Exponents and Powers

QUESTIONS

1. **Find the value of given expression:** $\left(\frac{5}{9}\right)^{(-2)} \times \left(\frac{3}{5}\right)^{(-2)} \times \left(\frac{3}{5}\right)^{(0)}$

(a) 10 (b) 9 (c) 20 (d) 30

2. **Simplify:** $x^2y^2 \times x^5y^3$

(a) x^7y^5 (b) x^7y^7 (c) x^5y^5 (d) x^5y^7

3. **The value of the expression** $\frac{4^{-5} \times 10^6 \times 625}{4^{-8} \times 4^2}$ **is given by**

(a) 2.5×10^9 (b) 3.5×10^5 (c) 4.5×10^5 (d) 5.5×10^5

4. **Find the value of m in the expression** $\frac{(16)^{2m+1}(64)^5}{(256)^2 \times 4} = (256)^{3m}$

(a) 1 (b) 0 (c) 4 (d) 5

5. The value of $\frac{1}{2}\left[\frac{-7}{4} + \frac{5}{3} + \frac{-5}{6} + \frac{1}{3} + \frac{-1}{2}\right] + \frac{1}{3}\left[\frac{-12}{5} + \frac{-7}{20} + \frac{3}{14} + \frac{1}{7} + \frac{-1}{10}\right]$ is

(a) $\frac{1153}{840}$ (b) $\frac{128}{105}$ (c) $\frac{128}{105}$ (d) $\frac{-125}{256}$

6. **Evaluate** $\left[\left(\sqrt{\frac{2}{3}}\right)^2 - \sqrt[3]{\frac{8}{27}}\right]^{1000}$

(a) 0 (b) 1 (c) 2 (d) -1

7. **Simplify** $\left(5an^{-2}\right)^{-1}$

(a) $\frac{n^2}{5a}$ (b) $\frac{n}{5a}$ (c) $\frac{n^3}{5a}$ (d) $\frac{n^4}{5a}$

8. **Simplify** $\left(\frac{a^{-2}}{b^{-2}}\right)^{-3}\left(\frac{a^{-3}}{b^{-5}}\right)$

(a) $\frac{1}{b^2}$ (b) $\frac{a^3}{b^{11}}$ (c) $\frac{a}{b}$ (d) $\frac{a^2}{b^3}$

9. **Simplify** $-(3)^3 - (-3)^2 + (-2)^2$

(a) -31 (b) -21 (c) -32 (d) -33

10. **Find the value of x such that** $\left(\frac{64}{125}\right)^2\left(\frac{4}{5}\right)^4\left(\frac{16}{25}\right)^{2x+1}=\left(\frac{256}{625}\right)^{3x}$

(a) $\frac{3}{2}$ (b) $\frac{2}{3}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

11. **By what number** $\left(\frac{4}{5}\right)^{-5}$ **must be multiplied so that the result is** $\frac{16}{9}$**?**

(a) $\frac{3}{2}$ (b) $\left(\frac{4}{3}\right)^7$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$

12. **The scientific notation of 165000000000000 is given by**

(a) 16.5×10^{13} (b) 165×10^{12} (c) 1650×10^{11} (d) 1.65×10^{14}

13. $\frac{\mathbf{8^{-1}\times5^3}}{\mathbf{2^{-4}}}=$

(a) 250 (b) 325 (c) 125 (d) 100

14. **Find x so that** $\left(\frac{5}{3}\right)^{-5}\times\left(\frac{5}{3}\right)^{-11}=\left(\frac{5}{3}\right)^{8x}$

(a) -4 (b) -2 (c) -6 (d) -8

15. **If** $x=\left(\frac{3}{2}\right)^2\times\left(\frac{2}{3}\right)^{-4}$ **then value of** $\mathbf{x^2}$ **is**

(a) $\left(\frac{2}{3}\right)^{11}$ (b) $\left(\frac{2}{3}\right)^{12}$ (c) $\left(\frac{2}{3}\right)^{7}$ (d) $\left(\frac{2}{3}\right)^{3}$

16. **The value of** $\left[\left(\sqrt[n]{x^2}\right)^{n/2}\right]^2$

(a) 0 (b) x^2 (c) x (d) $1/x$

17. **The exponential form of** $\sqrt{\sqrt{2}\times\sqrt{5}}$ **is**

(a) $(10)^{1/2}$ (b) $10^{1/4}$ (c) 10 (d) $10^{1/6}$

18. **The product of** $\sqrt[3]{2}\times\sqrt[4]{3}$ **is given**

(a) $\sqrt{10}$ (b) 1 (c) $\sqrt[12]{432}$ (d) $\sqrt{201}$

19. **If** $\mathbf{3^{-x}=3000}$**, then find** $\mathbf{10^3}\times3^{(2x+3)}$

(a) 3×10^{-3} (b) 27×10^{-3} (c) 9×10^{-3} (d) 3000

20. $\left(\frac{a^x}{a^y}\right)^z\times\left(\frac{a^y}{a^z}\right)^x\times\left(\frac{a^z}{a^x}\right)^y=$_____. $(a\neq0\ \mathbf{and}\ \mathbf{a}\neq1)$)

(a) 1 (b) 0 (c) a^{xyz} (d) $a^{xy+yz+zx}$

21. $\left(\frac{a}{b}\right)^{x+y+z} \div \left[\left(\sqrt{\frac{a}{b}}\right)^{-x} \times \left(\sqrt{\frac{a}{b}}\right)^{-y} \times \left(\sqrt{\frac{a}{b}}\right)^{-z}\right] =$_____

(a) $\left[a^3 / b^3\right]^{x+y+z}$ (b) $\left[a^2 / b^2\right]^{x+y+z}$ (c) $\left[a / b\right]^{(x+y+z)/2}$ (d) $\left[a / b\right]^{3(x+y+z)/2}$

22. **If $(\mathbf{x}+\mathbf{y})^{\mathbf{3}} = \mathbf{1331}$ and $(\mathbf{x}-\mathbf{y})^{\mathbf{5}} = \mathbf{243}$, then find $\mathbf{x^2 - y^2}$.**

(a) 33 (b) 22 (c) 11 (d) 44

23. **If xyz = 0, then find the value of** $(a^x)^{zy} + (a^y)^{zx} + (a^z)^{xy}$

(a) 3 (b) 2 (c) 1 (d) 0

24. **If $\mathbf{2^{2n-3} = 2048}$, then** $\left(4n + 3n^2\right) =$_____

(a) 175 (b) 25 (c) 125 (d) 75

25. **Find the value of** $\frac{1}{1+x^{a-b}} + \frac{1}{1+x^{b-a}}$

(a) 0 (b) -1 (c) 1 (d) x^{a+b}

26. **If $2^{2x-y} = 32$ and $2^{x+y} = 16$ then find $\mathbf{x^2 + y^2}$ is equal to**

(a) 9 (b) 10 (c) 11 (d) 13

27. $(-9)^3 \div (-9)^8$ **is equal to**

(a) $(9)^5$ (b) $(9)^{-5}$ (c) $(-9)^5$ (d) $(-9)^{-5}$

28. **For any two non-zero rational numbers x and** $y, x^4 \div y^4$ **is equal to**

(a) $(x \div y)^0$ (b) $(x \div y)^1$ (c) $(x \div y)^4$ (d) $(x \div y)^8$

29. $\left[\left(\frac{2}{13}\right)^{-6} \div \left(\frac{2}{13}\right)^3\right]^3 \times \left(\frac{2}{13}\right)^{-9}$

(a) $\left(\frac{2}{13}\right)^{36}$ (b) $\left(\frac{2}{13}\right)^{-36}$ (c) $\left(\frac{2}{13}\right)^{-36}$ (d) $\left(\frac{2}{13}\right)^{-36}$

30. **Find the value of n if** $\frac{2^n \times 2^6}{2^{-3}} = 2^{18}$

(a) 7 (b) 8 (c) 9 (d) 10

31. **Solve** $81^{2x} = (729)^2$

(a) $x = \frac{3}{4}$ (b) $x = \frac{2}{3}$ (c) $x = \frac{5}{6}$ (d) $x = \frac{3}{2}$

32. **Which of the following has the same value of** $\mathbf{3^6 \times \left(3^{-2}\right)^2 \times \left(2^3\right)^2 \times \left(2^{-2}\right)^3}$

(a) 9° (b) 9 (c) 9^2 (d) 9^3

33. **The value of x so that $\left(\frac{2}{7}\right)^4 \cdot \left(\frac{2}{7}\right)^3 = \left(\frac{2}{7}\right)^{4x-1}$ is**

(a) 1 (b) 2 (c) 3 (d) 4

34. **Avogadro number is written as 602,000,000,000,000,000,000,000, Express this number in standard form.**

(a) 6.02×10^{23} (b) 6.02×10^{21} (c) 602.0×10^{21} (d) 0.602×10^{23}

35. **What is the simplified form of $(-6xy)^6 \div (-6xy)^2$?**

(a) $(-6xy)^6$ (b) $(-6xy)^8$ (c) $(-6xy)$ (d) $(-6xy)^4$

36. **A number in standard form in written as 6.6×10^6. It can also be written as:**

(a) 6666666 (b) 66000 (c) 6600000000 (d) 6600000

37. **The speed of light is 300,000,000 ms^{-1} Express it in standard form.**

(a) $3.0 \times 10^8 ms^{-1}$ (b) $3.0 \times 10^{10} ms^{-1}$ (c) $3.0 \times 10^6 ms^{-1}$ (d) $3.0 \times 10^{12} ms^{-1}$

38. **Which is greater 4^3 or 3^4?**

(a) Both are equal (b) 4^3

(c) 3^4 (d) cannot be determined

39. Solve $(4^5)^x = (4^4)^x \div 4^2$

(a) $x = 4$ (b) $x = -2$ (c) $x = -3$ (d) $x = 2$

40. **The value of $\frac{x^{-4} \times y^{-6}}{x^{-16} \times y^{-7}}$**

(a) $x^{-1} \times y^{-1}$ (b) $x^{-1}y^{-1}$ (c) $\frac{1}{x^{12}y}$ (d) $x^{12}y$

ANSWER - KEY									
1. (b)	**2.** (a)	**3.** (a)	**4.** (a)	**5.** (a)	**6.** (a)	**7.** (a)	**8.** (b)	**9.** (c)	**10.** (a)
11. (b)	**12.** (d)	**13.** (a)	**14.** (b)	**15.** (b)	**16.** (d)	**17.** (b)	**18.** (c)	**19.** (a)	**20.** (a)
21. (d)	**22.** (a)	**23.** (a)	**24.** (a)	**25.** (c)	**26.** (b)	**27.** (d)	**28.** (c)	**29.** (d)	**30.** (c)
31. (d)	**32.** (b)	**33.** (b)	**34.** (a)	**35.** (d)	**36.** (d)	**37.** (a)	**38.** (c)	**39.** (b)	**40.** (d)

Answers and Solutions

1. **(b):** $\left(\frac{5}{9}\right)^{-2}\times\left(\frac{3}{5}\right)^{-2}\times\left(\frac{3}{5}\right)^{0}$

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

2. (a) $x^2y^2\times x^5y^5=x^{2+5}\times y^{2+3}$

$=x^7y^7.$

3. (a): $\frac{4^{(-5)}\times 10\times 625}{4^{(-3)}4^{(-8)}\times 4^2}=10^6\times 625\times 4.$

4. (a): $\frac{16^{(2m+1)}\times 64^5}{256^2\times 4}=\frac{16^{(2m+1)}\times\left(16^{3/2}\right)^5}{(16)^4\times 4}.$

$=\frac{16^{(2m+1)}\times 64^{\frac{7}{2}}}{4}=\frac{16^{(2m+\frac{9}{2})}}{4};RHS=(16)^{6m}$

Since LHS = RHS;

$\therefore 16^{2m+4}=16^{6m}\Rightarrow 2m+4=6m\Rightarrow m=1$

5. (a): Let $A=\frac{1}{2}\left[\frac{-7}{4}+\frac{5}{3}-\frac{5}{6}+\frac{1}{3}-\frac{1}{2}\right]$

$=\frac{1}{2}\left[\frac{-21+20-10+4-6}{12}\right]$

$=\frac{1}{2}\left[\frac{-13}{12}\right]=\frac{-13}{24}$

Let B $=\frac{1}{3}\left[\frac{-12}{5}+\frac{7}{20}-\frac{3}{14}+\frac{1}{7}-\frac{1}{10}\right]$

$=\frac{1}{3}\left[\frac{-336-49+30+20-14}{140}\right]$

$=\frac{1}{3}\left[\frac{-349}{140}\right]=\frac{-349}{420}$

Now $A+B=\frac{-13}{24}-\frac{349}{420}$

$$= \frac{-1820 - 2094}{3360} = \frac{-3904}{3360}$$

$$= \frac{-976}{840} = \frac{-122}{105}.$$

6. (a) Let $A = \left[\left(\sqrt{\frac{2}{3}}\right)^2 - 3\sqrt{\frac{8}{27}}\right]^{1000}$

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

$$\therefore A = \left[\frac{2}{3} - 2/3\right]^{1000} = 0.$$

7. (a): $\left(5an^{-2}\right)^{-1} = \left(\frac{5a}{n^2}\right)^{-1} = \frac{n^2}{5a}.$

8. (b) $\left(\frac{a^{-2}}{b^{-2}}\right)^{-3} \times \left(\frac{a^{-3}}{b^5}\right)$

$$= \frac{a^{+6}}{b^{+6}} \times \frac{a^{-3}}{b^5}$$

$$= \frac{a^3}{b^{11}}.$$

9. (c) $(-3)^3 - (-3)^2 + (-2)^2$

$$= -27 - (+9) + (+4)$$

$$= -27 - 9 + 4 = -32$$

10. (a) $\left(\frac{64}{125}\right)^2 \times \left(\frac{4}{5}\right)^4 \times \left(\frac{16}{25}\right)^{2x+1} = \left(\frac{256}{625}\right)^{3x}$

Writing all expression in terms of $\left(\frac{16}{25}\right)$.

$$= \left(\frac{16}{25} \times \frac{4}{5}\right)^2 \times \left(\frac{16}{25}\right)^2 \times \left(\frac{16}{25}\right)^{2x+1} = \left(\frac{16}{25}\right)^{6x}$$

$$\Rightarrow \left(\frac{16}{25}\right)^{2+1+2+2x+1} = \left(\frac{16}{25}\right)^{6x}$$

$\Rightarrow 2+1+2+2x+1=6x$

$\Rightarrow 6+2=6x$

$\Rightarrow 4x=6$

$\Rightarrow x=3/2.$

11. (b) Let no be $\left(\frac{4}{3}\right)^a$

Then, $\left(\frac{4}{3}\right)^{-5}\times\left(\frac{4}{3}\right)^a=\frac{16}{9}or\left(\frac{4}{3}\right)^2$

$\Rightarrow\left(\frac{4}{3}\right)^{(-5+a)}=\left(\frac{4}{3}\right)^2$

$\Rightarrow a-5=2 \quad \Rightarrow a=7$

$=\left(\frac{4}{3}\right)^7.$

Mind of Mathematician:

See the ingenuity, as we have not started by saying that let the no. be 'a'.

Rather, we have started by saying, "Let the no be $\left(\frac{4}{3}\right)^n$,

12. (d): Count the no. of digits after the first non-zero number i.e. 1.

13. (a): $\frac{8^{-1}\times5^3}{2^4}=\frac{2^{-3}\times5^3}{2^{-4}}=2^1\times5^3=250$

14. (b); $\left(\frac{5}{3}\right)^{-5}\times\left(\frac{5}{3}\right)^{-11}=\left(\frac{5}{3}\right)^{8x}$

$\Rightarrow\left(\frac{5}{3}\right)^{-5-11}=\left(\frac{5}{3}\right)^{8x}$

$\Rightarrow -5-11=8x$

15. (b) $x=\left(\frac{3}{2}\right)^2\times\left(\frac{2}{3}\right)^{-4}$

$$= \left(\frac{3}{2}\right)^{2} \times \left(\frac{2}{3}\right)^{-4} = \left(\frac{3}{2}\right)^{6}$$

$$\therefore x^{-2} = \left(\frac{3}{2}\right)^{-12} = \left(\frac{2}{3}\right)^{12}.$$

16. (b) $\left[\left\{\left(x^{2}\right)^{\frac{1}{n}}\right\}^{\frac{n}{2}}\right]^{2}$

$$= x^{2\times\frac{1}{n}\times\frac{n}{2}\times 2} = x^{2}.$$

17. (b) $\sqrt{\sqrt{2}\times\sqrt{5}} = \sqrt{\sqrt{10}} = 10^{\frac{1}{4}}$.

18. (c) $2^{\frac{1}{3}} \times 3^{\frac{1}{4}} = 2^{\frac{1}{3}\times\frac{1}{4}\times 4} \times 3^{\frac{1}{4}\times\frac{1}{3}\times 3}$

$$= \left(2^{4}\right)^{\frac{1}{12}} \times \left(3^{3}\right)^{\frac{1}{12}}$$

$$= \left[2^{4}\times 3^{3}\right]^{\frac{1}{12}} = (432)^{\frac{1}{12}}$$

19. $3^{-x} = 3000$

$$\Rightarrow 3^{x} = (3000)^{-1}$$

$$\Rightarrow \left(3^{x}\right)^{2} = \left[(3000)^{-1}\right]^{2}$$

$$\Rightarrow 3^{2x} = (3000)^{-1}$$

$$\Rightarrow 3^{2x+3} = (3000)^{-1} \times 9$$

$$\Rightarrow 10^{3} \times 3^{2x+3} = 10^{3} \times \left(3\times 10^{3}\right)^{-2} \times 27$$

$$= 10^{3} \times 3^{-2} \times 10^{-6} \times 27$$

$$= 3 \times 10^{-3}.$$

20. (a): $\left(\frac{a^{x}}{y^{y}}\right)^{z} \times \left(\frac{a^{y}}{y^{z}}\right)^{x} \times \left(\frac{a^{z}}{y^{x}}\right)^{y}$

$$= \frac{a^{xz+yz+zx}}{a^{yz+zx+zy}} = 1$$

21. (d): $\left(\frac{a}{b}\right)^{x+y+z} \div \left[\left(\frac{a}{b}\right)^{\frac{-x}{2}} \times \left(\frac{a}{b}\right)^{\frac{-y}{2}} \times \left(\frac{a}{b}\right)^{\frac{-z}{2}}\right]$

$= \left(\frac{a}{b}\right)^{x+y+z} \div \left[\left(\frac{a}{b}\right)^{\frac{-x-y-z}{2}}\right]$

$= \left(\frac{a}{b}\right)^{\left\{x+y+z-\left(\frac{-x-y-z}{2}\right)\right\}}$

$= \left(\frac{a}{b}\right)^{\left\{\frac{3}{2}x+y+z\right\}}$.

22. (a) $(x+y)^3 = 1331 \quad \Rightarrow x+y = (1331)^{\frac{1}{3}} = 11$

$(x-y)^5 = 243$

$\Rightarrow x-y = (243)^{\frac{1}{5}} = 3 \Rightarrow (x+y)(x-y) = 11 \times 3 = 33.$

23. (a) $\left(a^x\right)^{zy} + \left(a^y\right)^{zx} + \left(a^z\right)^{xy}$

$= a^{xyz} + a^{xyz} + a^{xyz}$

$= 3 \times a^{xyz}$

$xyz = 0 \Rightarrow 3 \times a^{xyz} = 3 \times a^{\circ} = 3$

24. (a) $2^{2n-3} = 2048$

$\Rightarrow 2^{2n-3} = 2^{11} \Rightarrow n = 7$

$\Rightarrow 4n + 3n^2 = 4 \times 7 + 3 \times 7^2$

$= 28 + 147 = 175$.

25. (c) $\frac{1}{1+x^{a-b}} + \frac{1}{1+x^{b-a}}$

$x^{a-b} = y \Rightarrow x^{b-a} = \frac{1}{y}$

$= \frac{1}{1+y} + \frac{1}{\frac{1}{1+y}} = \frac{1}{1+y} + \frac{y}{1+y} = \frac{1+y}{1+y} = 1.$

26. (b) $2^{2x-y} = 32$

$\Rightarrow 2x - y = 5$ ……..(1)

$\Rightarrow 2^{x+y} = 16 \Rightarrow x + y = 4$ ……(2)

Adding (1) & (2) $\Rightarrow 3x = 9 \Rightarrow x = 3$

$\Rightarrow y = 4 - 3 = 1$

$\therefore x^2 + y^2 = 3^2 + 1^2 = 10$

27. (d) $(-9)^3 \div (-9)^8$

$= (-9)^{3-8} = (-9)^5.$

28. (c) $x^4 \div y^4 = \dfrac{x^4}{y^4} = \left(\dfrac{x}{y}\right)^4 = (x \div y)^4$

29. (d) $\left[\left(\dfrac{2}{13}\right)^{16} \div \left(\dfrac{2}{13}\right)^3\right]^3 \times \left(\dfrac{2}{13}\right)^{-9}$

$= \left(\dfrac{2}{13}\right)^{\{-6-3\}\times 3} \times \left(\dfrac{2}{13}\right)^{-36}$

30. (c) $\dfrac{2^n \times 2^6}{2^{-3}} = 2^{18}$ $\quad 2^{N+6+3} = 2^{18}$

$= n + 9 = 18 = n = 9.$

31. (d) $81^{2x} = (72)^2 = (81 \times 9)^2 = (81)^2 \times 9^2$

$= (81)^2 \times 81 = 81^3 = 2x = 3 \Rightarrow x = \dfrac{3}{2}.$

32. (b) $3^6 \times (3^{-2})^2 \times (2^3)^2 \times (2^{-2})^3$

$= 3^6 \times 3^{-4} \times 2^6 \times 2^{-6} \quad = 3^{6-4} \times 2^{6-6}$

$= 3^2 \times 1 = 9.$

33. (b) $\left(\dfrac{2}{7}\right)^4 \bullet \left(\dfrac{2}{7}\right)^3 = \left(\dfrac{2}{7}\right)^{4x-1}$

$$\Rightarrow \left(\frac{2}{7}\right)^7 = \left(\frac{2}{7}\right)^{4x-1} \Rightarrow 7 = 4x - 1$$

$$\Rightarrow x = 2$$

34. (a) Count no. of digit after first non-zero number, i.e., 6.

35. (d) $(-6xy)^6 \div (-6xy)^2$

$= (-6xy)^{6-2} = (-6xy)^4$

36. (d) Logic is same as Q.34.

37. (a) Logic is same as Q.34.

38. (c) $4^3 = 4 \times 4 \times 4 = 64$

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

39. (b) $\left(4^5\right)^x = 4^{5x}$

$\left(4^4\right)^x = 4^{4x}$

$\therefore = 4^{5x} = 4^{4x-2} \Rightarrow 5x = 4x - 2$

$\Rightarrow x = -2$

40. (d) $\dfrac{x^{-4} \times y^{-6}}{x^{16} \times y^{-7}}$

$= x^{-4+16} \times y^{-6+7} = x^{12} \times y.$