NCERT Solutions for Class 7 Maths Chapter 13

Exponents and Powers Class 7

Chapter 13 Exponents and Powers Exercise 13.1, 13.2, 13.3 Solutions

Exercise 13.1 : Solutions of Questions on Page Number : **252**

Q1 :

Find the value of:

(i) 2^6 (ii) 9^3

(iii) 11^2 (iv)5^4

Answer :

(i) $2^6 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$

(ii) $9^3 = 9 \times 9 \times 9 = 729$

(iii)$11^2 = 11 \times 11 = 121$ (iv)$5^4 = 5 \times 5 \times 5 \times 5 = 625$

Q2 :

Express the following in exponential form:

(i) 6 x 6 x 6 x 6 (ii) *t* x *t*

(iii) *b* x *b* x *b* x *b* (iv) 5 x 5 x 7 x 7 x 7

(v) 2 x 2 x *a* x *a* (vi) *a* x *a* x *a* x *c* x *c* x *c* x *c* x *d*

Answer :

(i) $6 \times 6 \times 6 \times 6 = 6^4$

(ii) $t \times t = t^2$

(iii) $b \times b \times b \times b = b^4$

(iv) $5 \times 5 \times 7 \times 7 \times 7 = 5^2 \times 7^3$

(v) $2 \times 2 \times a \times a = 2^2 \times a^2$

(vi) $a \times a \times a \times c \times c \times c \times c \times d = a^3 c^4 d$

Q3 :

Express the following numbers using exponential notation:

(i) 512 (ii) 343

(iii) 729 (iv) 3125

Answer :

(i) $512 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^9$

(ii) $343 = 7 \times 7 \times 7 = 7^3$

(iii) $729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$

(iv) $3125 = 5 \times 5 \times 5 \times 5 \times 5 = 5^5$

Q4 :

Identify the greater number, wherever possible, in each of the following?
(i) 4^3 or 3^4 (ii) 5^3 or 3^5

(iii) 2^8 or 8^2 (iv) 100^2 or 2^{100}

(v) 2^{10} or 10^2

Answer :

(i) $4^3 = 4 \times 4 \times 4 = 64$

$3^4 = 3 \times 3 \times 3 \times 3 = 81$

Therefore, $3^4 > 4^3$

(ii) $5^3 = 5 \times 5 \times 5 = 125$

$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$

Therefore, $3^5 > 5^3$

(iii) $2^8 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 256$

$8^2 = 8 \times 8 = 64$

Therefore, $2^8 > 8^2$

(iv)100^2 or 2^{100}

$2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 1024$

$2^{100} = 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024 \times 1024$

$100^2 = 100 \times 100 = 10000$

Therefore, $2^{100} > 100^2$

(v) 2^{10} and 10^2

$2^{10} = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 1024$

$10^2 = 10 \times 10 = 100$

Therefore, $2^{10} > 10^2$

Q5 :
Express each of the following as product of powers of their prime factors:

(i) 648 (ii) 405

(iii) 540 (iv) 3,600

Answer :

(i) $648 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 = 2^3 . 3^4$

(ii) $405 = 3 \times 3 \times 3 \times 3 \times 5 = 3^4 . 5$

(iii) $540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5 = 2^2 . 3^3 . 5$ (iv) $3600 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5 = 2^4 . 3^2 . 5^2$

Q6 :
Simplify:

(i) 2×10^3 (ii) $7^2 \times 2^2$ (iii)

$2^3 \times 5$ (iv) 3×4^4

(v) 0×10^2 (vi) $5^2 \times 3^3$

(vii) $2^4 \times 3^2$ (viii) $3^2 \times 10^4$

Answer :

(i) $2 \times 10^3 = 2 \times 10 \times 10 \times 10 = 2 \times 1000 = 2000$

(ii) $7^2 \times 2^2 = 7 \times 7 \times 2 \times 2 = 49 \times 4 = 196$

(iii) $2^3 \times 5 = 2 \times 2 \times 2 \times 5 = 8 \times 5 = 40$

(iv) $3 \times 4^4 = 3 \times 4 \times 4 \times 4 \times 4 = 3 \times 256 = 768$

(v) $0 \times 10^2 = 0 \times 10 \times 10 = 0$

(vi) $5^2 \times 3^3 = 5 \times 5 \times 3 \times 3 \times 3 = 25 \times 27 = 675$

(vii) $2^4 \times 3^2 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 = 16 \times 9 = 144$ (viii) $3^2 \times 10^4 = 3 \times 3 \times 10 \times 10 \times 10 \times 10 = 9 \times 10000 = 90000$

Q7 :
Simplify:

(i) $(-4)^3$ (ii) $(-3) \times (-2)^3$

(iii) $(-3)^2 \times (-5)^2$ (iv)$(-2)^3 \times (-10)^3$

Answer :

(i) $(-4)^3 = (-4) \times (-4) \times (-4) = -64$

(ii) $(-3) \times (-2)^3 = (-3) \times (-2) \times (-2) \times (-2) = 24$

(iii) $(-3)^2 \times (-5)^2 = (-3) \times (-3) \times (-5) \times (-5) = 9 \times 25 = 225$

(iv) $(-2)^3 \times (-10)^3 = (-2) \times (-2) \times (-2) \times (-10) \times (-10) \times (-10)$

$= (-8) \times (-1000) = 8000$

Q8 :
Compare the following numbers:

(i) 2.7×10^{12}; 1.5×10^8

(ii) 4×10^{14}; 3×10^{17}

Answer :

(i) 2.7×10^{12}; 1.5×10^8

$2.7 \times 10^{12} > 1.5 \times 10^8$ (ii)

4×10^{14}; 3×10^{17}

$3 \times 10^{17} > 4 \times 10^{14}$

Exercise 13.2 : Solutions of Questions on Page Number : **260**

Q1 :
Using laws of exponents, simplify and write the answer in exponential form:

(i) $3^2 \times 3^4 \times 3^8$ (ii) 6^{15} ÃƒÂ· 6^{10} (iii) $a^3 \times a^2$

(iv) $7^x \times 7^2$ **(v)** $5^{2^3} \div 5^3$ **(vi)** $2^5 \times 5^5$

(vii) $a^4 \times b^4$ **(viii)** $(3^4)^3$

(ix) $\left(2^{20} \div 2^{15}\right) \times 2^3$ **(x)** 8^t ÃƒÂ· 8^2

Answer :

(i) $3_2 \times 3_4 \times 3_8 = (3)_{2+4+8}$ ($a_m \times a_n = a_{m+n}$)

$= 3^{14}$

(ii) 6^{15} ÃƒÂ· $6^{10} = (6)^{15-10}$ (a^m ÃƒÂ· $a^n = a^{m-n}$)

$= 6^5$

(iii) $a^3 \times a^2 = a^{(3+2)}$ ($a^m \times a^n = a^{m+n}$)

$= a^5$

(iv) $7^x + 7^2 = 7^{x+2}$ ($a^m \times a^n = a^{m+n}$)

(v) $(5^2)^3$ ÃƒÂ· 5^3

$= 5_{2 \times 3}$ ÃƒÂ· 5_3 $(a_m)_n = a_{mn}$

$= 5^6$ ÃƒÂ· 5^3

$= 5_{(6-3)}$ (a_m ÃƒÂ· $a_n = a_{m-n}$)

$= 5^3$

(vi) $2^5 \times 5^5$

$= (2 \times 5)^5$ [$a^m \times b^m = (a \times b)^m$]

$= 10^5$

(vii) $a^4 \times b^4$

$= (ab)^4$ [$a^m \times b^m = (a \times b)^m$]

(viii) $(3^4)^3 = 3^{4 \times 3} = 3^{12}$ $(a^m)^n = a^{mn}$

(ix) $(2^{20}$ ÃƒÂ· $2^{15}) \times 2^3$

$= (2_{20-15}) \times 2_3$ (a_m ÃƒÂ· $a_n = a_{m-n}$)

$= 2^5 \times 2^3$

$= (2_{5+3})$ ($a_m \times a_n = a_{m+n}$)

$= 2^8$

(x) 8^t ÃƒÂ· $8^2 = 8^{(t-2)}$ (a^m ÃƒÂ· $a^n = a^{m-n}$)

Q2 :

Simplify and express each of the following in exponential form:

(i) $\frac{2^3 \times 3^4 \times 4}{3 \times 32}$ (ii) $\left[5^{2^3} \times 5^4\right] \div 5^7$ (iii) $25^4 \div 5^3$

(iv) $\frac{3 \times 7^2 \times 11^8}{21 \times 11^3}$ (v) $\frac{3^7}{3^4 \times 3^3}$ (vi) $2^0 + 3^0 + 4^0$

(vii) $2^3 \times 3^3 \times 4^3$ (viii) $(3^3 + 2^3) \times 5^0$ (ix) $\frac{2^8 \times a^5}{4^3 \times a^3}$

(x) $\left(\frac{a^5}{a^3}\right) \times a^8$ (xi) $\frac{4^5 \times a^8 b^3}{4^5 \times a^5 b^2}$ (xii) $\left(2^3 \times 2\right)^2$

Answer :

(i)

$$\frac{2^3 \times 3^4 \times 4}{3 \times 32} = \frac{2^3 \times 3^4 \times 2 \times 2}{3 \times 2 \times 2 \times 2 \times 2 \times 2} = \frac{2^3 \times 3^4 \times 2^2}{3 \times 2^5}$$

$$= \frac{2^{3+2} \times 3^4}{3 \times 2^5} \qquad (a^m \times a^n = a^{m+n})$$

$$= \frac{2^5 \times 3^4}{3 \times 2^5}$$

$$= 2^{5-5} \times 3^{4-1} \qquad (a^m \div a^n = a^{m-n})$$

$$= 2^0 3^3 = 1 \times 3^3 = 3^3$$

(ii) $[(5^2)^3 \times 5^4]$ ÃfÂ· 5^7

= $[5^{2 \times 3} \times 5^4]$ ÃfÂ· 5^7 $(a^m)^n = a^{mn}$ =

$[5^6 \times 5^4]$ ÃfÂ· 5^7

= $[5^{6+4}]$ ÃfÂ· 5^7 $(a^m \times a^n = a^{m+n})$

= 5^{10} ÃfÂ· 5^7

= 5_{10-7} (a_m ÃfÂ· $a_n = a_{m-n}$)

= 5^3

(iii) 25^4 ÃfÂ· $5^3 = (5 \times 5)^4$ ÃfÂ· 5^3

= $(5^2)^4$ ÃfÂ· 5^3

= $5_{2 \times 4}$ ÃfÂ· 5_3 $(a_m)_n = a_{mn}$ =

5^8 ÃfÂ· 5^3

= 5_{8-3} (a_m ÃfÂ· $a_n = a_{m-n}$)

= 5^5

(iv)

$$\frac{3\times7^2\times11^8}{21\times11^3}=\frac{3\times7^2\times11^8}{3\times7\times11^3}$$
$$=3^{1-1}\times7^{2-1}\times11^{8-3} \qquad (a^m\div a^n=a^{m-n})$$
$$=3^0\times7^1\times11^5$$

$= 1 \times 7 \times 11^5 = 7 \times 11^5$

(v)

$$\frac{3^7}{3^4\times3^3}=\frac{3^7}{3^{4+3}} \qquad (a^m\times a^n=a^{m+n})$$
$$=\frac{3^7}{3^7}=3^{7-7} \qquad (a^m\div a^n=a^{m-n})$$
$$=3^0=1$$

(vi) $2^0 + 3^0 + 4^0 = 1 + 1 + 1 = 3$

(vii) $2^0 \times 3^0 \times 4^0 = 1 \times 1 \times 1 = 1$

(viii) $(3^0 + 2^0) \times 5^0 = (1 + 1) \times 1 = 2$

(ix)

$$\frac{2^8\times a^5}{4^3\times a^3}=\frac{2^8\times a^5}{(2\times2)^3\times a^3}=\frac{2^8\times a^5}{(2^2)^3\times a^3}$$
$$=\frac{2^8\times a^5}{(2^{2\times3})\times a^3} \qquad \left[(a^m)^n=a^{mn}\right]$$
$$=\frac{2^8\times a^5}{2^6\times a^3}$$
$$=2^{8-6}\times a^{5-3} \qquad (a^m\div a^n=a^{m-n})$$
$$=2^2\times a^2=(2\times a)^2 \qquad \left[a^m\times b^m=(a\times b)^m\right]$$
$$=(2a)^2$$

(x)

$$\left(\frac{a^5}{a^3}\right)\times a^8=a^{5-3}\times a^8 \qquad (a^m\div a^n=a^{m-n})$$
$$=a^2\times a^8$$
$$=a^{2+8}=a^{10} \qquad (a^m\times a^n=a^{m+n})$$

(xi)

$$\frac{4^5\times a^8b^3}{4^5\times a^5b^2}=4^{5-5}\times a^{8-5}\times b^{3-2} \qquad (a^m\div a^n=a^{m-n})$$
$$=4^0\times a^3\times b^1=1\times a^3\times b=a^3b$$

(xii) $(2^3 \times 2)^2 = \left(2^{3+1}\right)^2$ ($a^m \times a^n = a^{m+n}$)

$= (2_4)_2 = 2_{4 \times 2}$ $(a_m)_n = a_{mn}$

$= 2^8$

Q3 :

Say true or false and justify your answer:

(i) $10 \times 10^{11} = 100^{11}$ (ii) $2^3 > 5^2$

(iii) $2^3 \times 3^2 = 6^5$ (iv) $3^0 = (1000)^0$

Answer :

(i) $10 \times 10^{11} = 100^{11}$

L.H.S. = $10 \times 10^{11} = 10^{11+1}$ ($a^m \times a^n = a^{m+n}$)

$= 10^{12}$

R.H.S. = $100^{11} = (10 \times 10)^{11} = (10^2)^{11}$

$= 10_{2 \times 11} = 10_{22}$ $(a_m)_n = a_{mn}$

As L.H.S. ≠ R.H.S.,

Therefore, the given statement is false.

(ii) $2^3 > 5^2$

L.H.S. = $2^3 = 2 \times 2 \times 2 = 8$

R.H.S. = $5^2 = 5 \times 5 = 25$

As 25 > 8,

Therefore, the given statement is false.

(iii) $2^3 \times 3^2 = 6^5$

L.H.S. = $2^3 \times 3^2 = 2 \times 2 \times 2 \times 3 \times 3 = 72$

R.H.S. = $6^5 = 7776$

As L.H.S. ≠ R.H.S.,

Therefore, the given statement is false.

(iv) $3^0 = (1000)^0$

L.H.S. = $3^0 = 1$

R.H.S. = $(1000)^0 = 1$ = L.H.S.

Therefore, the given statement is true.

Q4 :

Express each of the following as a product of prime factors only in exponential form:

(i) 108 x 192 (ii) 270

(iii) 729 x 64 (iv) 768

Answer :
(i) 108 x 192
= (2 x 2 x 3 x 3 x 3) x (2 x 2 x 2 x 2 x 2 x 2 x 3)

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

= 2_{6+2} x 3_{3+1} (a_m x a_n = a_{m+n})

= 2^8 x 3^4

(ii) 270 = 2 x 3 x 3 x 3 x 5 = 2 x 3^3 x 5

(iii) 729 x 64 = (3 x 3 x 3 x 3 x 3 x 3) x (2 x 2 x 2 x 2 x 2 x 2)

= 3^6 x 2^6

(iv) 768 = 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 3 = 2^8 x 3

Q5 :
Simplify:

(i) $\frac{(2^5)^2 \times 7^3}{8^3 \times 7}$ **(ii)** $\frac{25 \times 5^2 \times t^8}{10^3 \times t^4}$ **(iii)** $\frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5}$

Answer :

(i)

$$\frac{(2^5)^2 \times 7^3}{8^3 \times 7} = \frac{2^{5\times2} \times 7^3}{(2\times2\times2)^3 \times 7} \qquad \left[(a^m)^n = a^{mn}\right]$$

$$= \frac{2^{10} \times 7^3}{(2^3)^3 \times 7} = \frac{2^{10} \times 7^3}{2^{3\times3} \times 7} \qquad \left[(a^m)^n = a^{mn}\right]$$

$$= \frac{2^{10} \times 7^3}{2^9 \times 7} = 2^{10-9} \times 7^{3-1} \qquad (a^m \div a^n = a^{m-n})$$

$$= 2^1 \times 7^2 = 2 \times 7 \times 7 = 98$$

(ii)

$$\frac{25 \times 5^2 \times t^8}{10^3 \times t^4} = \frac{5 \times 5 \times 5^2 \times t^8}{(5\times2)^3 \times t^4} \qquad (a\times b)^m = (a^m \times b^m)$$

$$= \frac{5^{1+1+2} \times t^8}{5^3 \times 2^3 \times t^4} \qquad (a^m \times a^n = a^{m+n})$$

$$= \frac{5^4 \times t^8}{5^3 \times 2^3 \times t^4} = \frac{5^{4-3} \times t^{8-4}}{2^3} \qquad (a^m \div a^n = a^{m-n})$$

$$= \frac{5^1 \times t^4}{2\times2\times2} = \frac{5t^4}{8}$$

(iii)

$$\frac{3^5\times10^5\times25}{5^7\times6^5}=\frac{3^5\times(2\times5)^5\times5\times5}{5^7\times2^5\times3^5}$$

$$=\frac{3^5\times2^5\times5^5\times5^2}{5^7\times2^5\times3^5} \qquad (a\times b)^m=(a^m\times b^m)$$

$$=\frac{3^5\times2^5\times5^{5+2}}{5^7\times2^5\times3^5} \qquad (a^m\times a^n=a^{m+n})$$

$$=\frac{3^5\times2^5\times5^7}{5^7\times2^5\times3^5}$$

$$=3^{5-5}\times2^{5-5}\times5^{7-7} \qquad (a^m\div a^n=a^{m-n})$$

$$=3^0\times2^0\times5^0=1\times1\times1=1$$

Exercise 13.3 : Solutions of Questions on Page Number : **263**

Q1 :

Write the following numbers in the expanded forms:

279404, 3006194, 2806196, 120719, 20068

Answer :

279404 = $2 \times 10^5 + 7 \times 10^4 + 9 \times 10^3 + 4 \times 10^2 + 0 \times 10^1 + 4 \times 10^0$

3006194 = $3 \times 10^6 + 0 \times 10^5 + 0 \times 10^4 + 6 \times 10^3 + 1 \times 10^2 + 9 \times 10^1 + 4 \times 10^0$

2806196 = $2 \times 10^6 + 8 \times 10^5 + 0 \times 10^4 + 6 \times 10^3 + 1 \times 10^2 + 9 \times 10^1 + 6 \times 10^0$

120719 = $1 \times 10^5 + 2 \times 10^4 + 0 \times 10^3 + 7 \times 10^2 + 1 \times 10^1 + 9 \times 10^0$

20068 = $2 \times 10^4 + 0 \times 10^3 + 0 \times 10^2 + 6 \times 10^1 + 8 \times 10^0$

Q2 :

Find the number from each of the following expanded forms:

(a) $8 \times 10^4 + 6 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 5 \times 10^0$

(b) $4 \times 10^5 + 5 \times 10^3 + 3 \times 10^2 + 2 \times 10^0$

(c) $3 \times 10^4 + 7 \times 10^2 + 5 \times 10^0$ (d) $9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$

Answer :

(a) $8 \times 10^4 + 6 \times 10^3 + 0 \times 10^2 + 4 \times 10^1 + 5 \times 10^0$

= 86045

(b) $4 \times 10^5 + 5 \times 10^3 + 3 \times 10^2 + 2 \times 10^0$

= 405302

(c) $3 \times 10^4 + 7 \times 10^2 + 5 \times 10^0$

= 30705

(d) $9 \times 10^5 + 2 \times 10^2 + 3 \times 10^1$
= 900230

Q3 :

Express the following numbers in standard form:

(i) 5, 00, 00, 000 (ii) 70, 00, 000

(iii) 3, 18, 65, 00, 000 (iv) 3, 90, 878

(v) 39087.8 (vi) 3908.78

Answer :

(i) $50000000 = 5 \times 10^7$

(ii) $7000000 = 7 \times 10^6$

(iii) $3186500000 = 3.1865 \times 10^9$

(iv) $390878 = 3.90878 \times 10^5$

(v) $39087.8 = 3.90878 \times 10^4$ (vi) $3908.78 = 3.90878 \times 10^3$

Q4 :

Express the number appearing in the following statements in standard form.

(a) The distance between Earth and Moon is 384, 000, 000 m.

(b) Speed of light in vacuum is 300, 000, 000 m/s.

(c) Diameter of the Earth is 1, 27, 56, 000 m.

(d) Diameter of the Sun is 1, 400, 000, 000 m.

(e) In a galaxy there are on an average 100, 000, 000, 000 stars.

(f) The universe is estimated to be about 12, 000, 000, 000 years old.

(g) The distance of the Sun from the centre of the Milky Way Galaxy is estimated to be 300, 000, 000, 000, 000, 000, 000 m.

(h) 60, 230, 000, 000, 000, 000, 000, 000 molecules are contained in a drop of water weighing 1.8 gm.

(i) The earth has 1, 353, 000, 000 cubic km of sea water.

(j) The population of India was about 1, 027, 000, 000 in March, 2001.

Answer :

(a) 3.84×10^8 m

(b) 3×10^8 m/s

(c) 1.2756×10^7 m

(d) 1.4×10^9 m

(e) 1×10^{11} stars

(f) 1.2×10^{10} years

(g) 3×10^{20} m

(h) 6.023×10^{22}

(i) 1.353×10^9 cubic km

(j) 1.027×10^9