

Exponents (Level 1)

Question Paper, Set 09

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 $y \times y \times y \times y$ in exponential form. [1 mark]
2. Find the value of 8^4 . [1 mark]
3. Write 15,625 as a power of 5. [2 marks]
4. Simplify $\left(\frac{3}{4}\right)^7 \times \left(\frac{3}{4}\right)^2$. [1 mark]
5. Simplify $\frac{10^9}{10^4}$ and find its value. [2 marks]
6. Write $25^2 \times 4^2$ as a single power and find its value. [2 marks]
7. Simplify $\frac{45^5}{15^5}$ and find its value. [2 marks]
8. Find the value of $(48 + 52)^0$. [1 mark]
9. Find the value of 7^{-2} . [2 marks]
10. Find the value of $(-1)^{999}$. [1 mark]
11. Find the value of $(-6)^3$. [1 mark]
12. If $3^{2x+5} = 27$, find x . [3 marks]
13. Write -6^5 and 6^4 as powers of -6 . [2 marks]
14. Simplify $(3ab^4)^2$. [3 marks]
15. Simplify $\frac{10^{12} \times 10^3}{10^9}$. [3 marks]
16. Simplify $(2^3)^{-2}$ and find its value. [3 marks]
17. (i) If $3^{x-4} \times 3^2 = 243$, find x . (ii) If $7^{3x+1} \div 7^{-1} = 49$, find x . [5 marks]
18. Find the value of: (i) $(9^0 + 5^{-1}) \times 5^2$ (ii) $\left(\frac{1}{5}\right)^{-2} + \left(\frac{1}{6}\right)^{-2} + \left(\frac{1}{7}\right)^{-2}$ [5 marks]
19. Find the value of: (i) $\frac{10^4 \times 10^{-\frac{1}{4}}}{10^3}$ (ii) $10^1 \times 10^{\frac{4}{3}} \times 10^{-\frac{1}{3}}$ [5 marks]
20. Simplify: (i) $(2m^4)^3 \times (3m)^2$ (ii) $\left(\frac{3}{2}\right)^{-2} \times \left(\frac{7}{3}\right)^{-4} \times \left(\frac{2}{7}\right)^{-3}$ [5 marks]

Key sheet

Q	Answer
1	y^4
2	4096
3	$15,625 = 5^6$
4	$\left(\frac{3}{4}\right)^9$
5	$10^5 = 1,00,000$
6	$(100)^2 = 10,000$
7	243
8	1
9	$\frac{1}{49}$
10	-1
11	-216
12	$x = -1$
13	$-6^5 = (-6)^5, 6^4 = (-6)^4$
14	$9a^2b^8$
15	10^6
16	$\frac{1}{64}$
17	(i) $x = 7$ (ii) $x = 0$
18	(i) 30 (ii) 110
19	(i) $\frac{1}{10}$ (ii) 100
20	(i) $72m^{14}$ (ii) $\frac{9}{14}$

Solutions

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

y is multiplied by itself 4 times.

$\therefore y \times y \times y \times y = y^4$, read as ' y power 4'

Ans: y^4

2. Find the value of 8^4 . [1]

$$8^4 = 8 \times 8 \times 8 \times 8$$

$$= 4096$$

Ans: 4096

3. Write 15,625 as a power of 5. [2]

Divide repeatedly by 5: 15,625, 3125, 625, 125, 25, 5.

$$15,625 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$$

$$= 5^6$$

Ans: $15,625 = 5^6$

4. Simplify $\left(\frac{3}{4}\right)^7 \times \left(\frac{3}{4}\right)^2$. [1]

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

$$\left(\frac{3}{4}\right)^7 \times \left(\frac{3}{4}\right)^2 = \left(\frac{3}{4}\right)^{7+2}$$

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

Ans: $\left(\frac{3}{4}\right)^9$

5. Simplify $\frac{10^9}{10^4}$ and find its value. [2]

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

$$\frac{10^9}{10^4} = 10^{9-4} = 10^5$$

$$= 1,00,000$$

Ans: $10^5 = 1,00,000$

6. Write $25^2 \times 4^2$ as a single power and find its value. [2]

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

$$25^2 \times 4^2 = (25 \times 4)^2$$

$$= (100)^2 = 100 \times 100$$

$$= 10,000$$

Ans: $(100)^2 = 10,000$

7. Simplify $\frac{45^5}{15^5}$ and find its value. [2]

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

$$\frac{45^5}{15^5} = \left(\frac{45}{15}\right)^5$$

$$= 3^5$$

$$= 243$$

Ans: 243

8. Find the value of $(48 + 52)^0$. [1]

$$48 + 52 = 100 \neq 0$$

$$(48 + 52)^0 = 100^0 = 1$$

Ans: 1

9. Find the value of 7^{-2} . [2]

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

$$7^{-2} = \frac{1}{7^2}$$

$$= \frac{1}{49}$$

Ans: $\frac{1}{49}$

10. Find the value of $(-1)^{999}$. [1]

999 is an odd number.

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

$$\therefore (-1)^{999} = -1$$

Ans: -1

11. Find the value of $(-6)^3$. [1]

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

$$(-6)^3 = -6^3 = -216$$

Ans: -216

12. If $3^{2x+5} = 27$, find x . [3]

$$\text{Given, } 3^{2x+5} = 27$$

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

$$\Rightarrow 3^{2x+5} = 3^3$$

$$\text{Using } a^m = a^n \Rightarrow m = n$$

$$\Rightarrow 2x + 5 = 3$$

$$\Rightarrow 2x = 3 - 5$$

$$\Rightarrow 2x = -2$$

$$\Rightarrow x = \frac{-2}{2} = -1$$

Ans: $x = -1$

13. Write -6^5 and 6^4 as powers of -6 . [2]

$$\text{Using } -a^n = (-a)^n \text{ for odd } n: -6^5 = (-6)^5$$

$$\text{Using } a^n = (-a)^n \text{ for even } n: 6^4 = (-6)^4$$

Ans: $-6^5 = (-6)^5, 6^4 = (-6)^4$

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

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

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

$$= 9a^2b^8$$

Ans: $9a^2b^8$

15. Simplify $\frac{10^{12} \times 10^3}{10^9}$. [3]

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

$$\begin{aligned}\frac{10^{12} \times 10^3}{10^9} &= \frac{10^{15}}{10^9} \\ &= 10^{15-9} = 10^6\end{aligned}$$

Ans: 10^6

16. Simplify $(2^3)^{-2}$ and find its value. [3]

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

$$\begin{aligned}(2^3)^{-2} &= 2^{3 \times (-2)} = 2^{-6} \\ &= \frac{1}{2^6} = \frac{1}{64}\end{aligned}$$

Ans: $\frac{1}{64}$

17. (i) If $3^{x-4} \times 3^2 = 243$, find x . (ii) If $7^{3x+1} \div 7^{-1} = 49$, find x . [5]

(i) Given, $3^{x-4} \times 3^2 = 243$

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

$$\Rightarrow 3^{x-4+2} = 3^5 \quad (a^m \times a^n = a^{m+n})$$

$$\Rightarrow 3^{x-2} = 3^5$$

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

$$\Rightarrow x - 2 = 5$$

$$\Rightarrow x = 5 + 2$$

$$\Rightarrow x = 7$$

(ii) Given, $7^{3x+1} \div 7^{-1} = 49$

Dividing 49 repeatedly by 7: 49, 7, so $49 = 7^2$.

$$\Rightarrow 7^{3x+1-(-1)} = 7^2 \quad \left(\frac{a^m}{a^n} = a^{m-n}\right)$$

$$\Rightarrow 7^{3x+2} = 7^2$$

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

$$\Rightarrow 3x + 2 = 2$$

$$\Rightarrow 3x = 2 - 2$$

$$\Rightarrow 3x = 0$$

$$\Rightarrow x = \frac{0}{3} = 0$$

Ans: (i) $x = 7$ (ii) $x = 0$

18. Find the value of: (i) $(9^0 + 5^{-1}) \times 5^2$ (ii) $\left(\frac{1}{5}\right)^{-2} + \left(\frac{1}{6}\right)^{-2} + \left(\frac{1}{7}\right)^{-2}$ [5]

$$(i) (9^0 + 5^{-1}) \times 5^2 = \left(1 + \frac{1}{5}\right) \times 25$$

$$= \frac{6}{5} \times 25$$

$$= 30$$

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

$$\left(\frac{1}{5}\right)^{-2} + \left(\frac{1}{6}\right)^{-2} + \left(\frac{1}{7}\right)^{-2} = (5)^2 + (6)^2 + (7)^2$$

$$= 25 + 36 + 49$$

$$= 110$$

Ans: (i) 30 (ii) 110

19. Find the value of: (i) $\frac{10^{\frac{9}{4}} \times 10^{-\frac{1}{4}}}{10^3}$ (ii) $10^1 \times 10^{\frac{4}{3}} \times 10^{-\frac{1}{3}}$ [5]

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

$$\frac{10^{\frac{9}{4}} \times 10^{-\frac{1}{4}}}{10^3} = \frac{10^{\frac{9}{4} + (-\frac{1}{4})}}{10^3}$$

$$= \frac{10^{\frac{8}{4}}}{10^3} = \frac{10^2}{10^3}$$

$$= 10^{2-3} = 10^{-1}$$

$$= \frac{1}{10^1} = \frac{1}{10}$$

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

$$10^1 \times 10^{\frac{4}{3}} \times 10^{-\frac{1}{3}} = 10^{1 + \frac{4}{3} + (-\frac{1}{3})}$$

$$= 10^{\frac{6}{3}} = 10^2$$

$$= 100$$

Ans: (i) $\frac{1}{10}$ (ii) 100

20. Simplify: (i) $(2m^4)^3 \times (3m)^2$ (ii) $\left(\frac{3}{2}\right)^{-2} \times \left(\frac{7}{3}\right)^{-4} \times \left(\frac{2}{7}\right)^{-3}$ [5]

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

$$(2m^4)^3 \times (3m)^2 = 2^3 \cdot (m^4)^3 \times 3^2 \cdot m^2$$

$$= 8m^{12} \times 9m^2$$

$$= 72 \cdot m^{12+2} = 72m^{14}$$

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

$$\left(\frac{3}{2}\right)^{-2} \times \left(\frac{7}{3}\right)^{-4} \times \left(\frac{2}{7}\right)^{-3} = \left(\frac{2}{3}\right)^2 \times \left(\frac{3}{7}\right)^4 \times \left(\frac{7}{2}\right)^3$$

$$= \frac{2^2}{3^2} \times \frac{3^4}{7^4} \times \frac{7^3}{2^3}$$

$$= 3^2 \times 2^{-1} \times 7^{-1} \quad (a^m \times a^n = a^{m+n}, \frac{a^m}{a^n} = a^{m-n})$$

$$= 9 \times \frac{1}{2} \times \frac{1}{7}$$

$$= \frac{9}{14}$$

Ans: (i) $72m^{14}$ (ii) $\frac{9}{14}$