

Exponents (Level 1)

Question Paper, Set 02

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 3^6 as a product. [1 mark]
2. Which is greater, 2^7 or 7^2 ? [1 mark]
3. Write 2048 as a power of 2. [2 marks]
4. Simplify $2^4 \times 2^5$ and find its value. [2 marks]
5. Simplify $(7^4)^3$. [1 mark]
6. Write $2^6 \times 5^6$ as a single power and find its value. [2 marks]
7. Find the value of $(x + 9)^0$, where $x + 9 \neq 0$. [1 mark]
8. Write $\frac{1}{32}$ as a power of 2 with a negative exponent. [2 marks]
9. Write $\left(\frac{4}{7}\right)^{-6}$ with a positive exponent. [1 mark]
10. Find the value of $(-1)^{24} + (-1)^{35}$. [1 mark]
11. Find the values of $(-2)^8$ and $(-2)^9$. [2 marks]
12. If $2^{2x-1} = 128$, find x . [3 marks]
13. Write 5^{2x} as a power of 25. [2 marks]
14. Simplify $\left(\frac{p^3}{3}\right)^3$. [3 marks]
15. Simplify $\frac{(3^2)^4 \times 3^5}{3^9}$. [3 marks]
16. Simplify $(3^2)^{-2}$ and find its value. [3 marks]
17. (i) If $5^{x+4} \div 5^{-2} = 625$, find x . (ii) If $(2^3)^x \times 2 = 1024$, find x . [5 marks]
18. Find the value of: (i) $2^5 \times \left(\frac{3}{2}\right)^5$ (ii) $(-1)^4 + (-1)^7 + (-1)^9$ [5 marks]
19. Find the value of: (i) $2^{\frac{11}{2}} \div 2^{\frac{5}{2}}$ (ii) $2^{\frac{1}{2}} \times 2^{\frac{3}{2}} \times 2^2$ [5 marks]
20. Simplify: (i) $9^2 \times \left(\frac{5}{3}\right)^4$ (ii) $(2^{-1} - 3^{-1}) \div 5^{-1}$ [5 marks]

Key sheet

Q	Answer
1	$3 \times 3 \times 3 \times 3 \times 3 \times 3$
2	2^7 , since $128 > 49$
3	$2048 = 2^{11}$
4	$2^9 = 512$
5	7^{12}
6	$(10)^6 = 10,00,000$
7	1
8	2^{-5}
9	$\left(\frac{7}{4}\right)^6$
10	0
11	$(-2)^8 = 256$, $(-2)^9 = -512$
12	$x = 4$
13	25^x
14	$\frac{p^9}{27}$
15	3^4
16	$\frac{1}{81}$
17	(i) $x = -2$ (ii) $x = 3$
18	(i) 243 (ii) -1
19	(i) 8 (ii) 16
20	(i) 625 (ii) $\frac{5}{6}$

Solutions

1. Write 3^6 as a product. [1]

3^6 means 3 multiplied by itself 6 times.

$$3^6 = 3 \times 3 \times 3 \times 3 \times 3 \times 3$$

Ans: $3 \times 3 \times 3 \times 3 \times 3 \times 3$

2. Which is greater, 2^7 or 7^2 ? [1]

$$2^7 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 128$$

$$7^2 = 7 \times 7 = 49$$

$128 > 49$, so 2^7 is greater.

Ans: 2^7 , since $128 > 49$

3. Write 2048 as a power of 2. [2]

Divide repeatedly by 2: 2048, 1024, 512, 256, 128, 64, 32, 16, 8, 4, 2.

$$2048 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

$$= 2^{11}$$

Ans: $2048 = 2^{11}$

4. Simplify $2^4 \times 2^5$ and find its value. [2]

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

$$2^4 \times 2^5 = 2^{4+5} = 2^9$$

$$= 512$$

Ans: $2^9 = 512$

5. Simplify $(7^4)^3$. [1]

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

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

$$= 7^{12}$$

Ans: 7^{12}

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

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

$$2^6 \times 5^6 = (2 \times 5)^6$$

$$= (10)^6 = 10 \times 10 \times 10 \times 10 \times 10 \times 10$$

$$= 10,00,000$$

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

7. Find the value of $(x + 9)^0$, where $x + 9 \neq 0$. [1]

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

$$(x + 9)^0 = 1$$

Ans: 1

8. Write $\frac{1}{32}$ as a power of 2 with a negative exponent. [2]

Divide repeatedly by 2: 32, 16, 8, 4, 2, so $32 = 2^5$.

$$\begin{aligned}\frac{1}{32} &= \frac{1}{2^5} \\ &= 2^{-5} \text{ (since } \frac{1}{a^n} = a^{-n} \text{)}\end{aligned}$$

Ans: 2^{-5}

9. Write $(\frac{4}{7})^{-6}$ with a positive exponent. [1]

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

$$(\frac{4}{7})^{-6} = (\frac{7}{4})^6$$

Ans: $(\frac{7}{4})^6$

10. Find the value of $(-1)^{24} + (-1)^{35}$. [1]

24 is even, so $(-1)^{24} = 1$; 35 is odd, so $(-1)^{35} = -1$.

$$(-1)^{24} + (-1)^{35} = 1 + (-1) = 0$$

Ans: 0

11. Find the values of $(-2)^8$ and $(-2)^9$. [2]

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

$$(-2)^8 = 2^8 = 256 \text{ (8 is even)}$$

$$(-2)^9 = -2^9 = -512 \text{ (9 is odd)}$$

Ans: $(-2)^8 = 256$, $(-2)^9 = -512$

12. If $2^{2x-1} = 128$, find x . [3]

Given, $2^{2x-1} = 128$

Dividing 128 repeatedly by 2: 128, 64, 32, 16, 8, 4, 2, so $128 = 2^7$.

$$\Rightarrow 2^{2x-1} = 2^7$$

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

$$\Rightarrow 2x - 1 = 7$$

$$\Rightarrow 2x = 7 + 1$$

$$\Rightarrow 2x = 8$$

$$\Rightarrow x = \frac{8}{2} = 4$$

Ans: $x = 4$

13. Write 5^{2x} as a power of 25. [2]

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

$$5^{2x} = (5^2)^x$$

$$= 25^x$$

Ans: 25^x

14. Simplify $\left(\frac{p^3}{3}\right)^3$. [3]

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

$$\begin{aligned}\left(\frac{p^3}{3}\right)^3 &= \frac{(p^3)^3}{3^3} \\ &= \frac{p^9}{27}\end{aligned}$$

Ans: $\frac{p^9}{27}$

15. Simplify $\frac{(3^2)^4 \times 3^5}{3^9}$. [3]

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

$$\frac{(3^2)^4 \times 3^5}{3^9} = \frac{3^8 \times 3^5}{3^9} = \frac{3^{13}}{3^9}$$

Using $\frac{a^m}{a^n} = a^{m-n}$: $3^{13-9} = 3^4$

Ans: 3^4

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

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

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

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

Ans: $\frac{1}{81}$

17. (i) If $5^{x+4} \div 5^{-2} = 625$, find x . (ii) If $(2^3)^x \times 2 = 1024$, find x . [5]

(i) Given, $5^{x+4} \div 5^{-2} = 625$

Dividing 625 repeatedly by 5: 625, 125, 25, 5, so $625 = 5^4$.

$$\Rightarrow 5^{x+4-(-2)} = 5^4 \quad \left(\frac{a^m}{a^n} = a^{m-n}\right)$$

$$\Rightarrow 5^{x+6} = 5^4$$

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

$$\Rightarrow x + 6 = 4$$

$$\Rightarrow x = 4 - 6$$

$$\Rightarrow x = -2$$

(ii) Given, $(2^3)^x \times 2 = 1024$

Dividing 1024 repeatedly by 2: 1024, 512, 256, 128, 64, 32, 16, 8, 4, 2, so $1024 = 2^{10}$.

$$\Rightarrow 2^{3x} \times 2^1 = 2^{10} \quad ((a^m)^n = a^{m \times n})$$

$$\Rightarrow 2^{3x+1} = 2^{10} \quad (a^m \times a^n = a^{m+n})$$

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

$$\Rightarrow 3x + 1 = 10$$

$$\Rightarrow 3x = 10 - 1$$

$$\Rightarrow 3x = 9$$

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

Ans: (i) $x = -2$ (ii) $x = 3$

18. Find the value of: (i) $2^5 \times \left(\frac{3}{2}\right)^5$ (ii) $(-1)^4 + (-1)^7 + (-1)^9$ [5]

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

$$2^5 \times \left(\frac{3}{2}\right)^5 = \left(2 \times \frac{3}{2}\right)^5$$

$$= 3^5 = 243$$

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

$$(-1)^4 + (-1)^7 + (-1)^9 = 1 + (-1) + (-1)$$

$$= -1$$

Ans: (i) 243 (ii) -1

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

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

$$2^{\frac{11}{2}} \div 2^{\frac{5}{2}} = 2^{\frac{11}{2} - \frac{5}{2}}$$

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

$$= 8$$

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

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

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

$$= 16$$

Ans: (i) 8 (ii) 16

20. Simplify: (i) $9^2 \times \left(\frac{5}{3}\right)^4$ (ii) $(2^{-1} - 3^{-1}) \div 5^{-1}$ [5]

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

$$9^2 \times \left(\frac{5}{3}\right)^4 = 81 \times \frac{5^4}{3^4}$$

$$= 81 \times \frac{625}{81}$$

$$= 625$$

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

$$= \frac{3-2}{6} \div \frac{1}{5} = \frac{1}{6} \div \frac{1}{5}$$

$$= \frac{1}{6} \times 5 = \frac{5}{6}$$

Ans: (i) 625 (ii) $\frac{5}{6}$
