256}{1}=256$

(iv) $\left(\frac{-3}{4}\right)^{-3}=\left(\frac{4}{-3}\right)^{3}=\frac{(4)^{3}}{(-3)^{3}}=\frac{64}{-27}=\frac{64\times-1}{-27\times-1}=\frac{-64}{27}$

(v) $(-3)^{-1}\times\left(\frac{1}{3}\right)^{-1}=\left(\frac{1}{-3}\right)^{1}\times\left(\frac{3}{1}\right)^{1}=\left(\frac{1\times3}{-3\times1}\right)^{1}=\left(\frac{3}{-3}\right)^{1}=\frac{1}{-1}=\frac{1\times-1}{-1\times-1}=\frac{-1}{1}=-1$

(vi) $\left(\frac{5}{7}\right)^{-1}\times\left(\frac{7}{4}\right)^{-1}=\left(\frac{7}{5}\right)^{1}\times\left(\frac{4}{7}\right)^{1}=\left(\frac{7\times4}{5\times7}\right)^{1}=\frac{4}{5}$

(vii) $\left(5^{-1}-7^{-1}\right)^{-1}=\left(\frac{1}{5}-\frac{1}{7}\right)^{-1}=\left(\frac{7-5}{35}\right)^{-1}$

$=\left(\frac{2}{35}\right)^{-1}=\left(\frac{35}{2}\right)^{1}=\frac{35}{2}$

(viii) $\left\{\left(\frac{4}{3}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right\}^{-1}=\left\{\left(\frac{3}{4}\right)^{1}-\left(\frac{4}{1}\right)^{1}\right\}^{-1}=\left(\frac{3}{4}-\frac{4}{1}\right)^{-1}$

$=\left(\frac{3-16}{4}\right)^{-1}=\left(\frac{-13}{4}\right)^{-1}$

$=\left(\frac{4}{-13}\right)^{1}=\left(\frac{4\times-1}{-13\times-1}\right)$

$=\frac{-4}{13}$

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

$=\left(\frac{2}{3}\times\frac{-2}{5}\right)$

$=\frac{-4}{15}$

(x) $\left(\frac{23}{25}\right)^{0}=1$ [since a^0 = 1 for every integer a]

Q10

Answer :

(i)

$\left[\left\{\left(-\frac{1}{4}\right)^{2}\right\}^{-2}\right]^{-1}=\left[\left(-\frac{1}{4}\right)^{2\times-2}\right]^{-1}$ $\left[s\,\mathrm{ince}\ \left\{\left(\frac{a}{b}\right)^{m}\right\}^{n}=\left(\frac{a}{b}\right)^{mn}\right]$

$=\left[\left(-\frac{1}{4}\right)^{-4}\right]^{-1}$

$=\left(-\frac{1}{4}\right)^{(-4)\times(-1)}$

$=\left(-\frac{1}{4}\right)^{4}=\frac{(-1)^{4}}{(4)^{4}}$

$=\frac{1}{256}$

(ii)

$\left\{\left(\frac{-2}{3}\right)^{2}\right\}^{3}=\left(\frac{-2}{3}\right)^{2\times3}$ $\left[s\,\mathrm{ince}\ \left\{\left(\frac{a}{b}\right)^{m}\right\}^{n}=\left(\frac{a}{b}\right)^{mn}\right]$

$=\left(\frac{-2}{3}\right)^{6}$

$=\frac{(-2)^{6}}{(3)^{6}}=\frac{64}{729}$ [since $(-2)^6$ = 64 and $(3)^6$ = 729]

(iii)

$\left(\frac{-3}{2}\right)^{3}\div\left(\frac{-3}{2}\right)^{6}=\left(\frac{-3}{2}\right)^{3-6}$ $\left[s\,\mathrm{ince}\ a^{m}\div a^{n}=a^{m-n}\right]$

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

$=\left(\frac{2}{-3}\right)^{3}$ $\left[s\,\mathrm{ince}\ \left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$

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

$=\frac{(-2)^{3}}{(3)^{3}}=\frac{-8}{27}$

(iv)

$\left(\frac{-2}{3}\right)^{7}\div\left(\frac{-2}{3}\right)^{4}=\left(\frac{-2}{3}\right)^{7-4}$ $\left[s\,\mathrm{ince}\ a^{m}\div a^{n}=a^{m-n}\right]$

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

$=\frac{(-2)^{3}}{(3)^{3}}=\frac{-8}{27}$

Q11

Answer :

Let the required number be *x*.

$(-5)^{-1} \times x = (8)^{-1}$

$\Rightarrow \frac{1}{-5} \times x = \frac{1}{8}$

$\therefore x = \frac{1}{8} \times (-5) = \frac{-5}{8}$

Hence, the required number is $\frac{-5}{8}$.

Q12

Answer :

Let the required number be *x*.

$(3)^{-3}$ x $x = 4$

$\Rightarrow \frac{1}{3^3} \times x = 4$

$\Rightarrow \frac{1}{27} \times x = 4$

$\therefore x = 4$ x $27 = 108$

Hence, the required number is 108.

Q13

Answer :

Let the required number be *x*.

$(-30)^{-1} \div x = 6^{-1}$

$\Rightarrow \frac{1}{(-30)} \times \frac{1}{x} = \frac{1}{6}$

$\Rightarrow \frac{1}{(-30x)} = \frac{1}{6}$

$\therefore x = \frac{6}{(-30)} = \frac{1}{-5}$

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

Hence, the required number is $\frac{-1}{5}$.

Q14

Answer :

$\left(\frac{3}{5}\right)^{3} \times \left(\frac{3}{5}\right)^{-6} = \left(\frac{3}{5}\right)^{2x-1}$

$\Rightarrow \left(\frac{3}{5}\right)^{3+(-6)} = \left(\frac{3}{5}\right)^{2x-1}$ $\quad \left[\text{since } a^m \times a^n = a^{m+n}\right]$

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

On equating the exponents:

$-3 = 2x - 1$

$\Rightarrow 2x = -3 + 1$

$\Rightarrow 2x = -2$

$\therefore x = \left(\frac{-2}{2}\right) = -1$

Q15

Answer :

$$\frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5} = \frac{3^5 \times (2\times5)^5 \times 5^2}{5^7 \times (2\times3)^5}$$

$$= \frac{3^5 \times 2^5 \times 5^5 \times 5^2}{5^7 \times 2^5 \times 3^5}$$

$$= \frac{3^5 \times 2^5 \times 5^7}{3^5 \times 2^5 \times 5^7}$$

$$= 3^{5-5} \times 2^{5-5} \times 5^{7-7}$$

$$= 3^0 \times 2^0 \times 5^0$$

$$= 1 \times 1 \times 1 = 1$$

Q16

Answer :

$$\frac{16\times2^{n+1} - 4\times2^n}{16\times2^{n+2} - 2\times2^{n+2}}$$

$$\Rightarrow \frac{2^4\times2^{n+1} - 2^2\times2^n}{2^4\times2^{n+2} - 2^{n+1}\times2^2}$$

$$\Rightarrow \frac{2^2\times\left(2^{n+3} - 2^n\right)}{2^2\times\left(2^{n+4} - 2^{n+1}\right)}$$

$$\Rightarrow \frac{2^n\times2^3 - 2^n}{2^n\times2^4 - 2^n\times2}$$

$$\Rightarrow \frac{2^n\left(2^3 - 1\right)}{2^n\left(2^4 - 2\right)} = \frac{8-1}{16-2} = \frac{7}{14} = \frac{1}{2}$$

Q17

Answer :

(i) $5^{2n} \times 5^3 = 5^9$

$5^{2n+3} = 5^9$ [since $a^n \times a^m = a^{m+n}$]

On equating the coefficients:

$2n + 3 = 9$

$\Rightarrow 2n = 9 - 3$

$\Rightarrow 2n = 6$

$\therefore n = \frac{6}{2} = 3$

(ii) $8 \times 2^{n+2} = 32$

$\Rightarrow (2)^3 \times 2^{n+2} = (2)^5$ [since $2^3 = 8$ and $2^5 = 32$]

$\Rightarrow (2)^{3+(n+2)} = (2)^5$

On equating the coefficients:

$3 + n + 2 = 5$

$\Rightarrow n + 5 = 5$

$\Rightarrow n = 5 - 5$

$\therefore n = 0$

(iii) $6^{2n+1} \div 36 = 6^3$

$\Rightarrow 6^{2n+1} \div 6^2 = 6^3$ [since $36 = 6^2$]

$\Rightarrow \frac{6^{2n+1}}{6^2} = 6^3$

$\Rightarrow 6^{2n+1-2} = 6^3$ [since $\frac{a^m}{a^n} = a^{m-n}$]

$\Rightarrow 6^{2n-1} = 6^3$

On equating the coefficients:

$2n - 1 = 3$

$\Rightarrow 2n = 3 + 1$

$\Rightarrow 2n = 4$

$\therefore n = \frac{4}{2} = 2$

Q18

Answer :

$2^{n-7} \times 5^{n-4} = 1250$

$\Rightarrow \frac{2^n}{2^7} \times \frac{5^n}{5^4} = 2 \times 5^4$ [since $1250 = 2 \times 5^4$]

$\Rightarrow \frac{2^n \times 5^n}{2^7 \times 5^4} = 2 \times 5^4$

$\Rightarrow 2^n \times 5^n = 2 \times 5^4 \times 2^7 \times 5^4$ [using cross multiplication]

$\Rightarrow 2^n \times 5^n = 2^{1+7} \times 5^{4+4}$ [since $a^m \times a^n = a^{m+n}$]

$\Rightarrow 2^n \times 5^n = 2^8 \times 5^8$

$\Rightarrow (2 \times 5)^n = (2 \times 5)^8$ [since $a^n \times b^n = (a \times b)^n$]

$\Rightarrow 10^n = 10^8$

$\Rightarrow n = 8$

Exponents
Exercise 5B

Q1

Answer :

(i) 538 = 5.38 × 10^2 [since the decimal point is moved 2 places to the left]

(ii) 6428000 = 6.428 × 10^6 [since the decimal point is moved 6 places to the left]

(iii) 82934000000 = 8.2934 × 10^{10} [since the decimal point is moved 10 places to the left]

(iv) 940000000000 = 9.4 × 10^{11} [since the decimal point is moved 11 places to the left]

(v) 23000000 = 2.3 × 10^7 [since the decimal point is moved 7 places to the left]

Q2

Answer :

(i) Diameter of the Earth = 1.2756 × 10^7 m
[since the decimal point is moved 7 places to the left]

(ii) Distance between the Earth and the Moon = 3.84 × 10^8 m
[since the decimal point is moved 8 places to the left]

(iii) Population of India in March 2001 = 1.027 × 10^9
[since the decimal point is moved 9 places to the left]

(iv) Number of stars in a galaxy = 1.0 × 10^{11}
[since the decimal point is moved 11 places to the left]

(v) Present age of the universe = 1.2 × 10^{10} years
[since the decimal point is moved 10 places to the left]

Q3

Answer :

(i) 684502 = 6 x 10^5 + 8 x 10^4 + 4 x 10^3 + 5 x 10^2 + 0 x 10^1 + 2 x 10^0
(ii) 4007185 = 4 x 10^6 + 0 x 10^5 + 0 x 10^4 + 7 x 10^3 + 1 x 10^2 + 8 x 10^1 + 5 x 10^0
(iii) 5807294 = 5 x 10^6 + 8 x 10^5 + 0 x 10^4 + 7 x 10^3 + 2 x 10^2 + 9 x 10^1 + 4 x 10^0
(iv) 50074 = 5 x 10^4 + 0 x 10^3 + 0 x 10^2 + 7 x 10^1 + 4 x 10^0

Note: $a^0 = 1$

Q4

Answer :

(i) 6 × 10^4 + 3 × 10^3 + 0 × 10^2 + 7 × 10^1 + 8 × 10^0
= 6 x 10000 + 3 x 1000 + 0 x 100 + 7 x 10 + 8 x 1 = 63078

(ii) 9 × 10^6 + 7 × 10^5 + 0 × 10^4 + 3 × 10^3 + 4 × 10^2 + 6 × 10^1 + 2 × 10^0
= 9 x 1000000 + 7 x 100000 + 0 x 10000 + 3 x 1000 + 4 x 100 + 6 x 10 + 2 x 1 = 9703462

(iii) 8 × 10^5 + 6 × 10^4 + 4 × 10^3 + 2 × 10^2 + 9 × 10^1 + 6 × 10^0
= 8 x 100000 + 6 x 10000 + 4 x 1000 + 2 x 100 + 9 x 10 + 6 x 1 = 864296

Exponents
Exercise 5C

Q1

Answer :

(d) 24

$$\left(6^{-1}-8^{-1}\right)^{-1}=\left(\frac{1}{6}-\frac{1}{8}\right)^{-1}$$
$$=\left(\frac{4-3}{24}\right)^{-1} \quad \text{[since L.C.M. of 6 and 8 is 24]}$$
$$=\left(\frac{1}{24}\right)^{-1}$$
$$=\left(\frac{24}{1}\right)^{1}=24 \quad \left[since \left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$$

Q2

Answer :

(c) 15

We have:

$$\left(5^{-1}\times 3^{-1}\right)^{-1}=\left(\frac{1}{5}\times\frac{1}{3}\right)^{-1}$$
$$=\left(\frac{1}{15}\right)^{-1}$$
$$=\left(\frac{15}{1}\right)^{1}=15 \quad \left[since \left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$$

Q3

Answer :

(c) $\frac{1}{16}$

We have:

$$\left(2^{-1}-4^{-1}\right)^{2}=\left(\frac{1}{2}-\frac{1}{4}\right)^{2}$$
$$=\left(\frac{2-1}{4}\right)^{2} \quad \text{[since L.C.M. of 2 and 4 is 4]}$$
$$=\left(\frac{1}{4}\right)^{2}$$
$$=\left(\frac{1}{4}\times\frac{1}{4}\right)=\frac{1}{16}$$

Q4

Answer :

(b) 29

We have:

$$\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-2}+\left(\frac{1}{4}\right)^{-2}=\left(\frac{2}{1}\right)^{2}+\left(\frac{3}{1}\right)^{2}+\left(\frac{4}{1}\right)^{2} \qquad \left[s\,\text{ince}\left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$$

= $(2^2 + 3^2 + 4^2)$

= (4 + 9 + 16)

= 29

Q5

Answer :

(c) $\frac{6}{5}$

We have:

$$\left\{6^{-1}+\left(\frac{3}{2}\right)^{-1}\right\}^{-1}=\left(\frac{1}{6}+\frac{2}{3}\right)^{-1}$$

= $\left(\frac{1+4}{6}\right)^{-1}$ [since L.C.M. of 3 and 6 is 6]

= $\left(\frac{5}{6}\right)^{-1}$

= $\left(\frac{6}{5}\right)^{1}=\left(\frac{6}{5}\right) \qquad \left[s\,\text{ince}\left(\frac{a}{b}\right)^{-1}=\left(\frac{b}{a}\right)^{1}\right]$

Q6

Answer :

(b) 64

We have:

$$\left(\frac{-1}{2}\right)^{-6}=\left(\frac{2}{-1}\right)^{6} \qquad \left[s\,\text{ince}\left(\frac{a}{b}\right)^{-n}=\left(\frac{b}{a}\right)^{n}\right]$$

$$=(-2)^6$$

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

$$=\ 64$$

Q7

Answer :

(b) $\frac{-3}{8}$

$$\left\{\left(\frac{3}{4}\right)^{-1}-\left(\frac{1}{4}\right)^{-1}\right\}^{-1}=\left(\frac{4}{3}-\frac{4}{1}\right)^{-1}$$

= $\left(\frac{4-12}{3}\right)^{-1}$ [since L.C.M. of 1 and 3 is 3]

= $\left(\frac{-8}{3}\right)^{-1}$

= $\left(\frac{3}{-8}\right)^{1} \qquad \left[s\,\text{ince}\left(\frac{\text{a}}{\text{b}}\right)^{-1}=\left(\frac{\text{b}}{\text{a}}\right)^{1}\right]$

= $\left(\frac{3\times-1}{-8\times-1}\right)=\frac{-3}{8}$

Q8

Answer :

(a) $\frac{1}{16}$

$$\left[\left\{\left(-\frac{1}{2}\right)^{2}\right\}^{-2}\right]^{-1} = \left[\left(-\frac{1}{2}\right)^{2\times-2}\right]^{-1} \qquad \left[s\text{ince}\left\{\left(\frac{a}{b}\right)^{m}\right\}^{n} = \left(\frac{a}{b}\right)^{mn}\right]$$

$$= \left[\left(-\frac{1}{2}\right)^{-4}\right]^{-1}$$

$$= \left(-\frac{1}{2}\right)^{(-4)\times(-1)}$$

$$= \left(-\frac{1}{2}\right)^{4} = \frac{(-1)^{4}}{(2)^{4}}$$

$$= \frac{1}{16}$$

Q9

Answer :

(c) 1

$(a)^0 = 1$

$\therefore \left(\frac{5}{6}\right)^{0} = 1$

Q10

Answer :

(b) $\frac{243}{32}$

$$\left(\frac{2}{3}\right)^{-5} = \left(\frac{3}{2}\right)^{5} \qquad \left[s\text{ince}\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}\right]$$

$$= \frac{3^5}{2^5} = \frac{3\times3\times3\times3\times3}{2\times2\times2\times2\times2} = \frac{243}{32}$$

Q11

Answer :

(b) $\left(\frac{1}{3}\right)^{8}$

$$\left\{\left(\frac{1}{3}\right)^{2}\right\}^{4} = \left(\frac{1}{3}\right)^{2\times4} = \left(\frac{1}{3}\right)^{8} \qquad \left[s\text{ince}\left\{\left(\frac{a}{b}\right)^{m}\right\}^{n} = \left(\frac{a}{b}\right)^{mn}\right]$$

Q12

Answer :

(b) $\frac{-2}{3}$

We have:

$$\left(\frac{-3}{2}\right)^{-1} = \left(\frac{2}{-3}\right)^{1} \qquad \left[s\text{ince}\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^{n}\right]$$

$$= \frac{-2}{3}$$

Q13

Answer :

(d) $\frac{135}{8}$

$$\left(3^2 - 2^2\right) \times \left(\frac{2}{3}\right)^{-3} = (9-4) \times \left(\frac{3}{2}\right)^{3} \qquad \left[s\text{ince}\left(\frac{a}{b}\right)^{-1} = \left(\frac{b}{a}\right)^{1}\right]$$

$$= 5 \times \frac{3^3}{2^3} = 5 \times \frac{27}{8} = \frac{135}{8}$$

Q14

Answer :

(a) $\frac{19}{64}$

We have:

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

$$\left[s\text{ince } \left(\frac{a}{b}\right)^{-1} = \left(\frac{b}{a}\right)^{1}\right]$$

$$= \left\{\left(3^3\right) - (2)^3\right\} \div (4)^3$$

$$= (27 - 8) \div 64$$

$$= 19 \div 64$$

$$= 19 \times \frac{1}{64} = \frac{19}{64}$$

Q15

Answer :

(c) $(-5)^5$

We have:

$$\left(\frac{-1}{5}\right)^{3} \div \left(\frac{-1}{5}\right)^{8} = \left(\frac{-1}{5}\right)^{3-8} \qquad \left[s\text{ince } a^m \div a^n = a^{m-n}\right]$$

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

$$= \left(\frac{5}{-1}\right)^{5} \qquad \left[\text{Since } \left(\frac{a}{b}\right)^{-1} = \left(\frac{b}{a}\right)^{1}\right]$$

$$= \left(\frac{5\times-1}{-1\times-1}\right)^{5} = \left(\frac{-5}{1}\right)^{5} = (-5)^5$$

Q16

Answer :

(a) $\frac{4}{25}$

$$\left(\frac{-2}{5}\right)^{7} \div \left(\frac{-2}{5}\right)^{5} = \left(\frac{-2}{5}\right)^{7-5} \qquad \left[s\text{ince } a^m \div a^n = a^{m-n}\right]$$

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

$$= \frac{(-2)^2}{(5)^2} = \frac{4}{25}$$

Q17

Answer :

(c) $\frac{4}{9}$

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

Q18

Answer :

(b) $\frac{-1}{8}$

We have:

$$\left(\frac{-1}{2}\right)^{3} = \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} = \frac{-1}{8}$$

Q19

Answer :

(c) $\frac{3}{4}$

$\left(\frac{5}{3}\right)^{-5} \times \left(\frac{5}{3}\right)^{11} = \left(\frac{5}{3}\right)^{8x}$
$\Rightarrow \left(\frac{5}{3}\right)^{-5+11} = \left(\frac{5}{3}\right)^{8x}$ [since $a^m \times a^n = a^{m+n}$]
$\Rightarrow \left(\frac{5}{3}\right)^{6} = \left(\frac{5}{3}\right)^{8x}$
On equating the coefficients:
6 = 8x
$\therefore x = \frac{6}{8} = \frac{3}{4}$

Q20

Answer :

(c) $\frac{-4}{5}$
Let the required number be x.
$(-8)^{-1} \times x = (10)^{-1}$
$\Rightarrow \frac{1}{-8} \times x = \frac{1}{10}$
$\therefore x = \frac{1}{10} \times \left(-8\right) = \frac{-4}{5}$
Hence, the required number is $\frac{-4}{5}$.

Q21

Answer :

(c) 2.156×10^6
A given number is said to be in standard form if it can be expressed as $k \times 10^n$, where k is a real number such that $1 \leq k < 10$ and n is a positive integer.
For example: 2.156×10^6