

Exponents (Level 1)

Question Paper, Set 07

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 $13 \times 13 \times 13 \times 13$ in exponential form. [1 mark]
2. Find the value of 3^7 . [1 mark]
3. Write 14,641 as a power of 11. [2 marks]
4. Simplify $13^6 \times 13^{15}$. [1 mark]
5. Simplify $\frac{21^6}{21}$. [2 marks]
6. Write $5^2 \times 7^2$ as a single power and find its value. [2 marks]
7. Simplify $\frac{6^2}{9^2}$ and find its value. [2 marks]
8. Find the value of 7×3^0 . [1 mark]
9. Find the value of 6^{-2} . [2 marks]
10. Find the value of $(-1)^{246}$. [1 mark]
11. Find the value of $(-10)^5$. [1 mark]
12. If $2^{3n} = 512$, find n . [3 marks]
13. Write 2^{3x} as a power of 8. [2 marks]
14. Simplify $\left(\frac{q^5}{2}\right)^4$. [3 marks]
15. Simplify $\frac{2^8 \times 2^6}{2^9}$. [3 marks]
16. Simplify $3^{-6} \times 3^8$ and find its value. [3 marks]
17. (i) If $2^{2x+1} \div 2^5 = 8$, find x . (ii) If $(3^2)^x \times 3^3 = 2187$, find x . [5 marks]
18. Find the value of: (i) $(3^{-1} \times 5^{-1}) \div 5^{-2}$ (ii) $(-5)^3 + (-2)^7$ [5 marks]
19. Find the value of: (i) $\frac{5^{\frac{11}{3}} \times 5^{-\frac{5}{3}}}{5^1}$ (ii) $5^{\frac{1}{2}} \times 5^{\frac{1}{2}} \times 5^1$ [5 marks]
20. Simplify: (i) $27^2 \times \left(\frac{2}{3}\right)^6$ (ii) $(-3)^{-10} \div (-3)^{-13}$ [5 marks]

Key sheet

Q	Answer
1	13^4
2	2187
3	$14,641 = 11^4$
4	13^{21}
5	21^5
6	$(35)^2 = 1225$
7	$\frac{4}{9}$
8	7
9	$\frac{1}{36}$
10	1
11	-1,00,000
12	$n = 3$
13	8^x
14	$\frac{9^{20}}{16}$
15	2^5
16	9
17	(i) $x = \frac{7}{2}$ (ii) $x = 2$
18	(i) $\frac{5}{3}$ (ii) -253
19	(i) 5 (ii) 25
20	(i) 64 (ii) -27

Solutions

1. Write $13 \times 13 \times 13 \times 13$ in exponential form. [1]

13 is multiplied by itself 4 times.

$\therefore 13 \times 13 \times 13 \times 13 = 13^4$, read as '13 power 4'

Ans: 13^4

2. Find the value of 3^7 . [1]

$$3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

$$= 2187$$

Ans: 2187

3. Write 14,641 as a power of 11. [2]

Divide repeatedly by 11: 14,641, 1331, 121, 11.

$$14,641 = 11 \times 11 \times 11 \times 11$$

$$= 11^4$$

Ans: $14,641 = 11^4$

4. Simplify $13^6 \times 13^{15}$. [1]

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

$$13^6 \times 13^{15} = 13^{6+15}$$

$$= 13^{21}$$

Ans: 13^{21}

5. Simplify $\frac{21^6}{21}$. [2]

$21 = 21^1$, Using $\frac{a^m}{a^n} = a^{m-n}$

$$\frac{21^6}{21} = 21^{6-1} = 21^5$$

Ans: 21^5

6. Write $5^2 \times 7^2$ as a single power and find its value. [2]

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

$$5^2 \times 7^2 = (5 \times 7)^2$$

$$= (35)^2 = 35 \times 35$$

$$= 1225$$

Ans: $(35)^2 = 1225$

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

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

$$\frac{6^2}{9^2} = \left(\frac{6}{9}\right)^2$$

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

$$= \frac{4}{9}$$

Ans: $\frac{4}{9}$

8. Find the value of 7×3^0 . [1]

$$3^0 = 1$$

$$7 \times 3^0 = 7 \times 1 = 7$$

Ans: 7

9. Find the value of 6^{-2} . [2]

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

$$6^{-2} = \frac{1}{6^2}$$

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

Ans: $\frac{1}{36}$

10. Find the value of $(-1)^{246}$. [1]

246 is an even number.

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

$$\therefore (-1)^{246} = 1$$

Ans: 1

11. Find the value of $(-10)^5$. [1]

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

$$(-10)^5 = -10^5 = -1,00,000$$

Ans: -1,00,000

12. If $2^{3n} = 512$, find n . [3]

$$\text{Given, } 2^{3n} = 512$$

Dividing 512 repeatedly by 2: 512, 256, 128, 64, 32, 16, 8, 4, 2, so $512 = 2^9$.

$$\Rightarrow 2^{3n} = 2^9$$

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

$$\Rightarrow 3n = 9$$

$$\Rightarrow n = \frac{9}{3} = 3$$

Ans: $n = 3$

13. Write 2^{3x} as a power of 8. [2]

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

$$2^{3x} = (2^3)^x$$

$$= 8^x$$

Ans: 8^x

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

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

$$\left(\frac{a^5}{2}\right)^4 = \frac{(a^5)^4}{2^4}$$

$$= \frac{a^{20}}{16}$$

Ans: $\frac{a^{20}}{16}$

15. Simplify $\frac{2^8 \times 2^6}{2^9}$. [3]

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

$$\begin{aligned}\frac{2^8 \times 2^6}{2^9} &= \frac{2^{14}}{2^9} \\ &= 2^{14-9} = 2^5\end{aligned}$$

Ans: 2^5

16. Simplify $3^{-6} \times 3^8$ and find its value. [3]

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

$$\begin{aligned}3^{-6} \times 3^8 &= 3^{-6+8} = 3^2 \\ &= 9\end{aligned}$$

Ans: 9

17. (i) If $2^{2x+1} \div 2^5 = 8$, find x . (ii) If $(3^2)^x \times 3^3 = 2187$, find x . [5]

(i) Given, $2^{2x+1} \div 2^5 = 8$

Dividing 8 repeatedly by 2: 8, 4, 2, so $8 = 2^3$.

$$\begin{aligned}\Rightarrow 2^{2x+1-5} &= 2^3 \left(\frac{a^m}{a^n} = a^{m-n}\right) \\ \Rightarrow 2^{2x-4} &= 2^3\end{aligned}$$

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

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

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

$$\Rightarrow 2x = 7$$

$$\Rightarrow x = \frac{7}{2}$$

(ii) Given, $(3^2)^x \times 3^3 = 2187$

Dividing 2187 repeatedly by 3: 2187, 729, 243, 81, 27, 9, 3, so $2187 = 3^7$.

$$\Rightarrow 3^{2x} \times 3^3 = 3^7 \left((a^m)^n = a^{m \times n}\right)$$

$$\Rightarrow 3^{2x+3} = 3^7 \left(a^m \times a^n = a^{m+n}\right)$$

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

$$\Rightarrow 2x + 3 = 7$$

$$\Rightarrow 2x = 7 - 3$$

$$\Rightarrow 2x = 4$$

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

Ans: (i) $x = \frac{7}{2}$ (ii) $x = 2$

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

$$(i) (3^{-1} \times 5^{-1}) \div 5^{-2} = \left(\frac{1}{3} \times \frac{1}{5}\right) \div \frac{1}{5^2}$$

$$= \frac{1}{15} \div \frac{1}{25}$$

$$= \frac{1}{15} \times 25 = \frac{5}{3}$$

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

$$(-5)^3 + (-2)^7 = -5^3 - 2^7$$

$$= -125 - 128$$

$$= -253$$

Ans: (i) $\frac{5}{3}$ (ii) -253

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

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

$$\frac{5^{\frac{11}{3}} \times 5^{-\frac{5}{3}}}{5^1} = \frac{5^{\frac{11}{3} + (-\frac{5}{3})}}{5^1}$$

$$= \frac{5^{\frac{6}{3}}}{5^1} = \frac{5^2}{5^1}$$

$$= 5^{2-1} = 5^1$$

$$= 5$$

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

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

$$= 5^{\frac{4}{2}} = 5^2$$

$$= 25$$

Ans: (i) 5 (ii) 25

20. Simplify: (i) $27^2 \times \left(\frac{2}{3}\right)^6$ (ii) $(-3)^{-10} \div (-3)^{-13}$ [5]

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

$$27^2 \times \left(\frac{2}{3}\right)^6 = 729 \times \frac{2^6}{3^6}$$

$$= 729 \times \frac{64}{729}$$

$$= 64$$

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

$$(-3)^{-10} \div (-3)^{-13} = (-3)^{-10 - (-13)} = (-3)^{-10+13} = (-3)^3$$

$$= -27$$

Ans: (i) 64 (ii) -27
