

Exponents (Level 1)

Question Paper, Set 10

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 4^7 as a product. [1 mark]
2. Which is greater, 3^4 or 4^3 ? [1 mark]
3. Write 2197 as a power of 13. [2 marks]
4. Simplify $6^2 \times 6^2$ and find its value. [2 marks]
5. Simplify $(13^8)^2$. [1 mark]
6. Write $3^2 \times 7^2$ as a single power and find its value. [2 marks]
7. Find the value of $(2^5)^0$. [1 mark]
8. Write $\frac{1}{512}$ as a power of 8 with a negative exponent. [2 marks]
9. Write $(\frac{1}{8})^{-2}$ with a positive exponent. [1 mark]
10. Find the value of $(-1)^8 - (-1)^{13}$. [1 mark]
11. Find the values of $(-5)^5$ and $(-5)^6$. [2 marks]
12. If $9^{y+1} = 729$, find y . [3 marks]
13. Write $(\frac{2}{7})^3$ and $\frac{1}{4^5}$ using negative exponents. [2 marks]
14. Simplify $(10b^2)^3$. [3 marks]
15. Simplify $\frac{(2^4)^3 \times 2^1}{2^{10}}$. [3 marks]
16. Simplify $4^{-2} \times 3^{-2}$ and find its value. [3 marks]
17. (i) If $6^{x+1} = \frac{1}{36}$, find x . (ii) If $(2^2)^x \times 2^3 = 512$, find x . [5 marks]
18. Find the value of: (i) $(4^{-1} \times 6^{-1}) \div 2^{-2}$ (ii) $(-3)^3 + (-6)^2$ [5 marks]
19. Find the value of: (i) $2^{\frac{4}{3}} \times 2^{\frac{5}{3}}$ (ii) $10^{\frac{2}{3}} \div 10^{\frac{8}{3}}$ [5 marks]
20. Simplify: (i) $16^2 \times (\frac{3}{4})^4$ (ii) $(-5)^{-7} \div (-5)^{-9}$ [5 marks]

Key sheet

Q	Answer
1	$4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$
2	3^4 , since $81 > 64$
3	$2197 = 13^3$
4	$6^4 = 1296$
5	13^{16}
6	$(21)^2 = 441$
7	1
8	8^{-3}
9	8^2
10	2
11	$(-5)^5 = -3125$, $(-5)^6 = 15,625$
12	$y = 2$
13	$\left(\frac{7}{2}\right)^{-3}$, 4^{-5}
14	$1000b^6$
15	2^3
16	$\frac{1}{144}$
17	(i) $x = -3$ (ii) $x = 3$
18	(i) $\frac{1}{6}$ (ii) 9
19	(i) 8 (ii) $\frac{1}{100}$
20	(i) 81 (ii) 25

Solutions

1. Write 4^7 as a product. [1]

4^7 means 4 multiplied by itself 7 times.

$$4^7 = 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$$

Ans: $4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$

2. Which is greater, 3^4 or 4^3 ? [1]

$$3^4 = 3 \times 3 \times 3 \times 3 = 81$$

$$4^3 = 4 \times 4 \times 4 = 64$$

$81 > 64$, so 3^4 is greater.

Ans: 3^4 , since $81 > 64$

3. Write 2197 as a power of 13. [2]

Divide repeatedly by 13: 2197, 169, 13.

$$2197 = 13 \times 13 \times 13$$

$$= 13^3$$

Ans: $2197 = 13^3$

4. Simplify $6^2 \times 6^2$ and find its value. [2]

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

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

$$= 1296$$

Ans: $6^4 = 1296$

5. Simplify $(13^8)^2$. [1]

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

$$(13^8)^2 = 13^{8 \times 2}$$

$$= 13^{16}$$

Ans: 13^{16}

6. Write $3^2 \times 7^2$ as a single power and find its value. [2]

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

$$3^2 \times 7^2 = (3 \times 7)^2$$

$$= (21)^2 = 21 \times 21$$

$$= 441$$

Ans: $(21)^2 = 441$

7. Find the value of $(2^5)^0$. [1]

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

$$(2^5)^0 = 2^{5 \times 0} = 2^0 = 1$$

Ans: 1

8. Write $\frac{1}{512}$ as a power of 8 with a negative exponent. [2]

Divide repeatedly by 8: 512, 64, 8, so $512 = 8^3$.

$$\begin{aligned}\frac{1}{512} &= \frac{1}{8^3} \\ &= 8^{-3} \text{ (since } \frac{1}{a^n} = a^{-n} \text{)}\end{aligned}$$

Ans: 8^{-3}

9. Write $(\frac{1}{8})^{-2}$ with a positive exponent. [1]

$$\begin{aligned}\text{Using } \left(\frac{a}{b}\right)^{-n} &= \left(\frac{b}{a}\right)^n \\ \left(\frac{1}{8}\right)^{-2} &= \left(\frac{8}{1}\right)^2, \left(\frac{8}{1}\right)^2 = 8^2\end{aligned}$$

Ans: 8^2

10. Find the value of $(-1)^8 - (-1)^{13}$. [1]

8 is even, so $(-1)^8 = 1$; 13 is odd, so $(-1)^{13} = -1$.

$$(-1)^8 - (-1)^{13} = 1 - (-1) = 2$$

Ans: 2

11. Find the values of $(-5)^5$ and $(-5)^6$. [2]

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

$$(-5)^5 = -5^5 = -3125 \text{ (5 is odd)}$$

$$(-5)^6 = 5^6 = 15,625 \text{ (6 is even)}$$

Ans: $(-5)^5 = -3125$, $(-5)^6 = 15,625$

12. If $9^{y+1} = 729$, find y . [3]

$$\text{Given, } 9^{y+1} = 729$$

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

$$\Rightarrow 9^{y+1} = 9^3$$

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

$$\Rightarrow y + 1 = 3$$

$$\Rightarrow y = 3 - 1$$

$$\Rightarrow y = 2$$

Ans: $y = 2$

13. Write $(\frac{2}{7})^3$ and $\frac{1}{4^5}$ using negative exponents. [2]

$$\text{Using } \left(\frac{b}{a}\right)^n = \left(\frac{a}{b}\right)^{-n}: \left(\frac{2}{7}\right)^3 = \left(\frac{7}{2}\right)^{-3}$$

$$\text{Using } \frac{1}{a^n} = a^{-n}: \frac{1}{4^5} = 4^{-5}$$

Ans: $(\frac{7}{2})^{-3}$, 4^{-5}

14. Simplify $(10b^2)^3$. [3]

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

$$(10b^2)^3 = 10^3 \times (b^2)^3$$

$$= 1000 \times b^6 = 1000b^6$$

Ans: $1000b^6$

15. Simplify $\frac{(2^4)^3 \times 2^1}{2^{10}}$. [3]

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

$$\frac{(2^4)^3 \times 2^1}{2^{10}} = \frac{2^{12} \times 2^1}{2^{10}} = \frac{2^{13}}{2^{10}}$$

$$\text{Using } \frac{a^m}{a^n} = a^{m-n}, 2^{13-10} = 2^3$$

Ans: 2^3

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

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

$$4^{-2} \times 3^{-2} = (4 \times 3)^{-2} = 12^{-2}$$

$$= \frac{1}{12^2} = \frac{1}{144}$$

Ans: $\frac{1}{144}$

17. (i) If $6^{x+1} = \frac{1}{36}$, find x . (ii) If $(2^2)^x \times 2^3 = 512$, find x . [5]

(i) Given, $6^{x+1} = \frac{1}{36}$

$$\frac{1}{36} = \frac{1}{6^2} = 6^{-2} \text{ (dividing 36 repeatedly by 6: 36, 6)}$$

$$\Rightarrow 6^{x+1} = 6^{-2}$$

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

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

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

$$\Rightarrow x = -3$$

(ii) Given, $(2^2)^x \times 2^3 = 512$

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

$$\Rightarrow 2^{2x} \times 2^3 = 2^9 \text{ ((} a^m \text{)}^n = a^{m \times n} \text{)}$$

$$\Rightarrow 2^{2x+3} = 2^9 \text{ (} a^m \times a^n = a^{m+n} \text{)}$$

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

$$\Rightarrow 2x + 3 = 9$$

$$\Rightarrow 2x = 9 - 3$$

$$\Rightarrow 2x = 6$$

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

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

18. Find the value of: (i) $(4^{-1} \times 6^{-1}) \div 2^{-2}$ (ii) $(-3)^3 + (-6)^2$ [5]

$$(i) (4^{-1} \times 6^{-1}) \div 2^{-2} = \left(\frac{1}{4} \times \frac{1}{6}\right) \div \frac{1}{2^2}$$

$$= \frac{1}{24} \div \frac{1}{4}$$

$$= \frac{1}{24} \times 4 = \frac{1}{6}$$

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

$$(-3)^3 + (-6)^2 = -3^3 + 6^2$$

$$= -27 + 36$$

$$= 9$$

Ans: (i) $\frac{1}{6}$ (ii) 9

19. Find the value of: (i) $2^{\frac{4}{3}} \times 2^{\frac{5}{3}}$ (ii) $10^{\frac{2}{3}} \div 10^{\frac{8}{3}}$ [5]

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

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

$$= 2^{\frac{9}{3}} = 2^3$$

$$= 8$$

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

$$10^{\frac{2}{3}} \div 10^{\frac{8}{3}} = 10^{\frac{2}{3} - \frac{8}{3}}$$

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

$$= \frac{1}{10^2} = \frac{1}{100}$$

Ans: (i) 8 (ii) $\frac{1}{100}$

20. Simplify: (i) $16^2 \times \left(\frac{3}{4}\right)^4$ (ii) $(-5)^{-7} \div (-5)^{-9}$ [5]

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

$$16^2 \times \left(\frac{3}{4}\right)^4 = 256 \times \frac{3^4}{4^4}$$

$$= 256 \times \frac{81}{256}$$

$$= 81$$

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

$$(-5)^{-7} \div (-5)^{-9} = (-5)^{-7-(-9)} = (-5)^{-7+9} = (-5)^2$$

$$= 25$$

Ans: (i) 81 (ii) 25
