

Exponents (Level 1)

Question Paper, Set 06

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 8^5 as a product. [1 mark]
2. Which is greater, 2^9 or 9^2 ? [1 mark]
3. Write 6561 as a power of 3. [2 marks]
4. Simplify $10^2 \times 10^4$ and find its value. [2 marks]
5. Simplify $\left(\left(\frac{2}{9}\right)^3\right)^4$. [1 mark]
6. Write $4^2 \times 9^2$ as a single power and find its value. [2 marks]
7. Find the value of $(-14)^0$. [1 mark]
8. Write $\frac{1}{256}$ as a power of 4 with a negative exponent. [2 marks]
9. Write $\left(\frac{11}{3}\right)^{-4}$ with a positive exponent. [1 mark]
10. Find the value of $(-1)^{63} + (-1)^{71}$. [1 mark]
11. Find the values of $(-3)^6$ and $(-3)^7$. [2 marks]
12. If $6^{3n-2} = 216$, find n . [3 marks]
13. Write 10^{x+3} as a product of two powers and simplify. [2 marks]
14. Simplify $(6x^2)^2$. [3 marks]
15. Simplify $(x^2y)^2 \times (xy^3)^3$. [3 marks]
16. Simplify $(4^{-2})^{-3}$ and find its value. [3 marks]
17. (i) If $10^{2x+1} \times 10^1 = 1,00,000$, find x . (ii) If $5^{x-2} = \frac{1}{25}$, find x . [5 marks]
18. Find the value of: (i) $(7^0 + 2^{-1}) \times 4^2$ (ii) $(-1)^6 + (-1)^{10} + (-1)^{13}$ [5 marks]
19. Find the value of: (i) $5^{\frac{2}{3}} \times 5^{\frac{4}{3}}$ (ii) $3^{\frac{1}{2}} \div 3^{\frac{9}{2}}$ [5 marks]
20. Simplify: (i) $(5a)^2 \times (2a)^3$ (ii) $\left(\frac{2}{3}\right)^{-3} \times \left(\frac{5}{2}\right)^{-2} \times \left(\frac{3}{5}\right)^{-1}$ [5 marks]

Key sheet

Q	Answer
1	$8 \times 8 \times 8 \times 8 \times 8$
2	2^9 , since $512 > 81$
3	$6561 = 3^8$
4	$10^6 = 10,00,000$
5	$\left(\frac{2}{9}\right)^{12}$
6	$(36)^2 = 1296$
7	1
8	4^{-4}
9	$\left(\frac{3}{11}\right)^4$
10	-2
11	$(-3)^6 = 729$, $(-3)^7 = -2187$
12	$n = \frac{5}{3}$
13	1000×10^x
14	$36x^4$
15	x^7y^{11}
16	4096
17	(i) $x = \frac{3}{2}$ (ii) $x = 0$
18	(i) 24 (ii) 1
19	(i) 25 (ii) $\frac{1}{81}$
20	(i) $200a^5$ (ii) $\frac{9}{10}$

Solutions

1. Write 8^5 as a product. [1]

8^5 means 8 multiplied by itself 5 times.

$$8^5 = 8 \times 8 \times 8 \times 8 \times 8$$

Ans: $8 \times 8 \times 8 \times 8 \times 8$

2. Which is greater, 2^9 or 9^2 ? [1]

$$2^9 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 512$$

$$9^2 = 9 \times 9 = 81$$

$512 > 81$, so 2^9 is greater.

Ans: 2^9 , since $512 > 81$

3. Write 6561 as a power of 3. [2]

Divide repeatedly by 3: 6561, 2187, 729, 243, 81, 27, 9, 3.

$$6561 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

$$= 3^8$$

Ans: $6561 = 3^8$

4. Simplify $10^2 \times 10^4$ and find its value. [2]

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

$$10^2 \times 10^4 = 10^{2+4} = 10^6$$

$$= 10,00,000$$

Ans: $10^6 = 10,00,000$

5. Simplify $\left(\left(\frac{2}{9}\right)^3\right)^4$. [1]

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

$$\left(\left(\frac{2}{9}\right)^3\right)^4 = \left(\frac{2}{9}\right)^{3 \times 4}$$

$$= \left(\frac{2}{9}\right)^{12}$$

Ans: $\left(\frac{2}{9}\right)^{12}$

6. Write $4^2 \times 9^2$ as a single power and find its value. [2]

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

$$4^2 \times 9^2 = (4 \times 9)^2$$

$$= (36)^2 = 36 \times 36$$

$$= 1296$$

Ans: $(36)^2 = 1296$

7. Find the value of $(-14)^0$. [1]

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

$-14 \neq 0$, so $(-14)^0 = 1$

Ans: 1

8. Write $\frac{1}{256}$ as a power of 4 with a negative exponent. [2]

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

$$\frac{1}{256} = \frac{1}{4^4}$$
$$= 4^{-4} \text{ (since } \frac{1}{a^n} = a^{-n} \text{)}$$

Ans: 4^{-4}

9. Write $\left(\frac{11}{3}\right)^{-4}$ with a positive exponent. [1]

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

$$\left(\frac{11}{3}\right)^{-4} = \left(\frac{3}{11}\right)^4$$

Ans: $\left(\frac{3}{11}\right)^4$

10. Find the value of $(-1)^{63} + (-1)^{71}$. [1]

63 is odd, so $(-1)^{63} = -1$; 71 is odd, so $(-1)^{71} = -1$.

$$(-1)^{63} + (-1)^{71} = -1 + (-1) = -2$$

Ans: -2

11. Find the values of $(-3)^6$ and $(-3)^7$. [2]

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

$$(-3)^6 = 3^6 = 729 \text{ (6 is even)}$$

$$(-3)^7 = -3^7 = -2187 \text{ (7 is odd)}$$

Ans: $(-3)^6 = 729$, $(-3)^7 = -2187$

12. If $6^{3n-2} = 216$, find n . [3]

$$\text{Given, } 6^{3n-2} = 216$$

Dividing 216 repeatedly by 6: 216, 36, 6, so $216 = 6^3$.

$$\Rightarrow 6^{3n-2} = 6^3$$

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

$$\Rightarrow 3n - 2 = 3$$

$$\Rightarrow 3n = 3 + 2$$

$$\Rightarrow 3n = 5$$

$$\Rightarrow n = \frac{5}{3}$$

Ans: $n = \frac{5}{3}$

13. Write 10^{x+3} as a product of two powers and simplify. [2]

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

$$10^{x+3} = 10^x \times 10^3$$

$$= 1000 \times 10^x$$

Ans: 1000×10^x

14. Simplify $(6x^2)^2$. [3]

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

$$(6x^2)^2 = 6^2 \times (x^2)^2$$

$$= 36 \times x^4 = 36x^4$$

Ans: $36x^4$

15. Simplify $(x^2y)^2 \times (xy^3)^3$. [3]

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

$$(x^2y)^2 \times (xy^3)^3 = x^4y^2 \times x^3y^9$$

Using $a^m \times a^n = a^{m+n}$: $= x^7y^{11}$

Ans: x^7y^{11}

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

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

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

$$= 4096$$

Ans: 4096

17. (i) If $10^{2x+1} \times 10^1 = 1,00,000$, find x . (ii) If $5^{x-2} = \frac{1}{25}$, find x . [5]

(i) Given, $10^{2x+1} \times 10^1 = 1,00,000$

Dividing 1,00,000 repeatedly by 10: 1,00,000, 10,000, 1000, 100, 10, so $1,00,000 = 10^5$.

$$\Rightarrow 10^{2x+1+1} = 10^5 \quad (a^m \times a^n = a^{m+n})$$

$$\Rightarrow 10^{2x+2} = 10^5$$

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

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

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

$$\Rightarrow 2x = 3$$

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

(ii) Given, $5^{x-2} = \frac{1}{25}$

$$\frac{1}{25} = \frac{1}{5^2} = 5^{-2} \quad (\text{dividing 25 repeatedly by 5: 25, 5})$$

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

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

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

$$\Rightarrow x = -2 + 2$$

$$\Rightarrow x = 0$$

Ans: (i) $x = \frac{3}{2}$ (ii) $x = 0$

18. Find the value of: (i) $(7^0 + 2^{-1}) \times 4^2$ (ii) $(-1)^6 + (-1)^{10} + (-1)^{13}$ [5]

$$(i) (7^0 + 2^{-1}) \times 4^2 = (1 + \frac{1}{2}) \times 16$$

$$= \frac{3}{2} \times 16$$

$$= 24$$

$$(ii) \text{ Using } (-1)^{\text{odd number}} = -1, (-1)^{\text{even number}} = 1$$

$$(-1)^6 + (-1)^{10} + (-1)^{13} = 1 + 1 + (-1)$$

$$= 1$$

Ans: (i) 24 (ii) 1

19. Find the value of: (i) $5^{\frac{2}{3}} \times 5^{\frac{4}{3}}$ (ii) $3^{\frac{1}{2}} \div 3^{\frac{9}{2}}$ [5]

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

$$5^{\frac{2}{3}} \times 5^{\frac{4}{3}} = 5^{\frac{2}{3} + \frac{4}{3}}$$

$$= 5^{\frac{6}{3}} = 5^2$$

$$= 25$$

$$(ii) \text{ Using } \frac{a^m}{a^n} = a^{m-n}$$

$$3^{\frac{1}{2}} \div 3^{\frac{9}{2}} = 3^{\frac{1}{2} - \frac{9}{2}}$$

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

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

Ans: (i) 25 (ii) $\frac{1}{81}$

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

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

$$(5a)^2 \times (2a)^3 = 5^2 \cdot a^2 \times 2^3 \cdot a^3$$

$$= 25a^2 \times 8a^3$$

$$= 200 \cdot a^{2+3} = 200a^5$$

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

$$(\frac{2}{3})^{-3} \times (\frac{5}{2})^{-2} \times (\frac{3}{5})^{-1} = (\frac{3}{2})^3 \times (\frac{2}{5})^2 \times (\frac{5}{3})^1$$

$$= \frac{3^3}{2^3} \times \frac{2^2}{5^2} \times \frac{5^1}{3^1}$$

$$= 2^{-1} \times 3^2 \times 5^{-1} (a^m \times a^n = a^{m+n}, \frac{a^m}{a^n} = a^{m-n})$$

$$= \frac{1}{2} \times 9 \times \frac{1}{5}$$

$$= \frac{9}{10}$$

Ans: (i) $200a^5$ (ii) $\frac{9}{10}$
