CHAPTER 13

EXPONENTS AND POWERS

Points to Remember :

Recall that we may write $3 \times 3 \times 3 \times 3$ as 3^4 and read it as 3 raised to the power 4. In 3^4, we call 3 as base and 4 as exponent. Similarly, when an integer 'a' is multiplied 'n' times, the result is expressed as a^n. Here 'a' is called the base and 'n' is called the exponent.

Difference between Exponent and Power :

For example : $2^3 = 2 \times 2 \times 2 = 8$

Here 2 = Base

3 = Exponent

8 = Third power of 2.

Laws of Exponents :

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

(*ii*) $\frac{a^m}{a^n} = a^{m-n} \quad (m > n)$

(*iii*) $(a^m)^n = a^{mn}$

(*iv*) $a^m \times b^m = (ab)^m$

(*v*) $a^m \div b^m = \left(\frac{a}{b}\right)^m$

(*vi*) $a^{-m} = \frac{1}{a^m}$

Further recall that,

(*i*) $a^\circ = 1$

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

(*iii*) $(-1)^{\text{odd number}} = -1$

Standard Form

When a number is expressed as a decimal between 1.0 and 10.0 multiplied by a power of 10 it is called its standard form. Thus, $A \times 10^n$ is in the standard form where $1 \leq A < 10$ and n is an integer. For example, a number 2806196 can be expressed in the standard form as 2.806196×10^6.

QUESTIONS

1. Find the base and exponent of 7^6.
2. Find the base and exponent of $(-41)^{91}$.
3. Give exponential form for $(-P) \times (-P) \times (-P) \times (-P) \times (-P)$
4. Give exponential form for $8324 \times 8324 \times 8324 \times 8324$
5. What is the square of 21?
6. What is the cube of 11?
7. What is the square of –16?
8. What is the cube of –50?
9. Find the value of $(-1)^{501}$?
10. $3^3 \times 27^2 = 3^{\square}$
11. $25^5 \times 125^4 = 5^{\square}$
12. $100^7 \div 10^4 = 10^{\square}$
13. $7^3 \times 7^7 =$ _____
14. $4^{14} \times 4^4 =$ _____
15. $4^{48} \div 4^6 =$ _____
16. $5^{\left(2^5\right)} = 5^x$ find x.
17. $(64)^3 = (4)^x$ find x.
18. Find the value of x if $(2^6 \div 2^{-3}) \times 2^{14} = 2^x$.
19. Find the value of $\left[\left(-16^6\right) \div \left(-16\right)^3\right] \times \left(-16\right)^{-3}$
20. Express $\frac{256}{81}$ in the exponential form.
21. Express $\frac{-27}{125}$ in the exponential form.
22. Find the value of $\left(\frac{-7}{5}\right)^{13} \div \left(\frac{-7}{5}\right)^{15}$
23. Find the value of $3^0 + 5^0 + 19^0$.
24. Find the value of $(7^0 + 3^0) \times (8^0 - 5^0)$
25. Find the value of $4^0 \times 6^0 \times 100^0$

26. Solve : $\dfrac{\left(\frac{4}{7}\right)^5 \times \left(\frac{2}{3}\right)^2}{\frac{4}{9} \times \left(\frac{4}{7}\right)^3}$

27. Find the value of : $\left(\frac{1}{5} \div \frac{1}{4}\right)^3$

28. Find $4^{-1} - 8^{-1}$

29. Find the value of $\left(\frac{4}{9}\right)^{-5} \times \left(\frac{4}{9}\right)^2 \times \left(\frac{4}{9}\right)^3$

30. Change into positive power (exponent) : $\left(\frac{3}{5}\right)^{-4}$

31. Change into positive power (exponent) : $11^{-7} \times 11^{-6}$

32. Change into positive power (exponent) : $\left[\left(\frac{4}{5}\right)^{-2}\right]^4$

33. Change into negative exponent : $\left(\frac{5}{7}\right)^2$

34. Change into negative exponent : $\left[(3)^2\right]^5$

35. Change into negative exponent : $(7^5 \div 7^2) \times 3^3$

36. $(-19)^{11} \div (-19)^{15} = \dfrac{1}{(-19)^{\square}}$

37. Solve and give the answer in exponential form :

$\left(\frac{3}{14}\right)^{12} \times \left(\frac{3}{14}\right)^8 \times \left(\frac{3}{14}\right)^0$

38. Give the answer in exponential form : $\left[\left(\frac{-4}{15}\right)^2\right]^8$

39. Find the value of $2^0 + 3^0 - 6^0$.

40. Give the answer in the form of rational number :

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

41. Solve : $\left(\frac{1}{4}\right)^{-2} + \left(\frac{1}{2}\right)^{-2} + \left(\frac{1}{3}\right)^{-2}$

42. By what exponent should $(3)^{-4}$ be multiplied so that the product may be equal to 3.

43. Find the value of x if $\left(\frac{-8}{3}\right)^{11} \div \left(\frac{-8}{3}\right)^{3} = \left(\frac{-8}{3}\right)^{2x+2}$

44. Find the value of a if $\left[\left(\frac{2}{11}\right)^{8}\right]^{3} = \left(\frac{2}{11}\right)^{a+1}$

45. Find the reciprocal of $\left(\frac{1}{3}\right)^{-2} \div \left(\frac{5}{3}\right)^{-2}$

46. Solve $\left[\left(\frac{3}{2}\right)^{2}\right]^{2} \times \left(\frac{1}{2}\right)^{-2} \times 3^{0}$

47. Solve and express the result in exponential form :

$$\frac{3^{21} \times 13^{2}}{13^{17} \times 3^{6}}$$

48. Solve and express as a rational number :

$$\left[\left(\frac{-3}{4}\right)^{3} \times \frac{9}{16}\right] \div \left(\frac{-3}{4}\right)^{3}$$

49. Find the value of $(3^{-2} - 5^{-1}) \times 17^{0}$

50. Fill the box : $\left(\frac{3}{8}\right)^{3} \times \left(\frac{3}{8}\right)^{\square} = 1$

51. What is the standard form of 390878?

52. The distance of the moon from the earth is 384000 km. What is its standard form?

53. What is the standard form of 0.0034256?

54. What is the expanded form in terms of the standard form for the number 53984?

55. What is the number obtained from the expanded form $4 \times 10^{3} + 2 \times 10^{2} + 9 \times 10^{1} + 3 \times 10^{0}$?

ANSWERS

1. Base = 7 Exponent = 6
2. Base = – 41 Exponent = 91
3. $(-P)^{5}$
4. $(8324)^{4}$

5. 441
6. 1331
7. 256
8. 125000
9. -1
10. 3^9
11. 5^{22}
12. $(10)^{10}$
13. 7^{10}
14. 4^{18}
15. 4^{42}
16. 32
17. $x = 9$
18. 23
19. 1
20. $\left(\frac{4}{3}\right)^4$
21. $\left(\frac{-3}{5}\right)^3$
22. $\frac{25}{49}$
23. 3
24. 0
25. 1
26. $\frac{16}{49}$
27. $\frac{64}{125}$
28. $\frac{1}{8}$
29. 1
30. $\left(\frac{5}{3}\right)^4$
31. $\left(\frac{1}{11}\right)^{13}$
32. $\left(\frac{5}{4}\right)^8$
33. $\left(\frac{7}{5}\right)^{-2}$
34. $\left(\frac{1}{3}\right)^{-10}$
35. $\left(\frac{1}{21}\right)^{-3}$
36. $\frac{1}{(-19)^4}$
37. $\left(\frac{3}{14}\right)^{20}$
38. $\left(\frac{-4}{15}\right)^{16}$
39. 1
40. $\frac{625}{144}$
41. 29
42. $(3)^5$
43. $x = 3$
44. $a = 23$
45. $\frac{1}{25}$
46. $\frac{81}{4}$

47. $\left(\frac{3}{13}\right)^{15}$

48. $\frac{9}{16}$

49. $\frac{-4}{45}$

50. -3

51. 3.90878×10^5

52. 3.84×10^5 km

53. 3.4256×10^{-3}

54. $5 \times 10^4 + 3 \times 10^3 + 9 \times 10^2 + 8 \times 10^1 + 4 \times 10^0$

55. 4293