Chapter - 11
Exponent

Exercise

In questions 1 to 22, there are four options, out of which one is correct. Write the correct one.

1. $[(-3)^2]^3$ is equal to
(a) $(-3)^8$ (b) $(-3)^6$ (c) $(-3)^5$ (d) $(-3)^{23}$

Solution:
We know that, $(a^m)^n = (a)^{m\times n}$. Therefore,
$[(-3)^2]^3 = [(-3)]^{2\times3}$
$= (-3)^6$

So, option (b) is correct.

2. For a non-zero rational number x, $x^8 \div x^2$ is equal to
(a) x^4 (b) x^6 (c) x^{10} (d) x^{16}

Solution:
We know that, when base is same, the powers get subtracted in division. Therefore,

$$x^8 \div x^2 = \frac{x^8}{x^2}$$
$$= x^{8-2}$$
$$= x^6$$

So, option (b) is correct.

3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the
(a) second power of x (b) third power of x (c) fifth power of x (d) sixth power of x

Solution:
Square of x is x^2
And cube of x is x^3
Now, product will be $x^2 \times x^3 = x^5$ i.e., fifth power of x.

So, option (c) is correct.

4. For any two non-zero rational numbers x and y, $x^5 \div y^5$ is equal to
(a) $(x\div y)^1$ (b) $(x\div y)^0$ (c) $(x\div y)^5$ (d) $(x\div y)^{10}$

Solution:
We know that, $a^m \div b^m = (a \div b)^m$

$x^5 \div y^5 = (x \div y)^5$

So, option (c) is correct.

5. $a^m \times a^n$ is equal to
(a) $(a^2)^{mn}$ (b) a^{m-n} (c) a^{m+n} (d) a^{mn}

Solution:
We know that when base is same, power gets added in multiplication. Therefore,
$a^m \times a^n = (a)^{m+n}$
So, option (c) is correct.

6. $(1^0 + 2^0 + 3^0)$ is equal to
(a) 0 (b) 1 (c) 3 (d) 6

Solution:
We know that any number raised to the power zero is equal to 1. Therefore,
$(1^0 + 2^0 + 3^0) = (1 + 1 + 1)$
$= 3$

So, option (c) is correct.

7. Value of $(10^{22} + 10^{20})/10^{20}$ is
(a) 10 (b) 10^{42} (c) 101 (d) 10^{22}

Solution:
$$\frac{(10^{22}+10^{20})}{10^{20}} = \frac{10^{20}(10^2+1)}{10^{20}}$$
$$= 100 + 1$$
$$= 101$$
So, option (c) is correct.

8. The standard form of the number 12345 is
(a) 1234.5×10^1 (b) 123.45×10^2 (c) 12.345×10^3 (d) 1.2345×10^4

Solution:
The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, $12345 = 1.2345 \times 10^4$.

So, option (d) is correct.

9. If $2^{1998} - 2^{1997} - 2^{1996} + 2^{1995} = K.2^{1995}$, then the value of K is
(a) 1 (b) 2 (c) 3 (d) 4

Solution:

$$2^{1998}-2^{1997}-2^{1996}+2^{1995}=2^{1995}\left(2^3-2^2-2^1+1\right)$$
$$=2^{1995}\left(8-4-2+1\right)$$
$$=2^{1995}\times 3$$

This implies, K = 3

So, option (c) is correct.

10. Which of the following is equal to 1?

(a) $2^0 + 3^0 + 4^0$ (b) $2^0 \times 3^0 \times 4^0$

(c) $(3^0 - 2^0) \times 4^0$ (d) $(3^0 - 2^0) \times (3^0 + 2^0)$

Solution:

$2^0 \times 3^0 \times 4^0 = 1 \times 1 \times 1$

$= 1$

So, option (b) is correct.

11. In standard form, the number 72105.4 is written as 7.21054×10^n where n is equal to

(a) 2 (b) 3 (c) 4 (d) 5

Solution:

The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.

Therefore, $72105.4 = 7.21054 \times 10^4$.

So, option (c) is correct.

12. Square of (-2/3) is

(a) -2/3 (b) 2/3 (c) -4/9 (d) 4/9

Solution:

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

So, option (d) is correct.

13. Cube of (-1/4) is

(a) –1/12 (b) 1/16 (c) -1/64 (d) 1/64

Solution:

$$\left(-\frac{1}{4}\right)^3 = \left(-\frac{1}{4}\right)\times\left(-\frac{1}{4}\right)\times\left(-\frac{1}{4}\right)$$

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

So, option (c) is correct.

14. Which of the following is not equal to $(–5/4)^4$?
(a) $(– 5)^4/(4^4)$ (b) $(5^4)/(– 4)^4$ (c) $-(5^4 / 4^4)$ (d) (-5/4) x (-5/4) x (-5/4) x (-5/4)

Solution:

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

$$= \frac{625}{256}$$

$$-\left(\frac{5^4}{4^4}\right) = -\frac{5^4}{4^4}$$

$$= -\frac{625}{256}$$

So, option (c) is correct.

15. Which of the following is not equal to 1 ?
(a) $(2^3 \times 3^2)/4 \times 18$ (b) $[(-2)^3 \times (-2)^4] \div (-2)^7$
(c) $(3^0 \times 5^3)/(5\times25)$ (d) $2^4/(7^0 + 3^0)^3$

Solution:

$$\frac{2^4}{\left(7^0+3^0\right)^3} = \frac{2^4}{(1+1)^3}$$

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

$$= 2$$

So, option (d) is correct.

16. $(2/3)^3 \times (5/7)^3$ is equal to
(a) $(2/3 \times 5/7)^9$ (b) $(2/3 \times 5/7)^6$ (c) $(2/3 \times 5/7)^3$ (d) $(2/3 \times 5/7)^0$

Solution:
We know that, when power is same bases get multiplied in case of multiplication of exponents, therefore,

$$\left(\frac{2}{3}\right)^3 \times \left(\frac{5}{7}\right)^3 = \left(\frac{2}{3} \times \frac{5}{7}\right)^3$$

Sp, option (c) is correct.

17. In standard form, the number 829030000 is written as K × 10^8 where K is equal to
(a) 82903 (b) 829.03 (c) 82.903 (d) 8.2903

Solution:
The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, 829030000 = 8.2903 × 10 ^ 8
This implies, K is equal to 8.2903.

So, option (d) is correct.

18. Which of the following has the largest value?
(a) 0.0001 (b) 1/10000 (c) $1/10^6$ (d) $1/10^6$ ÷ 0.1

Solution:
Among the given choices, 0.0001 has the largest value equivalent to 1×10^{-4} .

So, option (a) is correct.

19. In standard form 72 crore is written as
(a) 72×10^7 (b) 72×10^8 (c) 7.2×10^8 (d) 7.2×10^7

Solution:
The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, 72 crore is written as 7.2×10^8.

So, option (c) is correct.

20. For non-zero numbers a and b, $(a/b)^m \div (a/b)^n$, where m > n, is equal to
(a) $\left(\frac{a}{b}\right)^{mn}$ (b) $\left(\frac{a}{b}\right)^{m+n}$ (c) $\left(\frac{a}{b}\right)^{m-n}$ (d) $\left(\left(\frac{a}{b}\right)^{m}\right)^{n}$

Solution:
We know that, when base is same power gets subtracted in case of division of exponents.
Therefore,

$$\left(\frac{a}{b}\right)^m \div \left(\frac{a}{b}\right)^n = \left(\frac{a}{b}\right)^{m-n}$$

So, option (c) is correct.

21. Which of the following is not true?
(a) $3^2 > 2^3$ (b) $4^3 = 2^6$ (c) $3^3 = 9$ (d) $2^5 > 5^2$

Solution:
$3^3 = 3\times3\times3$
$= 27$ which is not equal to 9.

So, option (c) is the correct choice.

22. Which power of 8 is equal to 2^6?
(a) 3 (b) 2 (c) 1 (d) 4

Solution:
$2^6 = 2\times2\times2\times2\times2\times2$
$= 64$

We know that, $8 \times 8 = 64$

Therefore, $8^2 = 2^6$.

So,option (b) is correct.

In questions 23 to 39, fill in the blanks to make the statements true.

23.
$(-2)^{31}\times(-2)^{13}=(-2)^{\_\_}$

Solution:
We know that, when base is same power get added in case of multiplication of exponents.
Therefore,
$$(-2)^{31}\times(-2)^{13}=(-2)^{31+13}$$
$$=(-2)^{44}$$

$(-2)^{31}\times(-2)^{13}=(-2)^{\underline{44}}$

24.
$(-3)^{8}\div(-3)^{5}=(-3)^{\_\_}$

Solution:
We know that, when base is same power get subtracted in case of division of exponents.
Therefore,

$$(-3)^8 \div (-3)^5 = (-3)^{8+5}$$
$$= (-3)^{13}$$

$$(-3)^8 \div (-3)^5 = (-3)^{\underline{13}}$$

25.

$$\left(\frac{11}{15}\right)^4 \times (\_)^5 = \left(\frac{11}{15}\right)^9$$

Solution:

We know that, when base is same power get added in case of multiplication of exponents.
Therefore,

$$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^5 = \left(\frac{11}{15}\right)^{4+5}$$
$$= \left(\frac{11}{15}\right)^9$$
$$\left(\frac{11}{15}\right)^4 \times \left(\frac{11}{15}\right)^{\underline{5}} = \left(\frac{11}{15}\right)^9$$

26.

$$\left(\frac{-1}{4}\right)^3 \times \left(\frac{-1}{4}\right)^{\_} = \left(\frac{-1}{4}\right)^{11}$$

Solution:

We know that, when base is same power get added in case of multiplication of exponents.
Therefore,

$$\left(-\frac{1}{4}\right)^3 \times \left(-\frac{1}{4}\right)^8 = \left(-\frac{1}{4}\right)^{3+8}$$
$$= \left(-\frac{1}{4}\right)^{11}$$

$$\left(-\frac{1}{4}\right)^3 \times \left(-\frac{1}{4}\right)^{\underline{8}} = \left(-\frac{1}{4}\right)^{11}$$

27.

$$\left[\left(\frac{7}{11}\right)^3\right]^4 = \left(\frac{7}{11}\right)^{\_\_}$$

Solution:

We know that, $(a^m)^n = (a)^{m\times n}$. Therefore,

$$\left[\left(\frac{7}{11}\right)^3\right]^4 = \left(\frac{7}{11}\right)^{3\times4}$$

$$= \left(\frac{7}{11}\right)^{12}$$

$$\left[\left(\frac{7}{11}\right)^3\right]^4 = \left(\frac{7}{11}\right)^{\underline{12}}$$

28.

$$\left(\frac{6}{13}\right)^{10} \div \left[\left(\frac{6}{13}\right)^5\right]^2 = \left(\frac{6}{13}\right)^{\underline{\quad}}$$

Solution:

$$\left(\frac{6}{13}\right)^{10} \div \left[\left(\frac{6}{13}\right)^5\right]^2 = \left(\frac{6}{13}\right)^{10} \div \left(\frac{6}{13}\right)^{5\times2}$$

$$= \left(\frac{6}{13}\right)^{10} \div \left(\frac{6}{13}\right)^{10}$$

$$= \left(\frac{6}{13}\right)^{10-10}$$

$$= \left(\frac{6}{13}\right)^{0}$$

$$\left(\frac{6}{13}\right)^{10} \div \left[\left(\frac{6}{13}\right)^5\right]^2 = \left(\frac{6}{13}\right)^{\underline{0}}$$

29.

$$\left[\left(\frac{-1}{4}\right)^{16}\right]^2 = \left(\frac{-1}{4}\right)^{\underline{\quad}}$$

Solution:

We know that, $(a^m)^n = (a)^{m\times n}$. Therefore,

$$\left[\left(\frac{-1}{4}\right)^{16}\right]^{2}=\left(\frac{-1}{4}\right)^{16\times 2}$$

$$=\left(\frac{-1}{4}\right)^{32}$$

$$\left[\left(\frac{-1}{4}\right)^{16}\right]^{2}=\left(\frac{-1}{4}\right)^{\underline{32}}$$

30.

$$\left(\frac{13}{14}\right)^{5}\div(\_)^{2}=\left(\frac{13}{14}\right)^{3}$$

Solution:

We know that, when base is same power get subtracted in case of division of exponents.
Therefore,

$$\left(\frac{13}{14}\right)^{5}\div\left(\frac{13}{14}\right)^{2}=\left(\frac{13}{14}\right)^{5-2}$$

$$=\left(\frac{13}{14}\right)^{3}$$

$(13/14)^5 \times \underline{(13/14)}^2 = (13/14)^3$

31. $a^6 \times a^5 \times a^0 = a$——

Solution:

We know that, when base is same powers get added in case of multiplication of exponents.
Therefore, $a^6 \times a^5 \times a^0$ is simplified as:

$= a^{(6 + 5 + 0)}$

$= a^{11}$

$a^6 \times a^5 \times a^0 = a^{\underline{11}}$

32. 1 lakh = 10——

Solution:

1 lakh is 1,00,000. In standard form it is written as 10^5.

1 lakh = $10^{\underline{5}}$

33. 1 million = 10——

Solution:
1 million is 1,000,000. In standard form it is written as 10^6.

1 million = $10^{\underline{6}}$

34. 729 = 3——

Solution:
729 in terms of multiples of 3 can be written as:
729 = 3×3×3×3×3×3
= 3^6

$729 = 3^{\underline{6}}$

35. 432 = 2^4 × 3——

Solution:
432 in terms of multiples of 2 and 3 can be written as:
432 = 2×2×2×2×3×3×3
= $2^4 \times 3^3$

$432 = 2^4 \times 3^{\underline{3}}$

36. 53700000 = —— × 10^7

Solution:
The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, 53700000 is written as 5.37 × 10^7.

53700000 = <u>5.37</u> × 10^7

37. 88880000000 = —— × 10^{10}

Solution:
The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, 88880000000 is written as 8.888 × 10^{10}.

88880000000 = <u>8.888</u> × 10^{10}

38. 27500000 = 2.75 × 10——

Solution:

The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, 27500000 is written as 2.75×10^7.

$27500000 = 2.75 \times 10^{\underline{7}}$

39. $340900000 = 3.409 \times 10$——

Solution:
The standard exponential form is written as a a digit at once place followed by decimal and the number of places the decimal is shifted towards left is raised to the power of 10.
Therefore, 340900000 is written as 3.409×10^8.

$340900000 = 3.409 \times 10^{\underline{8}}$

40. Fill in the blanks with or = sign.
(a) 3^2 ______15 (b) 2^3 ______ 3^2
(c) 7^4 ______5^4 (d) 10,000 ______ 10^5 (e) 6^3 _____4^4

Solution:
(a) $3^2 = 9$, which is less than 15.
So, $3^2 \underline{<} 15$

(b) $2^3 = 8$
And, $3^2 = 9$

So,$2^3 \underline{<} 3^2$

(c) $7^4 = 2401$
And, $5^4 = 625$

So, $7^4 \underline{>} 5^4$

(d) 10^5 = 1,00,000, which is greater than 10,000
So, $10{,}000 \underline{<} 10^5$

(e) $6^3 = 216$
And, $4^4 = 256$

So, $6^3 \underline{<} 4^4$

In questions 41 to 65, state whether the given statements are True or False.

41. One million = 10^7

Solution:

One million is 1,000,000. In standard form it is written as 10^6.

So, the given statement is **False**.

42. One hour = 60^2 seconds

Solution:

We know that,
One hour = 60 minutes
One minute = 60 seconds
This implies, one hour = 60×60 seconds.

So, the given statement is **True**.

43. $1^0 \times 0^1 = 1$

Solution:
$1^0 \times 0^1 = 0$

So, the given statement is **False**.

44. $(-3)^4 = -12$

Solution:
$(-3)^4 = (-3)\times(-3)\times(-3)\times(-3)$
$= 81$

So, the given statement is **False**.

45. $3^4 > 4^3$

Solution:
$3^4 = 81$
$4^3 = 64$

So, the given statement is **True**.

46. $(-3/5)^{100} = (-3^{100}/-5^{100})$

Solution:
$(-3/5)^{100} = \left(\frac{-3^{100}}{-5^{100}}\right)$

So, the given statement is **True**.

47. $(10 + 10)^{10} = 10^{10} + 10^{10}$

Solution:

$(10 + 10)^{10} = 20^{10}$

$(10 + 10)^{10} \neq 10^{10} + 10^{10}$

So, the given statement is **False**.

48. $x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

Solution:

We know that, any number or variable raised to the power zero is equal to one. Therefore,
$x^0 \times x^0 = x^0 \div x^0$ is true for all non-zero values of x.

So, the given statement is **True**.

49. In the standard form, a large number can be expressed as a decimal number between 0 and 1, multiplied by a power of 10.

Solution:

A large number in standard form can be expressed as a natural number between 1 to 9 in ones place followed by decimal, multiplied by a power of 10.

So, the given statement is **False**.

50. 4^2 is greater than 2^4.

Solution:

$4^2 = 16$

$2^4 = 16$

So, the given statement is **False**.

51. $x^m + x^m = x^{2m}$, where x is a non-zero rational number and m is a positive integer.

Solution:

$x^m + x^m = x^m (1 + 1)$

$= 2 \times x^m$

So, the given statement is **False**.

52. $x^m \times y^m = (x \times y)^{2m}$, where x and y are non-zero rational numbers and m is a positive integer

Solution:

We know that when power is same bases get multiplied in case of multiplication of exponents. Therefore, $x^m \times y^m = (x \times y)^m$.

So, the given statement is **False**.

53. $x^m \div y^m = (x \div y)^m$, where x and y are non-zero rational numbers and m is a positive integer

Solution:
We know that when power is same, bases gets divided in case of division of exponents. Therefore, $x^m \div y^m = (x \div y)^m$.

So the given statement is **True**.

54. $x^m \times x^n = x^{m+n}$, where x is a non-zero rational number and m,n are positive integers.

Solution:
We know that when base is same powers gets added in case of multiplication of exponents. Therefore, $x^m \times x^n = x^{m+n}$.

So the given statement is **True**.

55. 4^9 is greater than 16^3.

Solution:
$4^9 = 262144$
$16^3 = 4096$

So the given statement is **True**.

56. $(2/5)^3 \div (5/2)^3 = 1$

Solution:

$$\left(\frac{2}{5}\right)^3 \div \left(\frac{5}{2}\right)^3 = \left(\frac{2}{5} \div \frac{5}{2}\right)^3$$
$$= \left(\frac{4}{25}\right)^3$$

So, the given statement is **False**.

57. $(4/3)^5$ x $(5/7)^5 = (4/3 + 5/7)^5$

Solution:

$$\left(\frac{4}{3}\right)^5 \times \left(\frac{5}{7}\right)^5 = \left(\frac{4}{3} \times \frac{5}{7}\right)^5$$
$$= \left(\frac{20}{21}\right)^5$$

So, the given statement is **False**.

58. $(5/8)^9 \div (5/8)^4 = (5/8)^4$

Solution:

$$\left(\frac{5}{8}\right)^9 \div \left(\frac{5}{8}\right)^4 = \left(\frac{5}{8}\right)^{9-4}$$
$$= \left(\frac{5}{8}\right)^5$$

So, the given statement is **False**.

59. $(7/3)^2$ x $(7/3)^5 = (7/3)^{10}$

Solution:

$$\left(\frac{7}{3}\right)^2 \times \left(\frac{7}{3}\right)^5 = \left(\frac{7}{3}\right)^{2+5}$$
$$= \left(\frac{7}{3}\right)^7$$

So, the given statement is **False**.

60. $5^0 \times 25^0 \times 125^0 = (5^0)^6$

Solution:

We know that any number or variable raised to the power zero is equal to 1. Therefore, in the given equation both L.H.S and R.H.S is equal to 1.

So, the give statement is **True**.

61. $876543 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

Solution:

$876543 = 8 \times 100000 + 7 \times 10000 + 6 \times 1000 + 5 \times 100 + 4 \times 10 + 3 \times 1$
$= 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 4 \times 10^1 + 3 \times 10^0$

So the given statement is **True**.

62. $600060 = 6 \times 10^5 + 6 \times 10^2$

Solution:

$600060 = 6 \times 100000 + 6 \times 10$

$= 6 \times 10^5 + 6 \times 10^1$

So, the given statement is **False**.

63. $4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432010$

Solution:

$4 \times 10^5 + 3 \times 10^4 + 2 \times 10^3 + 1 \times 10^0 = 432001$

So, the given statement is **False**.

64. $8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

Solution:

$8 \times 10^6 + 2 \times 10^4 + 5 \times 10^2 + 9 \times 10^0 = 8020509$

So, the given statement is **True**.

65. $4^0 + 5^0 + 6^0 = (4 + 5 + 6)^0$

Solution:

$4^0 + 5^0 + 6^0 = 1 + 1 + 1$

$= 3$

And $(4+5+6)^0 = (15)^0$

$= 1$

So, the given statement is **False**.

66. Arrange in ascending order : $2^5, 3^3, 2^3 \times 2, (3^3)^2, 3^5, 4^0, 2^3 \times 3^1$

Solution:

The given numbers in ascending number is as follows:

$$4^0 < 2^3 \times 2 < 2^3 \times 3^1 < 3^3 < 2^5 < 3^5 < (3^3)^2$$

67. Arrange in descending order :
$2^2+3, (2^2)^3, 2 \times 2^2, 3^5/3^2 , 3^2 \times 3^0, 2^3 \times 5^2$

Solution:

The given numbers in descending order is as follows:

$$2^3 \times 5^2 > (2^2)^3 > 2^{2+3} > \frac{3^5}{3^2} > 3^2 \times 3^0 > 2 \times 2^2$$

68. By what number should $(-4)^5$ be divided so that the quotient may be equal to $(-4)^3$?

Solution:

Let m be the required number. According to the question,

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

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

$$m = (-4)^2$$

So, the required number is $(-4)^2$ or 16.

69. Find m so that $(2/9)^3$ x $(2/9)^6 = (2/9)^{2m-1}$

Solution:

$$\left(\frac{2}{9}\right)^3 \times \left(\frac{2}{9}\right)^6 = \left(\frac{2}{9}\right)^{2m-1}$$

$$\left(\frac{2}{9}\right)^{3+6} = \left(\frac{2}{9}\right)^{2m-1}$$

$$\left(\frac{2}{9}\right)^9 = \left(\frac{2}{9}\right)^{2m-1}$$

Since base is same, therefore, equating powers, we get,

$$9 = 2m - 1$$

$$2m = 9 + 1$$

$$2m = 10$$

$$m = 5$$

So, the required value of m is 5.

70. If $p/q = (3/2)^2 \div (9/4)^0$, find the value of $(p/q)^3$

Solution:

Given, $p/q = (3/2)^2 \div (9/4)^0$

$$\left(\frac{3}{2}\right)^2 \div \left(\frac{9}{4}\right)^0 = \left(\frac{3}{2}\right)^2 \div 1$$

$$= \left(\frac{3}{2}\right)^2 \text{ or } \frac{9}{4}$$

Therefore, $(p/q)^3$ will be:

$$\left(\frac{9}{4}\right)^3 = \frac{729}{64}$$

71. Find the reciprocal of the rational number $(1/2)^2 \div (2/3)^3$

Solution:

$$\left(\frac{1}{2}\right)^2 \div \left(\frac{2}{3}\right)^3 = \frac{1}{4} \div \frac{8}{27}$$

$$= \frac{1}{4} \times \frac{27}{8}$$

$$= \frac{27}{32}$$

Reciprocal of $\frac{27}{32}$ is $\frac{32}{27}$.

72. Find the value of :

(a) 7^0

(b) $7^7 \div 7^7$

(c) $(-7)^2 \times 7 - 6 - 8$

(d) $(2^0 + 3^0 + 4^0)(4^0 - 3^0 - 2^0)$

(e) $2 \times 3 \times 4 \div 2^0 \times 3^0 \times 4^0$

(f) $(8^0 - 2^0) \times (8^0 + 2^0)$

Solution:

(a) $7^0 = 1$

(b) $7^7 \div 7^7 = 1$

(c)

$$(-7)^{2\times 7-6-8} = (-7)^{14-14}$$

$$= (-7)^0$$

$$= 1$$

(d) $(2^0 + 3^0 + 4^0)(4^0 - 3^0 - 2^0) = (1 + 1 + 1)(1 - 1 - 1)$

$= -3$

(e) $2 \times 3 \times 4 \div 2^0 \times 3^0 \times 4^0 = 2 \times 3 \times 4 \div 1$

$= 24$

(f) $(8^0 - 2^0) \times (8^0 + 2^0) = (1 - 1) \times (1 + 1)$

$= 0$

73. Find the value of n, where n is an integer and
$2^{n-5} \times 6^{2n-4} = 1/(12^4 \times 2)$

Solution:

$$2^{n-5} \times 6^{2n-4} = \frac{1}{12^4 \times 2}$$

$$2^{n-5} \times (2 \times 3)^{2n-4} = \frac{1}{(2^2 \times 3)^4 \times 2}$$

$$2^{n-5} \times 2^{2n-4} \times 3^{2n-4} = \frac{1}{2^8 \times 3^4 \times 2}$$

$$2^{3n-9} \times 3^{2n-4} = \frac{1}{2^9 \times 3^4}$$

$$2^{3n-9} \times 3^{2n-4} = 2^{-9} \times 3^{-4}$$

Comparing like terms on both sides, we get

$3n-9=-9$ and $2n-4=-4$

$3n = 0$ and $2n = 0$

$n = 0$

So, the value of n is zero.

74. Express the following in usual form:

(a) 8.01 × 10^7 (b) 1.75 × 10^{-3}

Solution:

(a) 8.01 × 10^7 = 80100000

(b) 1.75 × 10^{-3} = 0.000175

75. Find the value of

(a) 2^5 (b) (-3^5) (c) $-(-4)^4$

Solution:

(a)

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2$$
$$= 32$$

(b)

$$(-3)^5 = (-3) \times (-3) \times (-3) \times (-3) \times (-3)$$
$$= 243$$

(c)

$$-(-4)^4 = -[(-4) \times (-4) \times (-4) \times (-4)]$$
$$= -(256)$$
$$= -256$$

76. Express the following in exponential form :

(a) 3 × 3 × 3 × a × a × a ×a

(b) a × a × b × b × b × c × c × c × c
(c) s × s × t × t × s × s × t

Solution:
(a)
$3 \times 3 \times 3 \times a \times a \times a \times a = 3^3 \times a^4$

(b)
$a \times a \times b \times b \times b \times c \times c \times c \times c = a^2 \times b^3 \times c^4$

(c)
$s \times s \times t \times t \times s \times s \times t = s^4 \times t^3$

77. How many times of 30 must be added together to get a sum equal to 30^7?

Solution:
$30^7 = 21870000000$

Let 30 must be added together m times to get a sum equal to 30^7.
So, 30 × m = 21870000000
m = 21870000000 ÷ 30
m = 729000000
$m = 7.29 \times 10^8$
So, 30 must be added 7.29×10^8 number of times to get a sum equal to 30^7.

78. Express each of the following numbers using exponential notations:
(a) 1024 (b) 1029 (c) 144/875

Solution:
(a) $1024 = 2^{10}$
(b) $1029 = 3^1 \times 7^3$
(c) $\frac{144}{875} = \frac{12^2}{5^3 \times 7^1}$

79. Identify the greater number, in each of the following:
(a) 2^6 or 6^2 (b) 2^9 or 9^2 (c) 7.9×10^4 or 5.28×10^5

Solution:
(a)
$2^6 = 64$
$6^2 = 36$
So, 2^6 is the greater number.

(b)

$2^9 = 512$
$9^2 = 81$
So, 2^9 is the greater number.

(c)
$7.9 \times 10^4 = 79000$
$5.28 \times 10^5 = 528000$
So, 5.28×10^5 is the greater number.

80. Express each of the following as a product of powers of their prime factors:
(a) 9000 (b) 2025 (c) 800

Solution:
(a) $9000 = 2^3 \times 3^2 \times 5^3$
(b) $2025 = 5^2 \times 9^2$
(c) $800 = 2^5 \times 5^2$

81. Express each of the following in single exponential form:
(a) $2^3 \times 3^3$ **(b) $2^4 \times 4^2$**
(c) $5^2 \times 7^2$ **(d) $(-5)^5 \times (-5)$**
(e) $(-3)^3 \times (-10)^3$ **(f) $(-11)^2 \times (-2)^2$**

Solution:
(a)
$$2^3 \times 3^3 = (2 \times 3)^3$$
$$= 6^3$$
(b)
$$2^4 \times 4^2 = 2^4 \times (2^2)^2$$
$$= 2^4 \times 2^4$$
$$= 2^{4+4}$$
$$= 2^8$$
(c)
$$5^2 \times 7^2 = (5 \times 7)^2$$
$$= 35^2$$
(d)
$$(-5)^5 \times (-5)^1 = (-5)^{5+1}$$
$$= (-5)^6$$
(e)
$$(-3)^3 \times (-10)^3 = ((-3) \times (-10))^3$$
$$= 30^3$$
(f)

$$(-11)^2 \times (-2)^2 = ((-11)\times(-2))^2$$
$$= 22^2$$

82. Express the following numbers in standard form:
(a) 76,47,000 (b) 8,19,00,000 (c) 5, 83,00,00,00,000 (d) 24 billion

Solution:
(a) 76,47,000 = 7.647 × 10^6
(b) 8,19,00,000 = 8.19 × 10^7
(c) 5,83,00,00,00,000 = 5.83 × 10^{11}
(d) 24 billion is 24,000,000,000 = 2.4 × 10^{10}

83. The speed of light in vacuum is 3 × 10^8 m/s. Sunlight takes about 8 minutes to reach the earth. Express distance of Sun from Earth in standard form.

Solution:
Given: Speed of light in vacuum = 3 × 10^8 m/s
Time taken by sunlight to reach the earth is 8 minutes = 480 seconds
We know that,
$$\text{speed} = \frac{\text{distance}}{\text{time}}$$
$$\text{So, distance} = \text{speed} \times \text{time}$$
$$= 3\times10^8\times480$$
$$= 1.44\times 10^{11}\,\text{m/s}$$

84. Simplify and express each of the following in exponential form:

(a) $\left[\left(\frac{3}{7}\right)^4\times\left(\frac{3}{7}\right)^5\right]\div\left(\frac{3}{7}\right)^7$

(b) $\left[\left(\frac{7}{11}\right)^5\div\left(\frac{7}{11}\right)^2\right]\times\left(\frac{7}{11}\right)^2$

(c) $\left[3^7\div3^5\right]^4$

(d) $\left(\frac{a^6}{a^4}\right)\times a^5\times a^0$

(e) $\left[\left(\frac{3}{5}\right)^3\times\left(\frac{3}{5}\right)^8\right]\div\left[\left(\frac{3}{5}\right)^2\times\left(\frac{3}{5}\right)^4\right]$

(f) $\left(5^{15}\div5^{10}\right)\times5^5$

Solution:

(a)

$$\left[\left(\frac{3}{7}\right)^4 \times \left(\frac{3}{7}\right)^5\right] \div \left(\frac{3}{7}\right)^7 = \left[\left(\frac{3}{7}\right)^{4+5}\right] \div \left(\frac{3}{7}\right)^7$$

$$= \left(\frac{3}{7}\right)^9 \div \left(\frac{3}{7}\right)^7$$

$$= \left(\frac{3}{7}\right)^{9-7}$$

$$= \left(\frac{3}{7}\right)^2$$

(b)

$$\left[\left(\frac{7}{11}\right)^5 \div \left(\frac{7}{11}\right)^2\right] \times \left(\frac{7}{11}\right)^2 = \left[\left(\frac{7}{11}\right)^{5-2}\right] \times \left(\frac{7}{11}\right)^2$$

$$= \left(\frac{7}{11}\right)^3 \times \left(\frac{7}{11}\right)^2$$

$$= \left(\frac{7}{11}\right)^{3+2}$$

$$= \left(\frac{7}{11}\right)^5$$

(c)

$$\left[3^7 \div 3^5\right]^4 = \left[(3)^{7-5}\right]^4$$

$$= \left(3^2\right)^4$$

$$= (3)^8$$

(d)

$$\left(\frac{a^6}{a^4}\right) \times a^5 \times a^0 = (a)^{6-4} \times a^5$$

$$= a^2 \times a^5$$

$$= a^{2+5}$$

$$= a^7$$

(e)

$$\left[\left(\frac{3}{5}\right)^3 \times \left(\frac{3}{5}\right)^8\right] \div \left[\left(\frac{3}{5}\right)^2 \times \left(\frac{3}{5}\right)^4\right] = \left[\left(\frac{3}{5}\right)^{3+8}\right] \div \left[\left(\frac{3}{5}\right)^{2+4}\right]$$
$$= \left(\frac{3}{5}\right)^{11} \div \left(\frac{3}{5}\right)^6$$
$$= \left(\frac{3}{5}\right)^{11-6}$$
$$= \left(\frac{3}{5}\right)^5$$

(f)
$$\left(5^{15} \div 5^{10}\right) \times 5^5 = (5)^{15-10} \times 5^5$$
$$= 5^5 \times 5^5$$
$$= 5^{5+5}$$
$$= 5^{10}$$

85. Evaluate

(a) $\dfrac{7^8 \times a^{10} b^7 c^{12}}{7^6 \times a^8 b^4 c^{12}}$

(b) $\dfrac{5^4 \times 7^4 \times 2^7}{8 \times 49 \times 5^3}$

(c) $\dfrac{125 \times 5^2 \times a^7}{10^3 \times a^4}$

(d) $\dfrac{3^4 \times 12^3 \times 36}{2^5 \times 6^3}$

(e) $\left(\dfrac{6 \times 10}{2^2 \times 5^3}\right)^2 \times \dfrac{25}{27}$

(f) $\dfrac{15^4 \times 18^3}{3^3 \times 5^2 \times 12^2}$

(g) $\dfrac{6^4 \times 9^2 \times 25^3}{3^2 \times 4^2 \times 15^6}$

Solution:

(a)
$$\frac{7^8 \times a^{10} b^7 c^{12}}{7^6 \times a^8 b^4 c^{12}} = 7^{8-6} \times a^{10-8} b^{7-4} c^{12-12}$$
$$= 7^2 \times a^2 b^3 c^0$$
$$= 49 \times a^2 b^3$$

(b)

$$\frac{5^4 \times 7^4 \times 2^7}{8 \times 49 \times 5^3} = \frac{5^4 \times 7^4 \times 2^7}{2^3 \times 7^2 \times 5^3}$$

$$= 5^{5-3} \times 7^{4-2} \times 2^{7-2}$$

$$= 5^2 \times 7^2 \times 2^5$$

$$= 39200$$

(c)

$$\frac{125 \times 5^2 \times a^7}{10^3 \times a^4} = \frac{5^3 \times 5^2 \times a^7}{(2 \times 5)^3 \times a^4}$$

$$= \frac{5^{3+2} \times a^7}{2^3 \times 5^3 \times a^4}$$

$$= \frac{5^5 \times a^7}{2^3 \times 5^3 \times a^4}$$

$$= \frac{5^{5-3} \times a^{7-4}}{2^3}$$

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

$$= \frac{25 \times a^3}{8}$$

(d)

$$\frac{3^4 \times 12^3 \times 36}{2^5 \times 6^3} = \frac{3^4 \times (2 \times 6)^3 \times 6^2}{2^5 \times 6^3}$$

$$= \frac{3^4 \times 2^3 \times 6^3 \times 6^2}{2^5 \times 6^3}$$

$$= \frac{3^4 \times 6^{3+2-3}}{2^{5-3}}$$

$$= \frac{3^4 \times 6^2}{2^2}$$

$$= 729$$

(e)

$$\left(\frac{6\times 10}{2^2\times 5^3}\right)^2\times\frac{25}{27}=\left(\frac{(2\times 3)\times(2\times 5)}{2^2\times 5^3}\right)^2\times\frac{5^2}{3^3}$$

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

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

$$=\frac{5^{2+2-3}}{3^{3-2}}$$

$$=\frac{5}{3}$$

(f)

$$\frac{15^4\times 18^3}{3^3\times 5^2\times 12^2}=\frac{(3\times 5)^4\times(3\times 6)^3}{3^3\times 5^2\times(2\times 6)^2}$$

$$=\frac{3^4\times 5^4\times 3^3\times 6^3}{3^3\times 5^2\times 2^2\times 6^2}$$

$$=\frac{3^{4+3-3}\times 5^{4-2}\times 6^{3-2}}{2^2}$$

$$=\frac{3^4\times 5^2\times 6}{2^2}$$

Therefore, $\frac{15^4\times 18^3}{3^3\times 5^2\times 12^2}=\frac{6075}{2}$

(g)

$$\frac{6^4\times 9^2\times 25^3}{3^2\times 4^2\times 15^6}=\frac{(2\times 3)^4\times(3^2)^2\times(5^2)^3}{3^2\times(2^2)^2\times(3\times 5)^6}$$

$$=\frac{2^4\times 3^4\times 3^4\times 5^6}{3^2\times 2^4\times 3^6\times 5^6}$$

$$=\frac{3^{4+4-2-6}\times 5^{6-6}}{2^{4-4}}$$

$$=\frac{3^0\times 5^0}{2^0}$$

$$=1$$

Look for a pattern in the table to extend what you know about exponents to find more about negative exponents.

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}
10 * 10	10	1	$\frac{1}{10}$	100	2000
100	10	1	$\frac{1}{10} = 0.1$	$\frac{1}{100} = 0.01$	$\frac{1}{1000} = 0.001$

÷10 ÷10 ÷10 ÷10 ÷10

86. Express the given information in Scientific notation (standard form) and then arrange them in ascending order of their size.

Sl.No.	Deserts of the World	Area (Sq. Kilometres)
1.	Kalahari, South Africa	932,400
2.	Thar, India	199,430
3.	Gibson, Australia	155,400
4.	Great Victoria, Australia	647,500
5.	Sahara, North Africa	8,598,800

Solution:

1. Area of Kalahari, South Africa is 932,400 = 9.324×10^5.
2. Area of Thar, India is 199,430 = 1.9943×10^5.
3. Area of Gibson, Australia is 155,400 = 1.554×10^5.
4. Area of Great Victoria, Australia is 647,500 = 6.475×10^5.
5. Area of Sahara, North-Africa is 8,598,800 = 8.5988×10^6.

The required ascending order of the size of the deserts is:
Gibson, Australia < Thar, India < Great Victoria, Australia < Kalahari, South-Africa < Sahara, North-Africa.

87. Express the given information in Scientific notation and then arrange them in descending order of their size.

Sl.No.	Name of the Planet	Mass (in kg)
1.	Mercury	330000000000000000000000
2.	Venus	4870000000000000000000000
3.	Earth	5980000000000000000000000
4.	Mars	642000000000000000000000
5.	Jupiter	1900000000000000000000000000
6.	Saturn	569000000000000000000000000
7.	Uranus	86900000000000000000000000
8.	Neptune	102000000000000000000000000
9.	Pluto	13100000000000000000000

Solution:

The given information in scientific notation is as follows:

Sl.No.	Name of the Planet	Mass (in kg)
1.	Mercury	3.3×10^{23}
2.	Venus	4.87×10^{24}
3.	Earth	5.98×10^{24}
4.	Mars	6.42×10^{23}
5.	Jupiter	1.9×10^{27}
6.	Saturn	5.69×10^{26}
7.	Uranus	8.69×10^{25}
8.	Neptune	1.02×10^{26}
9.	Pluto	1.31×10^{22}

The required descending order of the size of planets is:

Jupiter > Saturn > Neptune > Uranus > Earth > Venus > Mars > Mercury > Pluto

88. Write the number of seconds in scientific notation.

Sl. No.	Unit	Value in Seconds
1.	1 Minute	60
2.	1 Hour	3,600
3.	1 Day	86,400
4.	1 Month	2,600,000
5.	1 Year	32,000,000
6.	10 Years	3,20,000,000

Solution:
The given information in scientific notation is as follows:

Sl. No.	Unit	Value in seconds
1.	1 Minute	6×10^1
2.	1 Hour	3.6×10^3
3.	1 Day	8.64×10^4
4.	1 Month	2.6×10^6
5.	1 Year	3.2×10^7
6.	10Years	3.2×10^8

89. In our own planet Earth, 361,419,000 square kilometre of area is covered with water and 148,647,000 square kilometre of area is covered by land. Find the approximate ratio of area covered with water to area covered by land by converting these numbers into scientific notation.

Solution:
Area covered with water = 361,419,000 km^2
Area covered by land = 148,647,000 km^2
The required ratio is:

$$\frac{361419000}{148647000} = \frac{3.1419 \times 10^8}{1.48647 \times 10^8}$$

$$\approx \frac{3.6 \times 10^8}{1.5 \times 10^8}$$

$$= \frac{12}{5}$$

So, the ratio of area covered with water to area covered by land is 12:5.

90. If $2^{n+2} - 2^{n+1} + 2^n = c \times 2^n$, find the value of c.

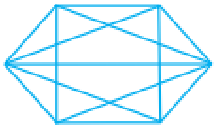
Solution:

$$2^{n+2} - 2^{n+1} + 2^n = c \times 2^n$$
$$2^n(2^2 - 2^1 + 1) = c \times 2^n$$
$$2^n(4 - 2 + 1) = c \times 2^n$$
$$2^n \times 3 = c \times 2^n$$
$$\text{or } 3 \times 2^n = c \times 2^n$$
On comparing the terms we get, c=3

91. A light year is the distance that light can travel in one year.
1 light year = 9,460,000,000,000 km.
(a) Express one light year in scientific notation.
(b) The average distance between Earth and Sun is 1.496 × 108 km. Is the distance between Earth and the Sun greater than, less than or equal to one light year?

Solution:
(a) One light year in scientific notation is expressed as 9.46×10^{12} km.
(b) Given: The average distance between earth and sun is 1.496×10^{8} km.
And, one light year is equal to 9.46×10^{12} km. So, the distance between Earth and the Sun is less than one light year.

92. Geometry Application : The number of diagonals of an n-sided figure is 1/2 (n^2 –3n). Use the formula to find the number of diagonals for a 6-sided figure (hexagon).



Solution:
Given: The number of diagonals of a n sided figure is
$$\frac{1}{2}(n^2 - 3n)$$
For a hexagon, n = 6, therefore, the number of diagonals will be:

$= \frac{1}{2}\left(6^2 - 3\times 6\right)$
$= \frac{1}{2}(36-18)$
$= \frac{1}{2}\times 18$
$= 9$

93. Life Science : Bacteria can divide in every 20 minutes. So 1 bacterium can multiply to 2 in 20 minutes. 4 in 40 minutes, and so on. How many bacteria will there be in 6 hours? Write your answer using exponents, and then evaluate.

Solution:
We know that, 1 hour = 60 minutes.
So, 6 hours will be equivalent to 6 × 60 = 360 minutes.

Given: A bacteria doubles itself in every 20 minutes.
So, number of times it doubles itself in 6 hours will be, 360 ÷ 20 = 18 times

Therefore, number of bacteria after 6 hours will be
= 2 × 2 × 2× 2…..× 2 (18 times)
= 2^{18}

94. Blubber makes up 27 per cent of a blue whale's body weight. Deepak found the average weight of blue whales and used it to calculate the average weight of their blubber. He wrote the amount as $2^2 \times 3^2 \times 5 \times 17$ kg. Evaluate this amount.

Solution:

Weight calculated by Deepak is:
$= 2^2 \times 3^2 \times 5 \times 17$
$= 4\times 9 \times 5 \times 17$
$=3060$ kg

95. Life Science Application : The major components of human blood are red blood cells, white blood cells, platelets and plasma. A typical red blood cell has a diameter of approximately 7×10^{-6} metres. A typical platelet has a diameter of approximately 2.33×10^{-6} metre. Which has a greater diameter, a red blood cell or a platelet?

Solution:
Given: Diameter of a red blood cell = 7×10^{-6} m
And, Diameter of a platelet = 2.33×10^{-6} m

As we can clearly see, size of red blood cell is greater. Therefore, diameter of red blood cell is greater than platelet.

96. A googol is the number 1 followed by 100 zeroes.
(a) How is a googol written as a power?
(b) How is a googol times a googol written as a power?

Solution:
(a) A googol as a power can be expressed as 1×10^{100}.
(b) A googol times a googol means googol multiplied by googol.
Therefore, the required number will be $1 \times 10^{100} \times 1 \times 10^{100} = 1 \times 10^{200}$.

97. What's the error?
A student said that $3^5/9^5$ is the same as 1/3 . What mistake has the student made?

Solution:
$$\frac{3^5}{9^5} = \left(\frac{3}{9}\right)^5$$
$$= \left(\frac{1}{3}\right)^5$$
$$= \frac{1}{3^5}$$
The student forgot the power term while solving the expression.