MATHS

BOOKS - ICSE

EXPONENTS AND POWERS

Example

1. Write the following in exponential form and identify the base and the exponent.

a. 32

b. 243

c. 625

d. -125

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2. Which is greater : $2^3 \text{or} 3^2$?

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3. Express the following as product of powers of their prime factors.

a. 432

b. 10125

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4. Evaluate :

a. $2^2 \times 10^3$

b. $5^2 \times 3^3$

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5. Evaluate :

a. $(-1)^7$

b. $(-1)^{10}$

c. $(-3)^3 \times (-2)^2$

d. $(-3)^4$

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6. Evaluate : $\left(\frac{3}{4}\right)^2$

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7. Evaluate : $\left(\frac{-4}{5}\right)^3$

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8. Express the following in exponential form :

a. $\frac{16}{81}$

b. $\frac{-27}{1000}$

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9. Evaluate : $2^3 \times 2^5$

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10. Evaluate : $(-5)^2 \times (-5)^3$

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11. Simplify and write in exponential form.

a. $3^a \times 3^b \times 3^c$

b. $(-5)^{13} \times 5^{213}$

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12. Evaluate : $2^{10} \div 2^{3}$

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13. Evaluate : $(-7)^{9} \div (-7)^{5}$

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14. Evaluate : $\left(2^{3}\right)^{4}$

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15. Evaluate : $\left(5^2\right)^6$

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16. Find n if $\left(5^3\right)^4 = \left(5^2\right)^n$

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17. Evaluate : $3^4 \times 5^4$

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18. Evaluate : $(-2)^3 \times 4^3$

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19. Evaluate : $(-3)^6 \times (-2)^6$

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20. Express $(-30)^{18}$ as a product of exponential forms in four different ways.

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21. Evaluate : $3^5 \div 2^5$

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22. Evaluate : $6^4 \div 2^4$

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23. Evaluate :

a. $6^3 \div 6^3$

b. $5^4 \div 5^4$

c. $(-3)^5 \div (-3)^5$

d. $\left(\frac{3}{5}\right)^4 \div \left(\frac{3}{5}\right)^4$

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24. Express 4^4 in exponent form with base 2.

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25. Write 8^3 as in exponent form with base 2.

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26. Express 5^8 in exponent form with base 25.

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27. Find n if $8^4 = 4^n$

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28. Simplify $6^6 \div 3^3$ and write in exponential form.

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29. Simplify and write in exponential form :

$$\left[\left(2^3\right)^2 \times 3^6\right] \div 5^6$$

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30. Simplify and write in exponential form :

$$\frac{12^4 \times 9^4 \times 4}{6^3 \times 8^2 \times 27}$$

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31. Simplify and write in exponential form :

$$\frac{3 \times 7^2 \times 11^8}{21 \times 11^3}$$

A. 7×11^3

B. 7×11^5

C. 7×11^6

D. 7×11^9

Answer: B

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32. Simplify and write in exponential form :

$$\frac{16 \times 25 \times 5^2 \times t^8}{10^3 \times t^4}$$

A. $10t^2$

B. $10t^3$

C. $10t^4$

D. $10t^5$

Answer: C

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33. Find the value of n, given :

$$\frac{2 \times 4^3 \times 2^{n-4} \times 3 \times 2^{n+2}}{3^3 \times 2^{16}} = \frac{2}{9}$$

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34. Is 10.342×10^7 the standard form of a large number ?

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35. Write 345.7896 in standard form.

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36. Write the numbers for the standard forms.

a. 1.002×10^8

b. 8.5214×10^7

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37. Express the numbers appearing in the following statements in standard form. a) speed of light in vacuum is 3,00,000,000 m/s

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38. Compare the following :

a. Radius of Earth and the distance (by road) from Srinagar to Bengaluru

b. Distances between Earth to Moon and Earth to Mercury.

c. Distances between Sun to Mercury and Sun to Pluto.

d. Mass of Earth and Jupiter.

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Try This

1. Write the following in exponential form and identify the base and the exponent.

a. $100,000$

b. 125

c. 243

d. 256

e. 2187

f. 3125

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2. Which is greater : $2^5 \text{or} 5^2$?

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3. Express the following as powers of their prime factors.

a. 1372

b. 400

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4. Evaluate :

a. $(-1)^{27}$

b. 0×11^{6}

c. $2^{4} \times 3^{3}$

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5. Evaluate :

a. $\left(\frac{3}{5}\right)^{3}$

b. $\left(\frac{-2}{7}\right)^{2}$

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6. Express the following in exponential form :

a. $\frac{49}{100}$

b. $\frac{-32}{3125}$

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7. Write in exponential form .

a. $3^4 \times 3^5$

b. $(-7)^4 \times (-7)^6$

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8. Simplify and write in exponential form.

a. $t^{129} \div t^{29}$

b. $(-2)^{200} \div 2^{50}$

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9. Simplify and write in exponential form.

a. $\left(29^{9}\right)^{100}$

b. $\left(15^{50}\right)^{20}$

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10. Find n if $\left(7^3\right)^6 = (7^n)^n$

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11. Express the following as product of exponential forms.

a. $(3 \times 5)^{12}$

b. $(-3k)^{20}$

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12. Express the following product in exponential forms.

a. $(-4)^{||} \times (-3)^{||}$

$3^{89} \times (-a)^{89}$

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13. Express 12^7 as a product of exponential forms in two different ways.

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14. Write in exponential form .

a. $3^4 \times 3^5$

b. $(-7)^4 \times (-7)^6$

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15. Simplify and write in exponential form.

a. $t^{129} \div t^{29}$

b. $(-2)^{200} \div 2^{50}$

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16. Simplify and write in exponential form.

a. $\left(29^{9}\right)^{100}$

b. $\left(15^{50}\right)^{20}$

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17. Find n if $\left(7^{3}\right)^{6} = \left(7^{n}\right)^{n}$

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18. Express in exponential form.

1. $(-4)^{5} \div c^{5}$

2. $(12)^3 \div (-4)^3$

3. $\left(7^{18} \div 7^{12}\right) \times 7^8$

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19. Evaluate : 1. $7^0 \times 4^0 \times 8^0$

2. $\left(9^0 + 7^0\right) \times 3^0$

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20. Write 9^5 in exponential form with base 3.

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21. Find n if $(27)^2 = 9^n$

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22. Evaluate : $12^7 \div 3^6$

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23. Simplify and write in exponential form :

$\left[(3^2)^4 \times 4^8\right] \div 7^8$

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24. Find a, if $\frac{\left(3^5\right)^2 \times a^3}{3^8 \times a^2} = \frac{9}{8}$

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25. Write in expanded form using exponents of

$10 : 8409203$

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26. Find the number from the expanded form :

$8 \times 10^5 + \left(1 \times 10^3\right) + \left(5 \times 10^1\right)$

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27. Write in standard form .

a. 458

b. 1000

c. 74582

d. 852147

e. 95147823600000

f. 100000000000

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28. Write the number for the standard forms given.

a. 6.023×10^{11}

b. 7.004×10^{7}

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29. Compare the mass of the sun with that of the Jupiter, if the mass of the Sun is approximately 2×10^{30} kg and mass of the Jupiter is approximately 2×10^{27} kg.

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30. Compare the distance of the sun from the earth and the distance of the mars from the Earth if the Sun is 1.5×10^{8} km from the Earth and the Mars is 5.5×10^{7} km from the Earth.

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Exercise 5 1

1. Write the following in exponential form and identify the base and exponent.

a. 6561

b. 7776

c. -16807

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2. Write the numbers as products of prime numbers in exponential form.

a. 432

b. 5000

c. 1568

d. 10125

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3. Express the following as a product of prime factors in exponential form.

a. 108×64

b. 288×324

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4. Insert $>$, $<$ or = sign

a. $2^9 \square 9^2$

b. $3^5 \square 5^3$

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5. Evaluate :

a. $(-1)^{11}$

b. $(-3)^2 \times (5)^3$

c. $6^2 \times 3^3$

d. $(-2)^3 \times (-5)^2$

e. $(-1)^7 \times 2$

f. $(-1)^4 \times (-1)^5$

g. $4^3 \times 3^4$

h. $(-2)^5 \times 5^3$

i. $(-4)^3 \times (-6)^3$

j. $(-1)^{33} \times (-3)^1$

k. $\left(\frac{-1}{6}\right)^2$

l. $\left(\frac{2}{11}\right)^3$

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6. Express the following in exponential form.

a. $\frac{256}{10000}$

b. $\frac{-1}{243}$

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7. Simplify and write in exponential form.

a. $5^{89} \times 5^{54}$

b. $(-9)^{157} \times 9^{23}$

c. $(-7)^{13} \times (-7)^{33}$

d. $6^{125} \times 6^{88}$

e. $(-12)^{255} \times 12^{45}$

f. $(-4)^{66} \times (-4)^{44}$

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8. Simplify and express in exponential form.

a. $23^{207} \div 23^{158}$

b. $(-19)^{105} \div 19^{28}$

c. $(-8)^{134} \div (-8)^{98}$

d. $43^{222} \div 43^{122}$

e. $(57)^{234} \div (-57)^{179}$

f. $(-a)^{83} \div (-a)^{67}$

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9. Simplify:

a. $\left(2^3\right)^6$

b. $\left(3^4\right)^7$

c. $\left(10^{15}\right)^{30}$

d. $\frac{6^{12}}{9^{12}}$

e. $\frac{16^5}{6^5}$

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10. Find n if :

a. $\left(3^4\right)^5 = \left(3^2\right)^n$

b. $5^{12} = 125^{n}$

c. $7^{2n+4} \times 7^{4} = \left(7^{8}\right)^{2}$

d. $8^{6} = 64^{n}$

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11. Express the following product in exponential form.

a. $(-5)^{14} \times (-7)^{14}$

b. $(a)^{19} \times (-b)^{19}$

c. $(3)^{21} \times 5^{21}$

d. $(6)^{9} \times (5)^{9}$

e. $(x)^{13} \times (-y)^{13}$

f. $(-7)^{32} \times (-9)^{32}$

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12. Express the following as a product of exponential form in four different forms, without using 1 as one of the factors of the product.

a. $(-12)^{16}$

b. $(-36)^{12}$

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13. Evaluate :

a. $(-9)^6 \div 3^6$

b. $15^5 \div 3^5 \times 5^2$

c. $\left(7^0 + 12^0\right) \times 6^0$

d. $\left(23^0 + 32^0\right) \div 22^0$

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14. State true or false.

a. $10 \times 10^8 = 100^8$

b. $3^0 + 8^0 - 7^0 = 4$

c. $2^4 \times 4^2 = 8^6$

d. $11^0 + 5^0 - 3^3 = 13$

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15. a. Express 36^4 as an exponential with base 6.

b. Express 125^{12} as an exponential with base 5.

c. Write 27^8 as an exponential with base 3.

d. Write 9^6 as an exponential with base 81.

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16. Simplify :

a. $\left[\left(3^3\right) \times 3^4\right] \div 3^4$

b. $18^6 \div 3^{12}$

c. $\left[\left(5^6\right)^9 \times \left(5^{15}\right)^5\right] - \left[\left(5^{13}\right)^5 \times \left(5^4\right)^{16}\right]$

d. $\left(3^5 \times 10^5 \times 25\right) \div \left(5^7 \times 6^5\right)$

e. $\left(\frac{2}{b}\right)^{18} \times b^{12} \times \left(3^4\right)^3$

f. $\left[\left(2^4\right)^2 \times 2^{12}\right] \div 4^2$

g. $12^8 \div 3^6$

h. $\left[\left(7^7\right)^8 \times \left(7^9\right)^5\right] - \left[\left(7^{11}\right)^6 \times \left(7^7\right)^5\right]$

i. $\left(25^2 \times p^4 \times q^8\right) \div \left(5^3 \times p^4 \times q^7\right)$

j. $\left(\frac{a}{3}\right)^{24} \times 2^8 \times \left(3^6\right)^4$

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17. Simplify and write the answer in exponential form.

a. $\dfrac{4^3 \times 10^5}{2^3 \times 5^4}$

b. $\dfrac{\left(6^4\right)^4 \times 5^8 \times a^6}{9^9 \times 10^6}$

c. $\dfrac{15^{32} \times 12^{15} \times 54^4}{25^{12} \times 18^8 \times 9^2}$

d. $\dfrac{8^4 \times 6^4}{2^8 \times 3^3}$

e. $\dfrac{8^{12} \times \left(9^2\right)^5 \times 5^6}{6^9 \times 15^4}$

f. $\dfrac{21^{16} \times 70^8 \times 36^{15}}{49^4 \times 15^5 \times 24^6}$

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18. Find n if :

a. $\left(\frac{4}{49}\right)^{5} \times \left(\frac{4}{49}\right)^{n-3} = \left(\frac{2}{7}\right)^{16}$

b. $\left(\frac{5}{7}\right)^{12} \times \left[\left(\frac{7}{5}\right)^{2}\right]^{8} = \left(\frac{7}{5}\right)^{2n-6}$

c. $\left(\frac{9}{25}\right)^{4} \times \left(\frac{9}{25}\right)^{n} = \left(\frac{3}{5}\right)^{12}$

d. $\left(\frac{3}{5}\right)^{20} \times \left[\left(\frac{5}{3}\right)^{3}\right]^{6} = \left(\frac{3}{5}\right)^{3n-13}$

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Exercise 5 2

1. Write the following numbers in expanded form using exponents of 10.

a. $32, 10, 089$

b. $54, 62, 010$

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2. Find the number :

a. $\left(4 \times 10^{5}\right) + \left(3 \times 10^{2}\right) + \left(7 \times 10^{0}\right)$

b. $\left(3 \times 10^{6}\right) + \left(8 \times 10^{3}\right) + \left(1 \times 10^{1}\right)$

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3. a. Express one light year $= 9,460,000,000,000km$ in the standard form.

b. The area of the USA is $9,834,000$ square kilometres and the area of India is $3,287,000$ square kilometres. Write the two areas in the standard form and compare them.

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4. Write the numbers in standard form :

a. 2371.2×10^{28}

b. 0.0678×10^{16}

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5. The population of India is $1,300,000,000$ and that of the USA is $320,000,000$. Write the population of both the countries in standard form and compare them.

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6. Brazil produced 2.5×10^6 metric tonnes of coffee in an year and India produced 3.5×10^5 metric tonnes of coffee the same year. Compare the quantities produced by the two countries .

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Revision Exercise

1. Write the base and exponent in each of the following.

a. 3^6

b. 11^3

c. 4^5

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2. Which is greater, 5^3 or 3^5 ?

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3. Write the following as powers of their prime factors:

a. 3375

b. 3267

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4. Simplify :

a. $(-2)^3 \times (-3)^3$

b. $5^2 \times 10^5$

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5. Simplify and write in exponential form.

a. $p^3 \times p^5 \times p^{25}$

b. $(-13)^{27} \times (-13)^{13}$

c. $\left(11^{16} \times 11^4\right) \div 11^5$

d. $10^{212} \div 10^{62}$

e. $(-17)^{89} \div 17^{50}$

f. $\left(16^{12}\right)^{50}$

g. $\left(7^{25}\right)^{50}$

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6. Find n if $\left(9^3\right)^2 = \left(3^n\right)^3$

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7. Express the following as product of exponential forms.

a. $(9 \times 3)^{18}$

b. $(-pq)^{12}$

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8. Express the following product in exponential form.

a. $(-7)^{19} \times (4)^{19}$

b. $(-1)^{66} \times (-a)^{66}$

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9. Express in exponential form.

a. $(-p)^{12} \div (-q)^{12}$

b. $a^{20} \div (-3)^{20}$

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10. Evaluate :

a. $181^{13} \div 181^{13}$

b. 275^{0}

c. $2\left(2^{0}+2^{1}+2^{2}\right)$

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11. Express 16^{7} in exponential form with base

a. 4

b. 2

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12. Simplify :

a. $15^7 \div 5^3$

b. $\frac{\left(5^4\right)^3 \times 2^{12}}{3^{12}}$

c. $\frac{\left(4^3\right)^2 \times 5^6}{10^6}$

d. $\frac{2 \times 3^4 \times 2^5}{9 \times 4^2}$

e. $\frac{2^2 \times 3^4 \times 16}{3^2 \times 32}$

f. $\frac{4^5 \times a^8 \times b^{16}}{4^4 \times a^7 \times b^4}$

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13. Find the value of n :

$$\frac{2^3 \times 5^{n+1} \times 10^2 \times 5^{n-1}}{125 \times 5^{n-2} \times 2^7} = \frac{25}{4}$$

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14. Write 50018531 in expanded form using exponents of 10.

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15. Write the number whose expanded form is :

$(9 \times 10^7) + (1 \times 10^4) + (2 \times 10^2)$

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16. Express the number appearing in the following statements in standard form.

a. the human eye blinks an average of $4,200,000$ times a year.

b. The length of the blood vessels in a human body is $97,000,000$ m.

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17. Comapre the population of India and Indonesia if India's population is 1.3×10^9 and that of Indonesia is 2.6×10^8.

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18. Write the numbers given in standard forms.

a. 2.159×10^{11}

b. 1.001×10^5

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Unit Practice Paper 1

1. Evaluate :

a. $3^2 \times 10^3$

b. $(-1)^{19}$

c. 0×15^5

d. $\left(\frac{2}{5}\right)^3$

e. $3^2 \times 3^5$

f. $(-4)^{10} \times 4^{100}$

g. $6^{10 \div 6^5}$

h. $\left(-2^5\right)^2$

i. $7^7 \div 7^5$

j. $10^5 \div 10^5$

k. $11^0 \times (-5)^0 \times 3^0$

l. $\left(100^0 + 50^0\right) \times (-25)^0$

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2. Express the following as powers of their prime factors .

a. 3400

b. 1575

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3. Express 64 in exponential form with base 2.

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4. Simplify and write in exponential form :

a. $\left[\left(2^3\right)^3 \times 4^5\right] \div 5^5$

b. $\dfrac{10 \times 4^4 \times 3^3}{6^3 \times 2^5 \times 15}$

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5. find the value of n, given :

$$\frac{4^{n-2} \times 2^{n-5} \times 6 \times 2^{n+3}}{3 \times 6^2} = \frac{4}{18}$$

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6. a. Write in expanded form using exponents of 10 : 46078905

Find the number :

$$\left(5 \times 10^6\right) + \left(2 \times 10^3\right) + \left(9 \times 10^1\right)$$

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7. The population of India is $1,300,000,000$ and that of Russia is $140,000,000$. Write the population of both the countries in standard form and compare them.

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