

Exponents (Level 1)

Question Paper, Set 08

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 $\left(\frac{5}{6}\right)^3$ as a product. [1 mark]
2. Which is greater, 4^5 or 5^4 ? [1 mark]
3. Write 4096 as a power of 4. [2 marks]
4. Simplify $12^7 \times 12^9 \times 12^{14}$. [2 marks]
5. Simplify $(y^5)^7$. [1 mark]
6. Write $8^2 \times 5^2$ as a single power and find its value. [2 marks]
7. Find the value of $9^0 - 1$. [1 mark]
8. Write $\frac{1}{729}$ as a power of 9 with a negative exponent. [2 marks]
9. Write $\left(\frac{2}{13}\right)^{-7}$ with a positive exponent. [1 mark]
10. Find the value of $(-1)^{40} \times (-1)^{52}$. [1 mark]
11. Find the values of $(-10)^3$ and $(-10)^4$. [2 marks]
12. If $10^{x+3} = 1,00,000$, find x . [3 marks]
13. Write 4^{x-3} as a quotient of two powers and simplify. [2 marks]
14. Simplify $(5t^4)^3$. [3 marks]
15. Simplify $(m^3n)^2 \times (mn^2)^2$. [3 marks]
16. Simplify $(-5)^{-3}$ and find its value. [3 marks]
17. (i) If $4^{2y-1} = \frac{1}{16}$, find y . (ii) If $(-5)^{x+1} \times (-5)^2 = (-5)^6$, find x . [5 marks]
18. Find the value of: (i) $(5^{-6} \div 5^{-8}) \times 5^1$ (ii) $4^2 \times \left(\frac{7}{4}\right)^2$ [5 marks]
19. Find the value of: (i) $10^{\frac{5}{2}} \times 10^{\frac{1}{2}}$ (ii) $7^{\frac{9}{2}} \div 7^{\frac{3}{2}}$ [5 marks]
20. Simplify: (i) $(5^2 \div 5^5)^2 \times 5^4$ (ii) $(2^{-1} - 5^{-1}) \div 4^{-1}$ [5 marks]

Key sheet

Q	Answer
1	$\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}$
2	4^5 , since $1024 > 625$
3	$4096 = 4^6$
4	12^{30}
5	y^{35}
6	$(40)^2 = 1600$
7	0
8	9^{-3}
9	$\left(\frac{13}{2}\right)^7$
10	1
11	$(-10)^3 = -1000$, $(-10)^4 = 10,000$
12	$x = 2$
13	$\frac{4^x}{64}$
14	$125t^{12}$
15	m^8n^6
16	$-\frac{1}{125}$
17	(i) $y = -\frac{1}{2}$ (ii) $x = 3$
18	(i) 125 (ii) 49
19	(i) 1000 (ii) 343
20	(i) $\frac{1}{25}$ (ii) $\frac{6}{5}$

Solutions

1. Write $(\frac{5}{6})^3$ as a product. [1]

$(\frac{5}{6})^3$ means (5, 6) multiplied by itself 3 times.

$$(\frac{5}{6})^3 = \frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}$$

Ans: $\frac{5}{6} \times \frac{5}{6} \times \frac{5}{6}$

2. Which is greater, 4^5 or 5^4 ? [1]

$$4^5 = 4 \times 4 \times 4 \times 4 \times 4 = 1024$$

$$5^4 = 5 \times 5 \times 5 \times 5 = 625$$

$1024 > 625$, so 4^5 is greater.

Ans: 4^5 , since $1024 > 625$

3. Write 4096 as a power of 4. [2]

Divide repeatedly by 4: 4096, 1024, 256, 64, 16, 4.

$$4096 = 4 \times 4 \times 4 \times 4 \times 4 \times 4$$

$$= 4^6$$

Ans: $4096 = 4^6$

4. Simplify $12^7 \times 12^9 \times 12^{14}$. [2]

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

$$12^7 \times 12^9 \times 12^{14} = 12^{7+9+14}$$

$$= 12^{30}$$

Ans: 12^{30}

5. Simplify $(y^5)^7$. [1]

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

$$(y^5)^7 = y^{5 \times 7}$$

$$= y^{35}$$

Ans: y^{35}

6. Write $8^2 \times 5^2$ as a single power and find its value. [2]

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

$$8^2 \times 5^2 = (8 \times 5)^2$$

$$= (40)^2 = 40 \times 40$$

$$= 1600$$

Ans: $(40)^2 = 1600$

7. Find the value of $9^0 - 1$. [1]

$$9^0 = 1$$

$$9^0 - 1 = 1 - 1 = 0$$

Ans: 0

8. Write $\frac{1}{729}$ as a power of 9 with a negative exponent. [2]

Divide repeatedly by 9: 729, 81, 9, so $729 = 9^3$.

$$\begin{aligned}\frac{1}{729} &= \frac{1}{9^3} \\ &= 9^{-3} \text{ (since } \frac{1}{a^n} = a^{-n} \text{)}\end{aligned}$$

Ans: 9^{-3}

9. Write $(\frac{2}{13})^{-7}$ with a positive exponent. [1]

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

$$(\frac{2}{13})^{-7} = (\frac{13}{2})^7$$

Ans: $(\frac{13}{2})^7$

10. Find the value of $(-1)^{40} \times (-1)^{52}$. [1]

40 is even, so $(-1)^{40} = 1$; 52 is even, so $(-1)^{52} = 1$.

$$(-1)^{40} \times (-1)^{52} = 1 \times 1 = 1$$

Ans: 1

11. Find the values of $(-10)^3$ and $(-10)^4$. [2]

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

$$(-10)^3 = -10^3 = -1000 \text{ (3 is odd)}$$

$$(-10)^4 = 10^4 = 10,000 \text{ (4 is even)}$$

Ans: $(-10)^3 = -1000$, $(-10)^4 = 10,000$

12. If $10^{x+3} = 1,00,000$, find x . [3]

Given, $10^{x+3} = 1,00,000$

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

$$\Rightarrow 10^{x+3} = 10^5$$

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

$$\Rightarrow x + 3 = 5$$

$$\Rightarrow x = 5 - 3$$

$$\Rightarrow x = 2$$

Ans: $x = 2$

13. Write 4^{x-3} as a quotient of two powers and simplify. [2]

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

$$4^{x-3} = \frac{4^x}{4^3}$$

$$= \frac{4^x}{64}$$

Ans: $\frac{4^x}{64}$

14. Simplify $(5t^4)^3$. [3]

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

$$(5t^4)^3 = 5^3 \times (t^4)^3$$

$$= 125 \times t^{12} = 125t^{12}$$

Ans: $125t^{12}$

15. Simplify $(m^3n)^2 \times (mn^2)^2$. [3]

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

$$(m^3n)^2 \times (mn^2)^2 = m^6n^2 \times m^2n^4$$

Using $a^m \times a^n = a^{m+n}$: $= m^8n^6$

Ans: m^8n^6

16. Simplify $(-5)^{-3}$ and find its value. [3]

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

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

$$= \frac{1}{-125} = -\frac{1}{125} \text{ (3 is odd)}$$

Ans: $-\frac{1}{125}$

17. (i) If $4^{2y-1} = \frac{1}{16}$, find y . (ii) If $(-5)^{x+1} \times (-5)^2 = (-5)^6$, find x . [5]

(i) Given, $4^{2y-1} = \frac{1}{16}$

$$\frac{1}{16} = \frac{1}{4^2} = 4^{-2} \text{ (dividing 16 repeatedly by 4: 16, 4)}$$

$$\Rightarrow 4^{2y-1} = 4^{-2}$$

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

$$\Rightarrow 2y - 1 = -2$$

$$\Rightarrow 2y = -2 + 1$$

$$\Rightarrow 2y = -1$$

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

(ii) Given, $(-5)^{x+1} \times (-5)^2 = (-5)^6$

$$\Rightarrow (-5)^{x+1+2} = (-5)^6 \text{ (} a^m \times a^n = a^{m+n} \text{)}$$

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

$$\Rightarrow x + 3 = 6$$

$$\Rightarrow x = 6 - 3$$

$$\Rightarrow x = 3$$

Ans: (i) $y = -\frac{1}{2}$ (ii) $x = 3$

18. Find the value of: (i) $(5^{-6} \div 5^{-8}) \times 5^1$ (ii) $4^2 \times \left(\frac{7}{4}\right)^2$ [5]

$$(i) (5^{-6} \div 5^{-8}) \times 5^1 = \frac{5^{-6}}{5^{-8}} \times 5^1$$

$$= 5^{-6+8} \times 5^1 = 5^2 \times 5^1$$

$$= 5^{2+1} = 5^3$$

$$= 125$$

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

$$4^2 \times \left(\frac{7}{4}\right)^2 = \left(4 \times \frac{7}{4}\right)^2$$

$$= 7^2 = 49$$

Ans: (i) 125 (ii) 49

19. Find the value of: (i) $10^{\frac{5}{2}} \times 10^{\frac{1}{2}}$ (ii) $7^{\frac{9}{2}} \div 7^{\frac{3}{2}}$ [5]

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

$$10^{\frac{5}{2}} \times 10^{\frac{1}{2}} = 10^{\frac{5}{2} + \frac{1}{2}}$$

$$= 10^{\frac{6}{2}} = 10^3$$

$$= 1000$$

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

$$7^{\frac{9}{2}} \div 7^{\frac{3}{2}} = 7^{\frac{9}{2} - \frac{3}{2}}$$

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

$$= 343$$

Ans: (i) 1000 (ii) 343

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

$$(i) (5^2 \div 5^5)^2 \times 5^4 = \left(\frac{5^2}{5^5}\right)^2 \times 5^4$$

$$= (5^{2-5})^2 \times 5^4 = (5^{-3})^2 \times 5^4$$

$$= 5^{-6} \times 5^4 \quad ((a^m)^n = a^{m \times n})$$

$$= 5^{-6+4} = 5^{-2}$$

$$= \frac{1}{5^2} = \frac{1}{25}$$

$$(ii) (2^{-1} - 5^{-1}) \div 4^{-1} = \left(\frac{1}{2} - \frac{1}{5}\right) \div \frac{1}{4}$$

$$= \frac{5-2}{10} \div \frac{1}{4} = \frac{3}{10} \div \frac{1}{4}$$

$$= \frac{3}{10} \times 4 = \frac{6}{5}$$

Ans: (i) $\frac{1}{25}$ (ii) $\frac{6}{5}$
