

Exponents (Level 1)

Question Paper, Set 04

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 t^7 as a product. [1 mark]
2. Which is greater, 3^5 or 5^3 ? [1 mark]
3. Write 2401 as a power of 7. [2 marks]
4. Simplify $4^3 \times 4^8 \times 4^5$. [2 marks]
5. Simplify $(11^6)^5$. [1 mark]
6. Write $3^4 \times 10^4$ as a single power and find its value. [2 marks]
7. Find the value of $4^0 + 6^0$. [1 mark]
8. Write $\frac{1}{343}$ as a power of 7 with a negative exponent. [2 marks]
9. Write $\left(\frac{9}{2}\right)^{-5}$ with a positive exponent. [1 mark]
10. Find the value of $(-1)^{18} \times (-1)^{11}$. [1 mark]
11. Find the values of $(-7)^2$ and $(-7)^3$. [2 marks]
12. If $7^{2x+3} = 49$, find x . [3 marks]
13. Write 1 and $\frac{1}{7}$ as powers of 7. [2 marks]
14. Simplify $(2x^2y^5)^3$. [3 marks]
15. Simplify $\frac{7^{11} \times 7^5}{7^{14}}$. [3 marks]
16. Simplify $2^{-3} \times 5^{-3}$ and find its value. [3 marks]
17. (i) If $3^{3x} \div 3^2 = 81$, find x . (ii) If $2^{x+3} = \frac{1}{64}$, find x . [5 marks]
18. Find the value of: (i) $(2^{15} \div 2^{11}) \times 2^3$ (ii) $(2^{-1} \times 3^{-1}) \div 6^{-2}$ [5 marks]
19. Find the value of: (i) $\frac{2^{\frac{13}{2}} \times 2^{-\frac{3}{2}}}{2^3}$ (ii) $3^{\frac{2}{3}} \times 3^{\frac{5}{3}} \times 3^{\frac{2}{3}}$ [5 marks]
20. Simplify: (i) $(2y^3)^2 \times (3y)^2$ (ii) $25^2 \times \left(\frac{2}{5}\right)^4$ [5 marks]

Key sheet

Q	Answer
1	$t \times t \times t \times t \times t \times t \times t$
2	3^5 , since $243 > 125$
3	$2401 = 7^4$
4	4^{16}
5	11^{30}
6	$(30)^4 = 8,10,000$
7	2
8	7^{-3}
9	$\left(\frac{2}{9}\right)^5$
10	-1
11	$(-7)^2 = 49$, $(-7)^3 = -343$
12	$x = -\frac{1}{2}$
13	$1 = 7^0$, $\frac{1}{7} = 7^{-1}$
14	$8x^6y^{15}$
15	7^2
16	$\frac{1}{1000}$
17	(i) $x = 2$ (ii) $x = -9$
18	(i) 128 (ii) 6
19	(i) 4 (ii) 27
20	(i) $36y^8$ (ii) 16

Solutions

1. Write t^7 as a product. [1]

t^7 means t multiplied by itself 7 times.

$$t^7 = t \times t \times t \times t \times t \times t \times t$$

Ans: $t \times t \times t \times t \times t \times t \times t$

2. Which is greater, 3^5 or 5^3 ? [1]

$$3^5 = 3 \times 3 \times 3 \times 3 \times 3 = 243$$

$$5^3 = 5 \times 5 \times 5 = 125$$

$243 > 125$, so 3^5 is greater.

Ans: 3^5 , since $243 > 125$

3. Write 2401 as a power of 7. [2]

Divide repeatedly by 7: 2401, 343, 49, 7.

$$2401 = 7 \times 7 \times 7 \times 7$$

$$= 7^4$$

Ans: $2401 = 7^4$

4. Simplify $4^3 \times 4^8 \times 4^5$. [2]

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

$$4^3 \times 4^8 \times 4^5 = 4^{3+8+5}$$

$$= 4^{16}$$

Ans: 4^{16}

5. Simplify $(11^6)^5$. [1]

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

$$(11^6)^5 = 11^{6 \times 5}$$

$$= 11^{30}$$

Ans: 11^{30}

6. Write $3^4 \times 10^4$ as a single power and find its value. [2]

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

$$3^4 \times 10^4 = (3 \times 10)^4$$

$$= (30)^4 = 30 \times 30 \times 30 \times 30$$

$$= 8,10,000$$

Ans: $(30)^4 = 8,10,000$

7. Find the value of $4^0 + 6^0$. [1]

$$4^0 = 1 \text{ and } 6^0 = 1$$

$$4^0 + 6^0 = 1 + 1 = 2$$

Ans: 2

8. Write $\frac{1}{343}$ as a power of 7 with a negative exponent. [2]

Divide repeatedly by 7: 343, 49, 7, so $343 = 7^3$.

$$\frac{1}{343} = \frac{1}{7^3}$$
$$= 7^{-3} \text{ (since } \frac{1}{a^n} = a^{-n} \text{)}$$

Ans: 7^{-3}

9. Write $\left(\frac{9}{2}\right)^{-5}$ with a positive exponent. [1]

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

$$\left(\frac{9}{2}\right)^{-5} = \left(\frac{2}{9}\right)^5$$

Ans: $\left(\frac{2}{9}\right)^5$

10. Find the value of $(-1)^{18} \times (-1)^{11}$. [1]

18 is even, so $(-1)^{18} = 1$; 11 is odd, so $(-1)^{11} = -1$.

$$(-1)^{18} \times (-1)^{11} = 1 \times (-1) = -1$$

Ans: -1

11. Find the values of $(-7)^2$ and $(-7)^3$. [2]

Using $(-a)^n = -a^n$ if n is odd, $(-a)^n = a^n$ if n is even

$$(-7)^2 = 7^2 = 49 \text{ (2 is even)}$$

$$(-7)^3 = -7^3 = -343 \text{ (3 is odd)}$$

Ans: $(-7)^2 = 49$, $(-7)^3 = -343$

12. If $7^{2x+3} = 49$, find x . [3]

Given, $7^{2x+3} = 49$

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

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

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

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

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

$$\Rightarrow 2x = -1$$

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

Ans: $x = -\frac{1}{2}$

13. Write 1 and $\frac{1}{7}$ as powers of 7. [2]

Using $1 = a^0$: $1 = 7^0$

Using $\frac{1}{a} = a^{-1}$: $\frac{1}{7} = 7^{-1}$

Ans: $1 = 7^0$, $\frac{1}{7} = 7^{-1}$

14. Simplify $(2x^2y^5)^3$. [3]

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

$$(2x^2y^5)^3 = 2^3 \times (x^2)^3 \times (y^5)^3$$

$$= 8x^6y^{15}$$

Ans: $8x^6y^{15}$

15. Simplify $\frac{7^{11} \times 7^5}{7^{14}}$. [3]

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

$$\begin{aligned}\frac{7^{11} \times 7^5}{7^{14}} &= \frac{7^{16}}{7^{14}} \\ &= 7^{16-14} = 7^2\end{aligned}$$

Ans: 7^2

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

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

$$\begin{aligned}2^{-3} \times 5^{-3} &= (2 \times 5)^{-3} = 10^{-3} \\ &= \frac{1}{10^3} = \frac{1}{1000}\end{aligned}$$

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

17. (i) If $3^{3x} \div 3^2 = 81$, find x . (ii) If $2^{x+3} = \frac{1}{64}$, find x . [5]

(i) Given, $3^{3x} \div 3^2 = 81$

Dividing 81 repeatedly by 3: 81, 27, 9, 3, so $81 = 3^4$.

$$\Rightarrow 3^{3x-2} = 3^4 \left(\frac{a^m}{a^n} = a^{m-n} \right)$$

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

$$\Rightarrow 3x - 2 = 4$$

$$\Rightarrow 3x = 4 + 2$$

$$\Rightarrow 3x = 6$$

$$\Rightarrow x = \frac{6}{3} = 2$$

(ii) Given, $2^{x+3} = \frac{1}{64}$

$\frac{1}{64} = \frac{1}{2^6} = 2^{-6}$ (dividing 64 repeatedly by 2: 64, 32, 16, 8, 4, 2)

$$\Rightarrow 2^{x+3} = 2^{-6}$$

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

$$\Rightarrow x + 3 = -6$$

$$\Rightarrow x = -6 - 3$$

$$\Rightarrow x = -9$$

Ans: (i) $x = 2$ (ii) $x = -9$

18. Find the value of: (i) $(2^{15} \div 2^{11}) \times 2^3$ (ii) $(2^{-1} \times 3^{-1}) \div 6^{-2}$ [5]

$$(i) (2^{15} \div 2^{11}) \times 2^3 = \frac{2^{15}}{2^{11}} \times 2^3$$

$$= 2^{15-11} \times 2^3 = 2^4 \times 2^3$$

$$= 2^{4+3} = 2^7$$

$$= 128$$

$$(ii) (2^{-1} \times 3^{-1}) \div 6^{-2} = \left(\frac{1}{2} \times \frac{1}{3} \right) \div \frac{1}{6^2}$$

$$= \frac{1}{6} \div \frac{1}{36}$$

$$= \frac{1}{6} \times 36 = 6$$

Ans: (i) 128 (ii) 6

19. Find the value of: (i) $\frac{2^{\frac{13}{2}} \times 2^{-\frac{3}{2}}}{2^3}$ (ii) $3^{\frac{2}{3}} \times 3^{\frac{5}{3}} \times 3^{\frac{2}{3}}$ [5]

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

$$\frac{2^{\frac{13}{2}} \times 2^{-\frac{3}{2}}}{2^3} = \frac{2^{\frac{13}{2} + (-\frac{3}{2})}}{2^3}$$

$$= \frac{2^{\frac{10}{2}}}{2^3} = \frac{2^5}{2^3}$$

$$= 2^{5-3} = 2^2$$

$$= 4$$

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

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

$$= 3^{\frac{9}{3}} = 3^3$$

$$= 27$$

Ans: (i) 4 (ii) 27

20. Simplify: (i) $(2y^3)^2 \times (3y)^2$ (ii) $25^2 \times \left(\frac{2}{5}\right)^4$ [5]

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

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

$$= 4y^6 \times 9y^2$$

$$= 36 \cdot y^{6+2} = 36y^8$$

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

$$25^2 \times \left(\frac{2}{5}\right)^4 = 625 \times \frac{2^4}{5^4}$$

$$= 625 \times \frac{16}{625}$$

$$= 16$$

Ans: (i) $36y^8$ (ii) 16
