

Mathematics

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(Chapter – 13) (Exponents and Powers)

(Class – VII)

Exercise 13.2

Question 1:

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

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

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

(viii) $(3^4)^3$

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

(x) $8^t \div 8^2$

Answer 1:

(i) $3^2 \times 3^4 \times 3^8 = 3^{(2+4+8)} = 3^{14}$

$\left[\because a^m \times a^n = a^{m+n} \right]$

(ii) $6^{15} \div 6^{10} = 6^{15-10} = 6^5$

$\left[\because a^m \div a^n = a^{m-n} \right]$

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

$\left[\because a^m \times a^n = a^{m+n} \right]$

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

$\left[\because a^m \times a^n = a^{m+n} \right]$

(v) $(5^2)^3 \div 5^3 = 5^{2 \times 3} \div 5^3 = 5^6 \div 5^3$

$\left[\because (a^m)^n = a^{m \times n} \right]$

$= 5^{6-3} = 5^3$

$\left[\because a^m \div a^n = a^{m-n} \right]$

(vi) $2^5 \times 5^5 = (2 \times 5)^5 = 10^5$

$\left[\because a^m \times b^m = (a \times b)^m \right]$

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

$\left[\because a^m \times b^m = (a \times b)^m \right]$

(viii) $(3^4)^3 = 3^{4 \times 3} = 3^{12}$

$\left[\because (a^m)^n = a^{m \times n} \right]$

(ix) $(2^{20} \div 2^{15}) \times 2^3 = (2^{20-15}) \times 2^3$

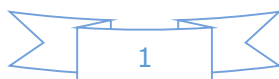
$\left[\because a^m \div a^n = a^{m-n} \right]$

$= 2^5 \times 2^3 = 2^{5+3} = 2^8$

$\left[\because a^m \times a^n = a^{m+n} \right]$

(x) $8^t \div 8^2 = 8^{t-2}$

$\left[\because a^m \div a^n = a^{m-n} \right]$



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Question 2:

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) $\frac{3 \times 7^2 \times 11^8}{21 \times 11}$

(v) $\frac{3^7}{3^4 \times 3^3}$

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

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

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

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

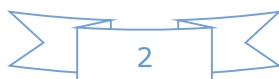
Answer 2:

(i) $\frac{2^3 \times 3^4 \times 4}{3 \times 32} = \frac{2^3 \times 3^4 \times 2^2}{3 \times 2^5} = \frac{2^{3+2} \times 3^4}{3 \times 2^5} \quad \left[\because a^m \times a^n = a^{m+n} \right]$
 $= \frac{2^5 \times 3^4}{3 \times 2^5} = 2^{5-5} \times 3^{4-3} \quad \left[\because a^m \div a^n = a^{m-n} \right]$
 $= 2^0 \times 3^3 = 1 \times 3^3 = 3^3$

(ii) $\left[(5^2)^3 \times 5^4 \right] \div 5^7 = \left[5^6 \times 5^4 \right] \div 5^7 \quad \left[\because (a^m)^n = a^{m \times n} \right]$
 $= \left[5^{6+4} \right] \div 5^7 = 5^{10} \div 5^7 \quad \left[\because a^m \times a^n = a^{m+n} \right]$
 $= 5^{10-7} = 5^3 \quad \left[\because a^m \div a^n = a^{m-n} \right]$

(iii) $25^4 \div 5^3 = (5^2)^4 \div 5^3 = 5^8 \div 5^3 \quad \left[\because (a^m)^n = a^{m \times n} \right]$
 $= 5^{8-3} = 5^5 \quad \left[\because a^m \div a^n = a^{m-n} \right]$

(iv) $\frac{3 \times 7^2 \times 11^8}{21 \times 11^3} = \frac{3 \times 7^2 \times 11^8}{3 \times 7 \times 11^3} = 3^{1-1} \times 7^{2-1} \times 11^{8-3} \quad \left[\because a^m \div a^n = a^{m-n} \right]$
 $= 3^0 \times 7^1 \times 11^5 = 7 \times 11^5$



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

$$\text{(vi)} \quad 2^0 + 3^0 + 4^0 = 1 + 1 + 1 = 3 \quad [\because a^0 = 1]$$

$$\text{(vii)} \quad 2^0 \times 3^0 \times 4^0 = 1 \times 1 \times 1 = 1 \quad [\because a^0 = 1]$$

$$\text{(viii)} \quad (3^0 + 2^0) \times 5^0 = (1 + 1) \times 1 = 2 \times 1 = 2 \quad [\because a^0 = 1]$$

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

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

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

$$\begin{aligned} \text{(xii)} \quad (2^3 \times 2)^2 &= (2^{3+1})^2 = (2^4)^2 & [\because a^m \times a^n = a^{m+n}] \\ &= 2^{4 \times 2} = 2^8 \end{aligned}$$



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Question 3:

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 3:

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

L.H.S. $10^{1+11} = 10^{12}$

and R.H.S. $(10^2)^{11} = 10^{22}$

Since, L.H.S. $\neq$ R.H.S.

Therefore, it is false.

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

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

and R.H.S. $5^2 = 25$

Since, L.H.S. is not greater than R.H.S.

Therefore, it is false.

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

L.H.S. $2^3 \times 3^2 = 8 \times 9 = 72$

and R.H.S. $6^5 = 7,776$

Since, L.H.S. $\neq$ R.H.S.

Therefore, it is false.

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

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

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

Since, L.H.S. = R.H.S.

Therefore, it is true.

Question 4:

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

(i) 108×192

(ii) 270

(iii) 729×64

(iv) 768

Answer 4:

(i) 108×192



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$$\begin{aligned}108 \times 192 &= (2^2 \times 3^3) \times (2^6 \times 3) \\&= 2^{2+6} \times 3^{3+1} \\&= 2^8 \times 3^4\end{aligned}$$

2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

2	108
2	54
3	27
3	9
3	3
	1

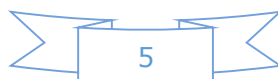


(ii) $\begin{array}{l} 270 \\ 270 \end{array} = 2 \times 3^5 \times 5$

2	270
3	135
3	45
3	15
5	5
	1

(iii) $\begin{array}{l} 729 \times 64 \\ 729 \times 64 \end{array} = 3^6 \times 2^6$

2	64
2	32
2	16
2	8



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2	4
2	2
	1

3	729
3	243
3	81
3	27
3	9
3	3
	1

2	768
2	384
2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

(iv)
$$\begin{array}{l} 768 \\ 768 \end{array} = 2^8 \times 3$$



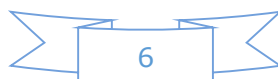
Question 5:

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)
$$\frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5}$$



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 **Answer 5:**

$$\begin{aligned}\text{(i)} \quad \frac{(2^5)^2 \times 7^3}{8^3 \times 7} &= \frac{2^{5 \times 2} \times 7^3}{(2^3)^3 \times 7} \\ &= \frac{2^{10} \times 7^3}{2^9 \times 7} \\ &= 2^{10-9} \times 7^{3-1} = 2 \times 7^2 \\ &= 2 \times 49 \\ &= 98\end{aligned}$$

$$\begin{aligned}\text{(ii)} \quad \frac{25 \times 5^2 \times t^8}{10^3 \times t^4} &= \frac{5^2 \times 5^2 \times t^8}{(5 \times 2)^3 \times t^4} \\ &= \frac{5^{2+2} \times t^{8-4}}{2^3 \times 3^3} \\ &= \frac{5^4 \times t^4}{2^3 \times 5^3} \\ &= \frac{5^{4-3} \times t^4}{2^3} \\ &= \frac{5t^4}{8}\end{aligned}$$



$$\begin{aligned}\text{(iii)} \quad \frac{3^5 \times 10^5 \times 25}{5^7 \times 6^5} &= \frac{3^5 \times (2 \times 5)^5 \times 5^2}{5^7 \times (2 \times 3)^5} \\ &= \frac{3^5 \times 2^5 \times 5^5 \times 5^2}{5^7 \times 2^5 \times 3^5} \\ &= \frac{3^5 \times 2^5 \times 5^{5+2}}{5^7 \times 2^5 \times 3^5} \\ &= \frac{3^5 \times 2^5 \times 5^7}{5^7 \times 2^5 \times 3^5} \\ &= 2^{5-5} \times 3^{5-5} \times 5^{5-5} \\ &= 2^0 \times 3^0 \times 5^0 \\ &= 1 \times 1 \times 1 \\ &= 1\end{aligned}$$

