

Exponents (Level 1)

Question Paper, Set 05

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 $\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$ in exponential form. [1 mark]
2. Find the value of 15^3 . [1 mark]
3. Write 7776 as a power of 6. [2 marks]
4. Simplify $11^5 \times 11^8$. [1 mark]
5. Simplify $\frac{5^9}{5^6}$ and find its value. [2 marks]
6. Write $2^3 \times 9^3$ as a single power and find its value. [2 marks]
7. Simplify $\frac{18^4}{6^4}$ and find its value. [2 marks]
8. Find the value of $8^0 \times 13^0$. [1 mark]
9. Find the value of 10^{-3} . [2 marks]
10. Find the value of $(-1)^{131}$. [1 mark]
11. Find the value of $(-4)^4$. [1 mark]
12. If $4^{x-2} = 256$, find x . [3 marks]
13. Write $(\frac{3}{5})^4$ and $\frac{1}{11^3}$ using negative exponents. [2 marks]
14. Simplify $(\frac{4}{z^2})^3$. [3 marks]
15. Simplify $\frac{(5^3)^2 \times 5^4}{5^7}$. [3 marks]
16. Simplify $2^3 \div 2^{-4}$ and find its value. [3 marks]
17. (i) If $(5^2)^x \times 5^{-1} = 125$, find x . (ii) If $(-2)^{x-1} \times (-2)^3 = (-2)^7$, find x . [5 marks]
18. Find the value of: (i) $5^6 \times (\frac{2}{5})^6$ (ii) $(\frac{1}{2})^{-2} + (\frac{1}{5})^{-2} + (\frac{1}{6})^{-2}$ [5 marks]
19. Find the value of: (i) $7^{\frac{1}{2}} \times 7^{\frac{3}{2}}$ (ii) $\frac{7^{\frac{7}{2}} \times 7^{-\frac{1}{2}}}{7^4}$ [5 marks]
20. Simplify: (i) $(2^7 \div 2^4)^2 \times 2^{-3}$ (ii) $(3^{-1} - 4^{-1}) \div 2^{-1}$ [5 marks]

Key sheet

Q	Answer
1	$\left(\frac{2}{3}\right)^4$
2	3375
3	$7776 = 6^5$
4	11^{13}
5	$5^3 = 125$
6	$(18)^3 = 5832$
7	81
8	1
9	$\frac{1}{1000}$
10	-1
11	256
12	$x = 6$
13	$\left(\frac{5}{3}\right)^{-4}, 11^{-3}$
14	$\frac{64}{z^6}$
15	5^3
16	128
17	(i) $x = 2$ (ii) $x = 5$
18	(i) 64 (ii) 65
19	(i) 49 (ii) $\frac{1}{7}$
20	(i) 8 (ii) $\frac{1}{6}$

Solutions

1. Write $\frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3}$ in exponential form. [1]

$\frac{2}{3}$ is multiplied by itself 4 times.

$$\therefore \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = \left(\frac{2}{3}\right)^4, \text{ read as '}\frac{2}{3}\text{ power 4'}$$

Ans: $\left(\frac{2}{3}\right)^4$

2. Find the value of 15^3 . [1]

$$15^3 = 15 \times 15 \times 15$$

$$= 3375$$

Ans: 3375

3. Write 7776 as a power of 6. [2]

Divide repeatedly by 6: 7776, 1296, 216, 36, 6.

$$7776 = 6 \times 6 \times 6 \times 6 \times 6$$

$$= 6^5$$

Ans: $7776 = 6^5$

4. Simplify $11^5 \times 11^8$. [1]

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

$$11^5 \times 11^8 = 11^{5+8}$$

$$= 11^{13}$$

Ans: 11^{13}

5. Simplify $\frac{5^9}{5^6}$ and find its value. [2]

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

$$\frac{5^9}{5^6} = 5^{9-6} = 5^3$$

$$= 125$$

Ans: $5^3 = 125$

6. Write $2^3 \times 9^3$ as a single power and find its value. [2]

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

$$2^3 \times 9^3 = (2 \times 9)^3$$

$$= (18)^3 = 18 \times 18 \times 18$$

$$= 5832$$

Ans: $(18)^3 = 5832$

7. Simplify $\frac{18^4}{6^4}$ and find its value. [2]

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

$$\frac{18^4}{6^4} = \left(\frac{18}{6}\right)^4$$

$$= 3^4$$

$$= 81$$

Ans: 81

8. Find the value of $8^0 \times 13^0$. [1]

$$8^0 = 1 \text{ and } 13^0 = 1$$

$$8^0 \times 13^0 = 1 \times 1 = 1$$

Ans: 1

9. Find the value of 10^{-3} . [2]

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

$$10^{-3} = \frac{1}{10^3}$$

$$= \frac{1}{1000}$$

Ans: $\frac{1}{1000}$

10. Find the value of $(-1)^{131}$. [1]

131 is an odd number.

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

$$\therefore (-1)^{131} = -1$$

Ans: -1

11. Find the value of $(-4)^4$. [1]

4 is even, and $(-a)^n = a^n$ for even n .

$$(-4)^4 = 4^4 = 256$$

Ans: 256

12. If $4^{x-2} = 256$, find x . [3]

$$\text{Given, } 4^{x-2} = 256$$

Dividing 256 repeatedly by 4: 256, 64, 16, 4, so $256 = 4^4$.

$$\Rightarrow 4^{x-2} = 4^4$$

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

$$\Rightarrow x - 2 = 4$$

$$\Rightarrow x = 4 + 2$$

$$\Rightarrow x = 6$$

Ans: $x = 6$

13. Write $(\frac{3}{5})^4$ and $\frac{1}{11^3}$ using negative exponents. [2]

$$\text{Using } (\frac{b}{a})^n = (\frac{a}{b})^{-n}: (\frac{3}{5})^4 = (\frac{5}{3})^{-4}$$

$$\text{Using } \frac{1}{a^n} = a^{-n}: \frac{1}{11^3} = 11^{-3}$$

Ans: $(\frac{5}{3})^{-4}$, 11^{-3}

14. Simplify $(\frac{4}{z^2})^3$. [3]

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

$$(\frac{4}{z^2})^3 = \frac{4^3}{(z^2)^3}$$

$$= \frac{64}{z^6}$$

Ans: $\frac{64}{z^6}$

15. Simplify $\frac{(5^3)^2 \times 5^4}{5^7}$. [3]

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

$$\frac{(5^3)^2 \times 5^4}{5^7} = \frac{5^6 \times 5^4}{5^7} = \frac{5^{10}}{5^7}$$

$$\text{Using } \frac{a^m}{a^n} = a^{m-n}: 5^{10-7} = 5^3$$

Ans: 5^3

16. Simplify $2^3 \div 2^{-4}$ and find its value. [3]

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

$$2^3 \div 2^{-4} = \frac{2^3}{2^{-4}} = 2^{3-(-4)} = 2^{3+4} = 2^7$$

$$= 128$$

Ans: 128

17. (i) If $(5^2)^x \times 5^{-1} = 125$, find x . (ii) If $(-2)^{x-1} \times (-2)^3 = (-2)^7$, find x . [5]

(i) Given, $(5^2)^x \times 5^{-1} = 125$

Dividing 125 repeatedly by 5: 125, 25, 5, so $125 = 5^3$.

$$\Rightarrow 5^{2x} \times 5^{-1} = 5^3 \quad ((a^m)^n = a^{m \times n})$$

$$\Rightarrow 5^{2x-1} = 5^3 \quad (a^m \times a^n = a^{m+n})$$

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

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

$$\Rightarrow 2x = 3 + 1$$

$$\Rightarrow 2x = 4$$

$$\Rightarrow x = \frac{4}{2} = 2$$

(ii) Given, $(-2)^{x-1} \times (-2)^3 = (-2)^7$

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

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

$$\Rightarrow x + 2 = 7$$

$$\Rightarrow x = 7 - 2$$

$$\Rightarrow x = 5$$

Ans: (i) $x = 2$ (ii) $x = 5$

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

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

$$5^6 \times \left(\frac{2}{5}\right)^6 = \left(5 \times \frac{2}{5}\right)^6$$

$$= 2^6 = 64$$

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

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

$$= 4 + 25 + 36$$

$$= 65$$

Ans: (i) 64 (ii) 65

19. Find the value of: (i) $7^{\frac{1}{2}} \times 7^{\frac{3}{2}}$ (ii) $\frac{7^{\frac{7}{2}} \times 7^{-\frac{1}{2}}}{7^4}$ [5]

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

$$7^{\frac{1}{2}} \times 7^{\frac{3}{2}} = 7^{\frac{1}{2} + \frac{3}{2}}$$

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

$$= 49$$

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

$$\frac{7^{\frac{7}{2}} \times 7^{-\frac{1}{2}}}{7^4} = \frac{7^{\frac{7}{2} + (-\frac{1}{2})}}{7^4}$$

$$= \frac{7^{\frac{6}{2}}}{7^4} = \frac{7^3}{7^4}$$

$$= 7^{3-4} = 7^{-1}$$

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

Ans: (i) 49 (ii) $\frac{1}{7}$

20. Simplify: (i) $(2^7 \div 2^4)^2 \times 2^{-3}$ (ii) $(3^{-1} - 4^{-1}) \div 2^{-1}$ [5]

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

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

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

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

$$= 8$$

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

$$= \frac{4-3}{12} \div \frac{1}{2} = \frac{1}{12} \div \frac{1}{2}$$

$$= \frac{1}{12} \times 2 = \frac{1}{6}$$

Ans: (i) 8 (ii) $\frac{1}{6}$
