

Exponents (Level 1)

Question Paper, Set 01

Time: 1 hour 30 minutes

Maximum marks: 50

Name: _____ Class: _____ Date: _____

1. Answer all 20 questions. The marks for each question are shown in brackets.
2. Show your working for the 2, 3 and 5 mark questions.
3. The key sheet and worked solutions are at the end of this paper.

1. Write $7 \times 7 \times 7 \times 7 \times 7$ in exponential form. [1 mark]
2. Find the value of 12^3 . [1 mark]
3. Write 729 as a power of 3. [2 marks]
4. Simplify $6^4 \times 6^9$. [1 mark]
5. Simplify $\frac{2^{12}}{2^8}$ and find its value. [2 marks]
6. Write $4^3 \times 5^3$ as a single power and find its value. [2 marks]
7. Simplify $\frac{12^3}{4^3}$ and find its value. [2 marks]
8. Find the value of 27^0 . [1 mark]
9. Find the value of 3^{-4} . [2 marks]
10. Find the value of $(-1)^{57}$. [1 mark]
11. Find the value of $(-2)^7$. [1 mark]
12. If $3^{x+4} = 243$, find x . [3 marks]
13. Write 4^{x+3} as a product of two powers and simplify. [2 marks]
14. Simplify $(2a^3)^4$. [3 marks]
15. Simplify $\frac{3^4 \times 3^9}{3^7}$. [3 marks]
16. Simplify $2^{-5} \times 2^9$ and find its value. [3 marks]
17. (i) If $2^{x+1} \times 2^4 = 128$, find x . (ii) If $3^{2m+1} = \frac{1}{27}$, find m . [5 marks]
18. Find the value of: (i) $(3^{12} \div 3^9) \times 3^{-1}$ (ii) $(\frac{1}{3})^{-2} + (\frac{1}{4})^{-2} + (\frac{1}{5})^{-2}$ [5 marks]
19. Find the value of: (i) $3^{\frac{5}{2}} \times 3^{\frac{3}{2}}$ (ii) $\frac{3^{\frac{9}{2}} \times 3^{-\frac{3}{2}}}{3^2}$ [5 marks]
20. Simplify: (i) $(3^4 \div 3^6)^3 \times 3^2$ (ii) $(3x^2)^3 \times (2x)^2$ [5 marks]

Key sheet

Q	Answer
1	7^5
2	1728
3	$729 = 3^6$
4	6^{13}
5	$2^7 = 128$
6	$(20)^3 = 8000$
7	27
8	1
9	$\frac{1}{81}$
10	-1
11	-128
12	$x = 1$
13	64×4^x
14	$16a^{12}$
15	3^6
16	16
17	(i) $x = 2$ (ii) $m = -2$
18	(i) 9 (ii) 50
19	(i) 81 (ii) 3
20	(i) $\frac{1}{81}$ (ii) $108x^8$

Solutions

1. Write $7 \times 7 \times 7 \times 7 \times 7$ in exponential form. [1]

7 is multiplied by itself 5 times.

$\therefore 7 \times 7 \times 7 \times 7 \times 7 = 7^5$, read as '7 power 5'

Ans: 7^5

2. Find the value of 12^3 . [1]

$$12^3 = 12 \times 12 \times 12$$

$$= 1728$$

Ans: 1728

3. Write 729 as a power of 3. [2]

Divide repeatedly by 3: 729, 243, 81, 27, 9, 3.

$$729 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

$$= 3^6$$

Ans: $729 = 3^6$

4. Simplify $6^4 \times 6^9$. [1]

Using $a^m \times a^n = a^{m+n}$

$$6^4 \times 6^9 = 6^{4+9}$$

$$= 6^{13}$$

Ans: 6^{13}

5. Simplify $\frac{2^{12}}{2^5}$ and find its value. [2]

Using $\frac{a^m}{a^n} = a^{m-n}$

$$\frac{2^{12}}{2^5} = 2^{12-5} = 2^7$$

$$= 128$$

Ans: $2^7 = 128$

6. Write $4^3 \times 5^3$ as a single power and find its value. [2]

Using $a^n \times b^n = (a \times b)^n$

$$4^3 \times 5^3 = (4 \times 5)^3$$

$$= (20)^3 = 20 \times 20 \times 20$$

$$= 8000$$

Ans: $(20)^3 = 8000$

7. Simplify $\frac{12^3}{4^3}$ and find its value. [2]

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

$$\frac{12^3}{4^3} = \left(\frac{12}{4}\right)^3$$

$$= 3^3$$

$$= 27$$

Ans: 27

8. Find the value of 27^0 . [1]

Using $a^0 = 1$ ($a \neq 0$)

$$27^0 = 1$$

Ans: 1

9. Find the value of 3^{-4} . [2]

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

$$3^{-4} = \frac{1}{3^4}$$

$$= \frac{1}{81}$$

Ans: $\frac{1}{81}$

10. Find the value of $(-1)^{57}$. [1]

57 is an odd number.

$$(-1)^{\text{odd number}} = -1$$

$$\therefore (-1)^{57} = -1$$

Ans: -1

11. Find the value of $(-2)^7$. [1]

7 is odd, and $(-a)^n = -a^n$ for odd n .

$$(-2)^7 = -2^7 = -128$$

Ans: -128

12. If $3^{x+4} = 243$, find x . [3]

Given, $3^{x+4} = 243$

Dividing 243 repeatedly by 3: 243, 81, 27, 9, 3, so $243 = 3^5$.

$$\Rightarrow 3^{x+4} = 3^5$$

Using $a^m = a^n \Rightarrow m = n$

$$\Rightarrow x + 4 = 5$$

$$\Rightarrow x = 5 - 4$$

$$\Rightarrow x = 1$$

Ans: $x = 1$

13. Write 4^{x+3} as a product of two powers and simplify. [2]

Using $a^{m+n} = a^m \times a^n$

$$4^{x+3} = 4^x \times 4^3$$

$$= 64 \times 4^x$$

Ans: 64×4^x

14. Simplify $(2a^3)^4$. [3]

Using $(ab)^n = a^n \times b^n$ and $(a^m)^n = a^{m \times n}$

$$(2a^3)^4 = 2^4 \times (a^3)^4$$

$$= 16 \times a^{12} = 16a^{12}$$

Ans: $16a^{12}$

15. Simplify $\frac{3^4 \times 3^9}{3^7}$. [3]

Using $a^m \times a^n = a^{m+n}$ and $\frac{a^m}{a^n} = a^{m-n}$

$$\begin{aligned}\frac{3^4 \times 3^9}{3^7} &= \frac{3^{13}}{3^7} \\ &= 3^{13-7} = 3^6\end{aligned}$$

Ans: 3^6

16. Simplify $2^{-5} \times 2^9$ and find its value. [3]

Using $a^m \times a^n = a^{m+n}$

$$\begin{aligned}2^{-5} \times 2^9 &= 2^{-5+9} = 2^4 \\ &= 16\end{aligned}$$

Ans: 16

17. (i) If $2^{x+1} \times 2^4 = 128$, find x . (ii) If $3^{2m+1} = \frac{1}{27}$, find m . [5]

(i) Given, $2^{x+1} \times 2^4 = 128$

Dividing 128 repeatedly by 2: 128, 64, 32, 16, 8, 4, 2, so $128 = 2^7$.

$$\Rightarrow 2^{x+1+4} = 2^7 \quad (a^m \times a^n = a^{m+n})$$

$$\Rightarrow 2^{x+5} = 2^7$$

Using $a^m = a^n \Rightarrow m = n$

$$\Rightarrow x + 5 = 7$$

$$\Rightarrow x = 7 - 5$$

$$\Rightarrow x = 2$$

(ii) Given, $3^{2m+1} = \frac{1}{27}$

$\frac{1}{27} = \frac{1}{3^3} = 3^{-3}$ (dividing 27 repeatedly by 3: 27, 9, 3)

$$\Rightarrow 3^{2m+1} = 3^{-3}$$

Using $a^m = a^n \Rightarrow m = n$

$$\Rightarrow 2m + 1 = -3$$

$$\Rightarrow 2m = -3 - 1$$

$$\Rightarrow 2m = -4$$

$$\Rightarrow m = \frac{-4}{2} = -2$$

Ans: (i) $x = 2$ (ii) $m = -2$

18. Find the value of: (i) $(3^{12} \div 3^9) \times 3^{-1}$ (ii) $\left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} + \left(\frac{1}{5}\right)^{-2}$ [5]

$$(i) \quad (3^{12} \div 3^9) \times 3^{-1} = \frac{3^{12}}{3^9} \times 3^{-1}$$

$$= 3^{12-9} \times 3^{-1} = 3^3 \times 3^{-1}$$

$$= 3^{3-1} = 3^2$$

$$= 9$$

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

$$\left(\frac{1}{3}\right)^{-2} + \left(\frac{1}{4}\right)^{-2} + \left(\frac{1}{5}\right)^{-2} = (3)^2 + (4)^2 + (5)^2$$

$$= 9 + 16 + 25$$

$$= 50$$

Ans: (i) 9 (ii) 50

19. Find the value of: (i) $3^{\frac{5}{2}} \times 3^{\frac{3}{2}}$ (ii) $\frac{3^{\frac{9}{2}} \times 3^{-\frac{3}{2}}}{3^2}$ [5]

(i) Using $a^m \times a^n = a^{m+n}$

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

$$= 3^{\frac{8}{2}} = 3^4$$

$$= 81$$

(ii) Using $a^m \times a^n = a^{m+n}$ and $\frac{a^m}{a^n} = a^{m-n}$

$$\frac{3^{\frac{9}{2}} \times 3^{-\frac{3}{2}}}{3^2} = \frac{3^{\frac{9}{2} + (-\frac{3}{2})}}{3^2}$$

$$= \frac{3^{\frac{6}{2}}}{3^2} = \frac{3^3}{3^2}$$

$$= 3^{3-2} = 3^1$$

$$= 3$$

Ans: (i) 81 (ii) 3

20. Simplify: (i) $(3^4 \div 3^6)^3 \times 3^2$ (ii) $(3x^2)^3 \times (2x)^2$ [5]

$$(i) (3^4 \div 3^6)^3 \times 3^2 = \left(\frac{3^4}{3^6}\right)^3 \times 3^2$$

$$= (3^{4-6})^3 \times 3^2 = (3^{-2})^3 \times 3^2$$

$$= 3^{-6} \times 3^2 \quad ((a^m)^n = a^{m \times n})$$

$$= 3^{-6+2} = 3^{-4}$$

$$= \frac{1}{3^4} = \frac{1}{81}$$

(ii) Using $(ab)^n = a^n \times b^n$ and $(a^m)^n = a^{m \times n}$

$$(3x^2)^3 \times (2x)^2 = 3^3 \cdot (x^2)^3 \times 2^2 \cdot x^2$$

$$= 27x^6 \times 4x^2$$

$$= 108 \cdot x^{6+2} = 108x^8$$

Ans: (i) $\frac{1}{81}$ (ii) $108x^8$
