

Exponents (Level 1)

Question Paper, Set 03

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 $m \times m \times m \times m \times m \times m$ in exponential form. [1 mark]
2. Find the value of 11^3 . [1 mark]
3. Write 3125 as a power of 5. [2 marks]
4. Simplify $\left(\frac{2}{5}\right)^3 \times \left(\frac{2}{5}\right)^6$. [1 mark]
5. Simplify $\frac{13^9}{13}$. [2 marks]
6. Write $5^3 \times 6^3$ as a single power and find its value. [2 marks]
7. Simplify $\frac{35^3}{7^3}$ and find its value. [2 marks]
8. Find the value of $\left(\frac{5}{11}\right)^0$. [1 mark]
9. Find the value of 2^{-6} . [2 marks]
10. Find the value of $(-1)^{84}$. [1 mark]
11. Find the value of $(-9)^3$. [1 mark]
12. If $5^{3m+1} = 625$, find m . [3 marks]
13. Write 2^{x-5} as a quotient of two powers and simplify. [2 marks]
14. Simplify $(3m^4)^3$. [3 marks]
15. Simplify $(xy^2)^3 \times (x^2y)^4$. [3 marks]
16. Simplify $(-2)^{-5}$ and find its value. [3 marks]
17. (i) If $7^{2x-1} \times 7^3 = 2401$, find x . (ii) If $(-3)^{x+2} \times (-3)^4 = (-3)^9$, find x . [5 marks]
18. Find the value of: (i) $(5^0 + 3^{-1}) \times 3^2$ (ii) $(-3)^4 + (-2)^5$ [5 marks]
19. Find the value of: (i) $2^{\frac{7}{2}} \times 2^{\frac{5}{2}}$ (ii) $5^{\frac{7}{3}} \div 5^{\frac{1}{3}}$ [5 marks]
20. Simplify: (i) $\left(\frac{3}{4}\right)^{-2} \times \left(\frac{5}{3}\right)^{-3} \times \left(\frac{4}{5}\right)^{-4}$ (ii) $(-2)^{-15} \div (-2)^{-12}$ [5 marks]

Key sheet

Q	Answer
1	m^6
2	1331
3	$3125 = 5^5$
4	$\left(\frac{2}{5}\right)^9$
5	13^8
6	$(30)^3 = 27,000$
7	125
8	1
9	$\frac{1}{64}$
10	1
11	-729
12	$m = 1$
13	$\frac{2^x}{32}$
14	$27m^{12}$
15	$x^{11}y^{10}$
16	$-\frac{1}{32}$
17	(i) $x = 1$ (ii) $x = 3$
18	(i) 12 (ii) 49
19	(i) 64 (ii) 25
20	(i) $\frac{15}{16}$ (ii) $-\frac{1}{8}$

Solutions

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

m is multiplied by itself 6 times.

$\therefore m \times m \times m \times m \times m \times m = m^6$, read as ' m power 6'

Ans: m^6

2. Find the value of 11^3 . [1]

$$11^3 = 11 \times 11 \times 11$$

$$= 1331$$

Ans: 1331

3. Write 3125 as a power of 5. [2]

Divide repeatedly by 5: 3125, 625, 125, 25, 5.

$$3125 = 5 \times 5 \times 5 \times 5 \times 5$$

$$= 5^5$$

Ans: $3125 = 5^5$

4. Simplify $\left(\frac{2}{5}\right)^3 \times \left(\frac{2}{5}\right)^6$. [1]

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

$$\left(\frac{2}{5}\right)^3 \times \left(\frac{2}{5}\right)^6 = \left(\frac{2}{5}\right)^{3+6}$$

$$= \left(\frac{2}{5}\right)^9$$

Ans: $\left(\frac{2}{5}\right)^9$

5. Simplify $\frac{13^9}{13}$. [2]

$13 = 13^1$, Using $\frac{a^m}{a^n} = a^{m-n}$

$$\frac{13^9}{13} = 13^{9-1} = 13^8$$

Ans: 13^8

6. Write $5^3 \times 6^3$ as a single power and find its value. [2]

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

$$5^3 \times 6^3 = (5 \times 6)^3$$

$$= (30)^3 = 30 \times 30 \times 30$$

$$= 27,000$$

Ans: $(30)^3 = 27,000$

7. Simplify $\frac{35^3}{7^3}$ and find its value. [2]

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

$$\frac{35^3}{7^3} = \left(\frac{35}{7}\right)^3$$

$$= 5^3$$

$$= 125$$

Ans: 125

8. Find the value of $\left(\frac{5}{11}\right)^0$. [1]

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

$$\left(\frac{5}{11}\right)^0 = 1$$

Ans: 1

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

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

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

$$= \frac{1}{64}$$

Ans: $\frac{1}{64}$

10. Find the value of $(-1)^{84}$. [1]

84 is an even number.

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

$$\therefore (-1)^{84} = 1$$

Ans: 1

11. Find the value of $(-9)^3$. [1]

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

$$(-9)^3 = -9^3 = -729$$

Ans: -729

12. If $5^{3m+1} = 625$, find m . [3]

$$\text{Given, } 5^{3m+1} = 625$$

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

$$\Rightarrow 5^{3m+1} = 5^4$$

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

$$\Rightarrow 3m + 1 = 4$$

$$\Rightarrow 3m = 4 - 1$$

$$\Rightarrow 3m = 3$$

$$\Rightarrow m = \frac{3}{3} = 1$$

Ans: $m = 1$

13. Write 2^{x-5} as a quotient of two powers and simplify. [2]

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

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

$$= \frac{2^x}{32}$$

Ans: $\frac{2^x}{32}$

14. Simplify $(3m^4)^3$. [3]

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

$$\begin{aligned}(3m^4)^3 &= 3^3 \times (m^4)^3 \\ &= 27 \times m^{12} = 27m^{12}\end{aligned}$$

Ans: $27m^{12}$

15. Simplify $(xy^2)^3 \times (x^2y)^4$. [3]

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

$$\begin{aligned}(xy^2)^3 \times (x^2y)^4 &= x^3y^6 \times x^8y^4 \\ \text{Using } a^m \times a^n &= a^{m+n}: = x^{11}y^{10}\end{aligned}$$

Ans: $x^{11}y^{10}$

16. Simplify $(-2)^{-5}$ and find its value. [3]

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

$$\begin{aligned}(-2)^{-5} &= \frac{1}{(-2)^5} \\ &= \frac{1}{-32} = -\frac{1}{32} \text{ (5 is odd)}\end{aligned}$$

Ans: $-\frac{1}{32}$

17. (i) If $7^{2x-1} \times 7^3 = 2401$, find x . (ii) If $(-3)^{x+2} \times (-3)^4 = (-3)^9$, find x . [5]

(i) Given, $7^{2x-1} \times 7^3 = 2401$

Dividing 2401 repeatedly by 7: 2401, 343, 49, 7, so $2401 = 7^4$.

$$\Rightarrow 7^{2x-1+3} = 7^4 \text{ (} a^m \times a^n = a^{m+n} \text{)}$$

$$\Rightarrow 7^{2x+2} = 7^4$$

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

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

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

$$\Rightarrow 2x = 2$$

$$\Rightarrow x = \frac{2}{2} = 1$$

(ii) Given, $(-3)^{x+2} \times (-3)^4 = (-3)^9$

$$\Rightarrow (-3)^{x+2+4} = (-3)^9 \text{ (} a^m \times a^n = a^{m+n} \text{)}$$

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

$$\Rightarrow x + 6 = 9$$

$$\Rightarrow x = 9 - 6$$

$$\Rightarrow x = 3$$

Ans: (i) $x = 1$ (ii) $x = 3$

18. Find the value of: (i) $(5^0 + 3^{-1}) \times 3^2$ (ii) $(-3)^4 + (-2)^5$ [5]

(i) $(5^0 + 3^{-1}) \times 3^2 = (1 + \frac{1}{3}) \times 9$

$$= \frac{4}{3} \times 9$$

$$= 12$$

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

$$(-3)^4 + (-2)^5 = 3^4 - 2^5$$

$$= 81 - 32$$

$$= 49$$

Ans: (i) 12 (ii) 49

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

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

$$2^{\frac{7}{2}} \times 2^{\frac{5}{2}} = 2^{\frac{7}{2} + \frac{5}{2}}$$

$$= 2^{\frac{12}{2}} = 2^6$$

$$= 64$$

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

$$5^{\frac{7}{3}} \div 5^{\frac{1}{3}} = 5^{\frac{7}{3} - \frac{1}{3}}$$

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

$$= 25$$

Ans: (i) 64 (ii) 25

20. Simplify: (i) $(\frac{3}{4})^{-2} \times (\frac{5}{3})^{-3} \times (\frac{4}{5})^{-4}$ (ii) $(-2)^{-15} \div (-2)^{-12}$ [5]

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

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

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

$$= 3^1 \times 4^{-2} \times 5^1 \quad (a^m \times a^n = a^{m+n}, \frac{a^m}{a^n} = a^{m-n})$$

$$= 3 \times \frac{1}{16} \times 5$$

$$= \frac{15}{16}$$

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

$$(-2)^{-15} \div (-2)^{-12} = (-2)^{-15 - (-12)} = (-2)^{-15+12} = (-2)^{-3}$$

$$= \frac{1}{(-2)^3} = \frac{1}{-8} = -\frac{1}{8}$$

Ans: (i) $\frac{15}{16}$ (ii) $-\frac{1}{8}$
