

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) $6 \times 6 \times 6 \times 6$ (ii) $t \times t$

(iii) $b \times b \times b \times b$ (iv) $5 \times 5 \times 7 \times 7 \times 7$

(v) $2 \times 2 \times a \times a$ (vi) $a \times a \times a \times c \times c \times c \times c \times d$

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) $648 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 3 = 2^3 \cdot 3^4$

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

(iii) $540 = 2 \times 2 \times 3 \times 3 \times 3 \times 5 = 2^2 \cdot 3^3 \cdot 5$

(iv) $3600 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5 = 2^4 \cdot 3^2 \cdot 5^2$

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) $6^{15} \div 6^{10}$ (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) $a^t \times b^4$ (viii) $(3^4)^3$

(ix) $(2^{20} \div 2^{15}) \times 2^3$ (x) $8^t \div 8^2$

Answer :

(i) $3_2 \times 3_4 \times 3_8 = (3)_{2+4+8} \quad (a_m \times a_n = a_{m+n})$
 $= 3^{14}$

(ii) $6^{15} \div 6^{10} = (6)^{15-10} \quad (a^m \div a^n = a^{m-n})$
 $= 6^5$

(iii) $a^3 \times a^2 = a^{3+2} \quad (a^m \times a^n = a^{m+n})$
 $= a^5$

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

(v) $(5^2)^3 \div 5^3$
 $= 5_{2 \times 3} \div 5_3 \quad (a_m)^n = a_{mn}$
 $= 5^6 \div 5^3$
 $= 5_{(6-3)} \quad (a_m \div a_n = a_{m-n})$
 $= 5^3$

(vi) $2^5 \times 5^5$
 $= (2 \times 5)^5 \quad [a^m \times b^m = (a \times b)^m]$
 $= 10^5$

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

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

(ix) $(2^{20} \div 2^{15}) \times 2^3$
 $= (2_{20-15}) \times 2_3 \quad (a_m \div a_n = a_{m-n})$
 $= 2^5 \times 2^3$
 $= (2^{5+3}) \quad (a_m \times a_n = a_{m+n})$
 $= 2^8$

(x) $8^t \div 8^2 = 8^{(t-2)} \quad (a^m \div a^n = a^{m-n})$

Q2 :

Simplify and express each of the following in exponential form:

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

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

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

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

Answer :

(i)

$$\begin{aligned} \frac{2^3 \times 3^4 \times 4}{3 \times 32} &= \frac{2^3 \times 3^4 \times 2 \times 2}{3 \times 2 \times 2 \times 2 \times 2 \times 2} = \frac{2^3 \times 3^4 \times 2^2}{3 \times 2^5} \\ &= \frac{2^{3+2} \times 3^4}{3 \times 2^5} \quad (a^m \times a^n = a^{m+n}) \\ &= \frac{2^5 \times 3^4}{3 \times 2^5} \\ &= 2^{5-5} \times 3^{4-1} \quad (a^m \div a^n = a^{m-n}) \\ &= 2^0 3^3 = 1 \times 3^3 = 3^3 \end{aligned}$$

$$(ii) [(5^2)^3 \times 5^4] \div 5^7$$

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

$$[5^6 \times 5^4] \div 5^7$$

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

$$= 5^{10} \div 5^7$$

$$= 5^{10-7} \quad (a_m \div a_n = a_{m-n})$$

$$= 5^3$$

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

$$= (5^2)^4 \div 5^3$$

$$= 5_{2 \times 4} \div 5_3 \quad (a_m)^n = a_{mn} =$$

$$5^8 \div 5^3$$

$$= 5_{8-3} \quad (a_m \div a_n = a_{m-n})$$

$$= 5^5$$

(iv)

$$\begin{aligned}\frac{3 \times 7^2 \times 11^8}{21 \times 11^3} &= \frac{3 \times 7^2 \times 11^8}{3 \times 7 \times 11^3} \\ &= 3^{1-1} \times 7^{2-1} \times 11^{8-3} \quad (a^m \div a^n = a^{m-n}) \\ &= 3^0 \times 7^1 \times 11^5\end{aligned}$$

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

(v)

$$\begin{aligned}\frac{3^7}{3^4 \times 3^3} &= \frac{3^7}{3^{4+3}} \quad (a^m \times a^n = a^{m+n}) \\ &= \frac{3^7}{3^7} = 3^{7-7} \quad (a^m \div a^n = a^{m-n}) \\ &= 3^0 = 1\end{aligned}$$

(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)

$$\begin{aligned} \frac{2^8 \times a^5}{4^3 \times a^3} &= \frac{2^8 \times a^5}{(2 \times 2)^3 \times a^3} = \frac{2^8 \times a^5}{(2^2)^3 \times a^3} \\ &= \frac{2^8 \times a^5}{(2^{2 \times 3}) \times a^3} && [(a^m)^n = a^{mn}] \\ &= \frac{2^8 \times a^5}{2^6 \times a^3} \\ &= 2^{8-6} \times a^{5-3} && (a^m \div a^n = a^{m-n}) \\ &= 2^2 \times a^2 = (2 \times a)^2 && [a^m \times b^m = (a \times b)^m] \\ &= (2a)^2 \end{aligned}$$

(x)

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

(xi)

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

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

$$= (2^4)^2 = 2^4 \times 2^4 = 2^8$$

$$= 2^8$$

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}

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

$$= 10_{2 \times 11} = 10_{22} \quad (a^m)^n = a_{mn}$$

As L.H.S. \neq R.H.S.,

Therefore, the given statement is false.

$$\text{(ii) } 2^3 > 5^2$$

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

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

As $25 > 8$,

Therefore, the given statement is false.

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

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

$$\text{R.H.S.} = 6^5 = 7776$$

As L.H.S. \neq R.H.S.,

Therefore, the given statement is false.

$$\text{(iv) } 3^0 = (1000)^0$$

$$\text{L.H.S.} = 3^0 = 1$$

$$\text{R.H.S.} = (1000)^0 = 1 = \text{L.H.S.}$$

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) 108×192

$$= (2 \times 2 \times 3 \times 3 \times 3) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3)$$

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

$$= 2_{6+2} \times 3_{3+1} \quad (a^m \times a^n = a_{m+n})$$

$$= 2^8 \times 3^4$$

(ii) $270 = 2 \times 3 \times 3 \times 3 \times 5 = 2 \times 3^3 \times 5$

(iii) $729 \times 64 = (3 \times 3 \times 3 \times 3 \times 3 \times 3) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2)$

$$= 3^6 \times 2^6$$

(iv) $768 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^8 \times 3$

Q5 :

Simplify:

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

Answer :

(i)

$$\begin{aligned} \frac{(2^5)^2 \times 7^3}{8^3 \times 7} &= \frac{2^{5 \times 2} \times 7^3}{(2 \times 2 \times 2)^3 \times 7} && [(a^m)^n = a^{mn}] \\ &= \frac{2^{10} \times 7^3}{(2^3)^3 \times 7} = \frac{2^{10} \times 7^3}{2^{3 \times 3} \times 7} && [(a^m)^n = a^{mn}] \\ &= \frac{2^{10} \times 7^3}{2^9 \times 7} = 2^{10-9} \times 7^{3-1} && (a^m \div a^n = a^{m-n}) \\ &= 2^1 \times 7^2 = 2 \times 7 \times 7 = 98 \end{aligned}$$

(ii)

$$\begin{aligned} \frac{25 \times 5^2 \times t^8}{10^3 \times t^4} &= \frac{5 \times 5 \times 5^2 \times t^8}{(5 \times 2)^3 \times t^4} && (a \times b)^m = (a^m \times b^m) \\ &= \frac{5^{1+1+2} \times t^8}{5^3 \times 2^3 \times t^4} && (a^m \times a^n = a^{m+n}) \\ &= \frac{5^4 \times t^8}{5^3 \times 2^3 \times t^4} = \frac{5^{4-3} \times t^{8-4}}{2^3} && (a^m \div a^n = a^{m-n}) \\ &= \frac{5^1 \times t^4}{2 \times 2 \times 2} = \frac{5t^4}{8} \end{aligned}$$

(iii)

$$\begin{aligned} \frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5} &= \frac{3^5 \times (2 \times 5)^5 \times 5 \times 5}{5^7 \times 2^5 \times 3^5} \\ &= \frac{3^5 \times 2^5 \times 5^5 \times 5^2}{5^7 \times 2^5 \times 3^5} && (a \times b)^m = (a^m \times b^m) \\ &= \frac{3^5 \times 2^5 \times 5^{5+2}}{5^7 \times 2^5 \times 3^5} && (a^m \times a^n = a^{m+n}) \\ &= \frac{3^5 \times 2^5 \times 5^7}{5^7 \times 2^5 \times 3^5} \\ &= 3^{5-5} \times 2^{5-5} \times 5^{7-7} && (a^m \div a^n = a^{m-n}) \\ &= 3^0 \times 2^0 \times 5^0 = 1 \times 1 \times 1 = 1 \end{aligned}$$

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 m.
- (h) 60, 230, 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