



MATHS

BOOKS - MTG IIT JEE FOUNDATION

NUMBER SYSTEMS

Illustrations

1. Find seven rational numbers between $1/6$ and $5/21$.

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2. Find five rational numbers between 4 and 5.

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3. Locate $\sqrt{2}$ on the number line.



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4. Locate $\sqrt{3}$ on the number line .



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5. Locate $\sqrt{17}$ on the number line.



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6. Express $21/25$ in decimal form.



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7. Express $87/32$ in decimal form.

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8. Express $\frac{5}{8}$ in decimal form.

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9. Convert $\frac{27}{16}$ into decimal form.

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10. Represent the following as decimal numbers :

$$\frac{12}{7}$$

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11. Represent the following as decimal numbers :

$$\frac{1}{3}$$

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12. Represent the following as decimal numbers :

$$\frac{4}{11}$$

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13. Find the period of decimals of $\frac{22}{7}$ and the length of its period.

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14. Express the rational number $1/27$ in recurring decimal form by using the recurring decimal expansion of $1/3$. Hence, write $59/27$ in recurring decimal form.

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15. Convert the following decimal numbers into the form m/m .

(i) 0.35

(ii) 0.175

(iii) 0.0025



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16. Express the following recurring decimal expansions in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

(i) $0.\bar{4}$

(ii) $12.\overline{124}$

(iii) $0.2\overline{37}$



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17. Represent 4.765 on the number line.



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18. Visualise $3.\overline{26}$ on the number line, upto 4 decimal places.



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19. Rationalise the denominator of $\frac{5}{\sqrt{3} - \sqrt{5}}$



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20. Rationalise the denominator of $\frac{1}{8 + 4\sqrt{2}}$



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21. Rationalise the denominator of $\frac{a^2}{\sqrt{a^2 + b^2} + b}$



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22. Simplify :

(i) $\left(\frac{243}{32}\right)^{\frac{4}{5}}$

(ii) $\sqrt[3]{(343)^{-2}}$



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23. Simplify : $\left(\frac{25}{9}\right)^{-\frac{3}{2}} \times \left(\frac{2}{5}\right)^{-3}$



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24. Simplify : $\pi^{3/4} \cdot \pi^{1/2}$



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25. Simplify :

$$\left(\frac{x^l}{x^{-m}}\right)^{l^2+m^2-lm} \times \left(\frac{x^m}{x^{-n}}\right)^{m^2+n^2-mn} \times \left(\frac{x^n}{x^{-1}}\right)^{n^2+l^2-nl}$$



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26. Simplify :

$$\left(\frac{2^a}{2^b}\right)^{a+b} \cdot \left(\frac{2^b}{2^c}\right)^{b+c} \cdot \left(\frac{2^c}{2^a}\right)^{c+a}$$

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27. If $a^x = b$, $b^y = c$ and $c^z = a$, prove that $xyz = 1$

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Solved Examples

1. Find the value of $2.\bar{6} - 0.\bar{9}$.

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2. Simplify: $5\sqrt[3]{250} + 7\sqrt[3]{16} - 14\sqrt[3]{54}$



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3. Express $0.\overline{235}$ in the form p/q where p and q are integers and $q \neq 0$.



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4. Check whether $7\sqrt{5}$, $\frac{7}{\sqrt{5}}$, $\sqrt{2} + 21$, $\pi - 2$ are irrational numbers or not.



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5. Evaluate : $\frac{\sqrt{7} + \sqrt{5}}{\sqrt{7} + \sqrt{20} + \sqrt{28} - \sqrt{5} - \sqrt{80}}$



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6. Find any five rational numbers lying between $\frac{2}{7}$ and $\frac{2}{5}$.



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7. Express the rational number $1/13$ in decimal form and hence, find the decimal expansion of $4\frac{4}{13}$.



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8. Find an irrational number between $\frac{1}{7}$ and $\frac{2}{7}$.



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9. By taking $\sqrt{2} = 1.414$, find the value of $\frac{5\sqrt{2}}{2}$



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10. By taking $\sqrt{3} = 1.732$, find the value of $\frac{5\sqrt{3}}{3}$ upto three places of decimal .

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11. By taking $\pi = 3.141$, evaluate $\frac{2\pi + 3\sqrt{2}}{5}$ upto three places of decimal.

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12. Simplify : $0.88\bar{5} - 0.3\bar{53}$.

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13. If $m = 1 + \sqrt{2}$, then find the value of $m^4 - \frac{1}{m^4}$.

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14. If $(\sqrt{6})^n = 216$ then find the value of $(n)^{3/2}$



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15. Which of the following is greater : $\frac{12}{\sqrt{2}}$ or $\frac{18}{\sqrt{3}}$?



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Ncert Questions Exercise 1.1

1. Is zero a rational number? Can you write it in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$?



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2. Find six rational numbers between 3 and 4 .



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3. Find five rational numbers between $\frac{3}{5}$ and $\frac{4}{5}$.



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4. State whether the following statements are true or false . Give reasons for your answers.

- (i) Every natural number is a whole number.
- (ii) Every integer is a whole number .
- (iii) Every rational number is a whole number .



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Ncert Questions Exercise 1 2

1. State whether the following statements are true or false . Justify your answers.

(i) Every irrational number is a real number .

(ii) Every point on the number line is of the form \sqrt{m} , where m is a natural number .

(iii) Every real number is an irrational number .



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2. Are the square roots of all positive integers irrational? If not, give an example of the square root of a number that is a rational number.



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3. Represent $\sqrt{5}$ on the number line



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1. Write the following in decimal form and say what kind of decimal expansion each has : (i) $\frac{36}{100}$ (ii) $\frac{1}{11}$ (iii) $4\frac{1}{11}$ (iv) $\frac{3}{13}$ (v) $\frac{2}{11}$ (vi) $\frac{329}{400}$



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2. You know that $\frac{1}{7} = 0.\overline{142857}$. Can you predict what the decimal expansions of $\frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}, \frac{6}{7}$ are, without actually doing the long division ? If so, how ?

[Hint : Study the remainders while finding the value of $\frac{1}{7}$ carefully .]



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3. Express the following in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

(i) $0.\overline{6}$

(ii) $0.4\overline{7}$

(iii) $0.\overline{001}$



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4. Express $0.99999 \dots$ in the form $\frac{p}{q}$. Are you surprised by your answer?

With your teacher and classmates discuss why the answer makes sense.

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5. What can the maximum number of digits be in the repeating block of digits in the decimal expansion of $1/17$? Perform the division to check your answer.

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6. Look at several examples of rational numbers in the form $\frac{p}{q}$ ($q \neq 0$)

where p and q are integers with no common factors other than 1 and having terminating decimal representations (expansions). Can you guess what property q must satisfy?

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7. Write three numbers whose decimal expansions are non-terminating non-recurring.



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8. Find three different irrational numbers between the rational numbers $\frac{5}{7}$ and $\frac{9}{11}$.



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9. Classify the following numbers as rational or irrational.

(i) $\sqrt{23}$

(ii) $\sqrt{225}$

(iii) 0.3796

(iv) 7.478478

(v) 1.101001000100001



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Ncert Questions Exercise 1 4

1. Visualise 3.765 on the number line, using successive magnification .



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2. Visualise 4. $\overline{26}$ on the number line, upto 4 decimal places.



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Ncert Questions Exercise 1 5

1. Classify the following numbers as rational or irrational .

(i) $2 - \sqrt{5}$

(ii) $(3 + \sqrt{23}) - \sqrt{23}$

(iii) $\frac{2\sqrt{7}}{7\sqrt{7}}$

(iv) $\frac{1}{\sqrt{2}}$

(v) 2π



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2. Simplify each of the following expressions :

(i) $(3 + \sqrt{3})(2 + \sqrt{2})$

(ii) $(3 + \sqrt{3})(3 - \sqrt{3})$

(iii) $(\sqrt{5} + \sqrt{2})^2$

(iv) $(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})$



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3. Recall, π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is , $\pi = c/d$. This seems to contradict the fact that π is irrational. How will you resolve this contradiction ?



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4. Represent $\sqrt{9.37}$ on the number line.



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5. Rationalise the denominators of the following :

(i) $\frac{1}{\sqrt{7}}$

(ii) $\frac{1}{\sqrt{7} - \sqrt{6}}$

(iii) $\frac{1}{\sqrt{5} + \sqrt{2}}$

(iv) $\frac{1}{\sqrt{7} - 2}$



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Ncert Questions Exercise 1 6

1. Find :

(i) $64^{1/2}$

(ii) $32^{1/5}$

(iii) $125^{1/3}$



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2. Find :

(i) $9^{3/2}$

(ii) $32^{2/5}$

(iii) $16^{3/4}$

(iv) $125^{-1/3}$



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3. Simplify :

(i) $2^{2/3} \cdot 2^{1/5}$

(ii) $\left(\frac{1}{3^3}\right)^7$

(iii) $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$

(iv) $7^{1/2} \cdot 8^{1/2}$

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Exercise Multiple Choice Question Level 1

1. $0.12\bar{3}$ can be expressed in rational form as

A. $\frac{900}{111}$

B. $\frac{111}{900}$

C. $\frac{123}{10}$

D. $\frac{121}{900}$

Answer: B

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2. The fraction $\frac{2(\sqrt{2} + \sqrt{6})}{3(\sqrt{2} + \sqrt{3})}$ is equal to

A. $\frac{2\sqrt{2}}{3}$

B. 1

C. $\frac{2\sqrt{3}}{3}$

D. $\frac{4}{3}$

Answer: D



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3. If $x \geq 0$, then $\sqrt{x\sqrt{x\sqrt{x}}} =$

A. $x\sqrt{x}$

B. $x\sqrt[4]{x}$

C. $\sqrt[8]{x}$

D. $\sqrt[8]{x^7}$

Answer: D



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4. Set of natural numbers is a subset of

- A. Set of even numbers
- B. Set of odd numbers
- C. Set of composite numbers
- D. Set of real numbers

Answer: D



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5. Simplify: $\frac{7\sqrt{3}}{\sqrt{10} + \sqrt{3}} - \frac{2\sqrt{5}}{\sqrt{6} + \sqrt{5}} - \frac{3\sqrt{2}}{\sqrt{15} + 3\sqrt{2}}$

- A. 1
- B. 2
- C. $1/2$

D. 3

Answer: A



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6. The rationalising factor of $\sqrt[5]{a^2b^3c^4}$ is

A. $\sqrt[5]{a^3b^2c}$

B. $\sqrt[4]{a^3b^2c}$

C. $\sqrt[3]{a^3b^2c}$

D. $\sqrt{a^3b^2c}$

Answer: A



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7. $1/(\sqrt{3} - \sqrt{2})$ is not equal to

A. $\sqrt{3} + \sqrt{2}$

B. $\sqrt{2} / (\sqrt{6} - 2)$

C. $(\sqrt{3} - \sqrt{2}) / (5 - 2\sqrt{6})$

D. $\sqrt{3} / (9 - \sqrt{6})$

Answer: D



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8. $\frac{a + \sqrt{a^2 - b^2}}{a - \sqrt{a^2 - b^2}} + \frac{a - \sqrt{a^2 - b^2}}{a + \sqrt{a^2 - b^2}}$

A. a^2

B. b^2

C. $a^2 - b^2$

D. $4a^2 - 2b^2$

Answer: D



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9. Arrange in descending order of magnitude $\sqrt[3]{2}$, $\sqrt[6]{3}$, $\sqrt[9]{4}$.

A. $\sqrt[9]{4}$, $\sqrt[6]{3}$, $\sqrt[3]{2}$

B. $\sqrt[9]{4}$, $\sqrt[3]{2}$, $\sqrt[6]{3}$

C. $\sqrt[3]{2}$, $\sqrt[6]{3}$, $\sqrt[9]{4}$

D. $\sqrt[6]{3}$, $\sqrt[9]{4}$, $\sqrt[3]{2}$

Answer: A



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10. Write a rational number between $\sqrt{2}$ and $\sqrt{3}$

A. $\frac{\sqrt{2} + \sqrt{3}}{2}$

B. $\frac{\sqrt{2} \times \sqrt{3}}{2}$

C. 1.5

D. 1.8

Answer: C



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11. The greater between $\sqrt{17} - \sqrt{12}$ and $\sqrt{11} - \sqrt{6}$ is

A. $\sqrt{17} - \sqrt{12}$

B. $\sqrt{11} - \sqrt{6}$

C. Both are equal

D. Cannot compare

Answer: B



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12. Which of the following expressions is same as $\frac{1}{\left(\sqrt[3]{2} - 1\right)}$?

A. $\sqrt[3]{2} + 1$

B. $\sqrt[3]{4} + 1$

C. $\sqrt[3]{4} + \sqrt[3]{2} + 1$

D. $\sqrt[3]{4} + 2\sqrt[3]{2} + 1$

Answer: C



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13. If $m = \frac{cab}{a - b}$ then b equals

A. $\frac{m(a - b)}{ca}$

B. $\frac{cab - ma}{-m}$

C. $\frac{1}{1 + c}$

D. $\frac{ma}{m + ca}$

Answer: D



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14. The value of $\left(\frac{x^q}{x^r}\right)^{\frac{1}{qr}} \times \left(\frac{x^r}{x^p}\right)^{\frac{1}{rp}} \times \left(\frac{x^p}{x^q}\right)^{\frac{1}{pq}}$ is equal to:

A. $x^{\frac{1}{p} + \frac{1}{q} + \frac{1}{r}}$

B. 0

C. $x^{pq+qr+rp}$

D. 1

Answer: D



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15. The value of $\left(\sqrt[6]{27} - \sqrt{6\frac{3}{4}}\right)^2$ equals

A. $\frac{\sqrt{3}}{2}$

B. $\frac{3}{2}$

C. $\frac{\sqrt{3}}{4}$

D. $\frac{3}{4}$

Answer: D



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16. The rational number between $1/2$ and $1/3$ is

A. $2/5$

B. $1/5$

C. $3/5$

D. $4/5$

Answer: A



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17. Simplify: $\frac{2^{n+4} - 2(2^n)}{2(2^{n+3})}$

A. $\left(2^{n+1} - \frac{1}{8}\right)$

B. -2^{n+1}

C. $1 - 2^n$

D. $7/8$

Answer: D



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18. If $\left(a + \frac{1}{a}\right)^2 = 9$, then $a^3 + \frac{1}{a^3}$ equals

A. $\frac{10\sqrt{3}}{3}$

B. $3\sqrt{3}$

C. 18

D. $7\sqrt{7}$

Answer: C



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19. If both 'a' and 'b' are rational numbers, then 'a' and 'b' from

$$\frac{3 - \sqrt{5}}{3 + 2\sqrt{5}} = a\sqrt{5} - b, \text{ respectively are}$$

A. $\frac{9}{11}, \frac{19}{11}$

B. $\frac{19}{11}, \frac{9}{11}$

C. $\frac{2}{11}, \frac{8}{11}$

D. $\frac{10}{11}, \frac{21}{11}$

Answer: A



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20. $\frac{2\sqrt{6}}{\sqrt{2} + \sqrt{3} + \sqrt{5}}$ equals

A. $\sqrt{2} + \sqrt{3} - \sqrt{5}$

B. $4 - \sqrt{2} - \sqrt{3}$

C. $\sqrt{2} + \sqrt{3} + \sqrt{6} - 5$

D. $\frac{1}{2}(\sqrt{2} + \sqrt{5} - \sqrt{3})$

Answer: A



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21. If $25^{x-1} = 5^{2x-1} - 100$, then find the value of x.

A. 3

B. 2

C. 4

D. 1

Answer: B



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22. If $x = 2 - \sqrt{3}$, then the values of $x^2 + \frac{1}{x^2}$ and $x^2 - \frac{1}{x^2}$ respectively are

A. $14, 8\sqrt{3}$

B. $-14, -8\sqrt{3}$

C. $14, -8\sqrt{3}$

D. $-14, 8\sqrt{3}$

Answer: C



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23. $4^{44} + 4^{44} + 4^{44} + 4^{44} = 4^x$, then x

A. 45

B. 44

C. 176

D. 11

Answer: A



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24. The 100^{th} root of $10^{(10^{10})}$ is

A. $10^{8^{10}}$

B. 10^{10^8}

C. $(\sqrt{10}) (\sqrt{10})^{10}$

D. $10(\sqrt{10})^{\sqrt{10}}$

Answer: B



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25. Which of the following numbers has the terminating decimal representation ?

A. $1/7$

B. $1/3$

C. $3/5$

D. $17/3$

Answer: C



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26. Which of the following numbers can be represented as non-terminating repeating decimals ?

A. $39/24$

B. $3/16$

C. $3/11$

D. $137/25$

Answer: C

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27. If $g = t^{\frac{2}{3}} + 4t^{-\frac{1}{2}}$, what is the value of g when $t = 64$?

A. $31/2$

B. $33/2$

C. 16

D. $257/16$

Answer: B

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28. if $x = 9 + 4\sqrt{5}$ find the value of $\sqrt{x} - \frac{1}{\sqrt{x}}$

A. 1

B. 2

C. 3

D. 4

Answer: D



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29. If $x = \frac{1}{\sqrt{5} - 2}$, find the value of $x^3 - 3x^2 - 5x + 3$.

A. 3

B. 4

C. 5

D. 6

Answer: B



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30. The smallest rational number by which $1/3$ should be multiplied so that its decimal expansion terminates after one place of decimal is

A. $3/100$

B. $3/10$

C. 3

D. 30

Answer: B



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31. Evaluate : $(27)^{-\frac{1}{3}} \cdot (27)^{-\frac{1}{3}} \left[(27)^{\frac{1}{3}} - (27)^{\frac{2}{3}} \right]$

A. $-2/3$

B. $1/3$

C. $-1/3$

D. $2/3$

Answer: A



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32. If $\frac{2^{m+n}}{2^{n-m}} = 16$, $\frac{3^p}{3^n} = 81$ and $a = 2^{1/10}$ then $\frac{a^{2m+n-p}}{(a^{m-2n+2p})^{-1}} =$

A. 2

B. $1/4$

C. 9

D. $1/8$

Answer: A



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33. Find the value of $\frac{4}{(216)^{-2/3}} - \frac{1}{(256)^{-3/4}}$

A. 144

B. 64

C. 80

D. 36

Answer: C



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34. Find the value of $\frac{(x^{a+b})^2 (x^{b+c})^2 (x^{c+a})^2}{(x^a x^b x^c)^4}$

A. 1

B. 4

C. -1

D. 2

Answer: A



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35. $\frac{3^{5x} \times 81^2 \times 6561}{3^{2x}} = 3^7$, then $x =$

A. 3

B. -3

C. $1/3$

D. $-1/3$

Answer: B



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36. For an integer n , a student states the following :

I. If n is odd, $(n + 1)^2$ is even .

II. If n is even $(n - 1)^2$ is odd.

III. If n is even $\sqrt{(n - 1)}$ is irrational .

Which of the above statements would be true ?

A. Both I and III

B. Both I and II

C. All I, II and III

D. Both II and III

Answer: B



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37. If $\sqrt{5} = 2.236$ and $\sqrt{10} = 3.162$, then the value of
$$\frac{15}{\sqrt{10} + \sqrt{20} + \sqrt{40} - \sqrt{5} - \sqrt{80}}$$
 is

A. 5.398

B. 4.398

C. 3.398

D. 6.398

Answer: A



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38. The value of $\frac{1}{1 \times 2} + \frac{1}{2 \times 3} + \frac{1}{3 \times 4} + \dots + \frac{1}{99 \times 100}$ is

A. less than $\frac{99}{100}$

B. equal to $\frac{99}{100}$

C. equal to $\frac{99}{100}$

D. greater than $\frac{100}{99}$

Answer: B



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39. If $x = \frac{\sqrt{3} + 1}{2}$ then $x^3 + \frac{1}{x^3} =$

A. $\frac{28\sqrt{3} + 15}{8}$

B. $\frac{27\sqrt{3} - 35}{4}$

C. $\frac{28\sqrt{3} - 15}{8}$

D. $\frac{27\sqrt{3} + 35}{4}$

Answer: B



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40. Which one of the following is correct ?

A.

$$\{(\sqrt[3]{7} + \sqrt[7]{3})(\sqrt[3]{7} + \sqrt[7]{3} - 2)\} - 24 = (\sqrt[3]{7} + \sqrt[7]{3} + 4)(\sqrt[3]{7} + \sqrt[7]{3} - 6)$$

B.

$$\{(\sqrt[3]{7} + \sqrt[7]{3})(\sqrt[3]{7} + \sqrt[7]{3} + 2)\} + 24 = (\sqrt[3]{7} + \sqrt[7]{3} + 4)(\sqrt[3]{7} + \sqrt[7]{3} + 6)$$

C.

$$\{(\sqrt[3]{7} + \sqrt[7]{3})(\sqrt[3]{7} + \sqrt[7]{3} + 2)\} - 24 = (\sqrt[3]{7} + \sqrt[7]{3} - 4)(\sqrt[3]{7} + \sqrt[7]{3} - 6)$$

D.

$$\{(\sqrt[3]{7} + \sqrt[7]{3})(\sqrt[3]{7} + \sqrt[7]{3} - 2)\} + 24 = (\sqrt[3]{7} + \sqrt[7]{3} - 4)(\sqrt[3]{7} + \sqrt[7]{3} + 6)$$

Answer: A



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41. Simplify $\sqrt[5]{x^4 \sqrt[4]{x^3 \sqrt[3]{x^2 \sqrt{x}}}}$.

A. $x^{23/24}$

B. $x^{23/6}$

C. $x^{5/6}$

D. $x^{119/120}$

Answer: D



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42. If $x = \frac{\sqrt{p+q} + \sqrt{p-q}}{\sqrt{p+q} - \sqrt{p-q}}$ then find the value of $qx^2 - 2px + q$

A. 0

B. 1

C. -1

D. 2

Answer: A



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43. Which of the following statements is true ?

- A. Product of two irrational numbers is always irrational
- B. Product of a rational and an irrational number is always irrational
- C. Sum of two irrational numbers can never be irrational
- D. Sum of an integer and a rational number can never be an integer

Answer: B



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44. Simplify :
$$\frac{3^{-3} \times 6^2 \times \sqrt{98}}{5^2 \times \left(\frac{1}{25}\right)^{\frac{1}{3}} \times (15)^{-\frac{4}{3}} \times 3^{\frac{1}{3}}}$$

A. $28\sqrt{2}$

B. 28

C. $28\sqrt{3}$

D. None of these

Answer: A



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45. Simplify : $\frac{3\sqrt{2}}{\sqrt{6} - \sqrt{3}} - \frac{4\sqrt{3}}{\sqrt{6} - \sqrt{2}} + \frac{2\sqrt{3}}{\sqrt{6} + 2}$

A. $\sqrt{2}$

B. $\sqrt{3}$

C. 1

D. 0

Answer: D



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46. If $a = \frac{\sqrt{2} + 1}{\sqrt{2} - 1}$ and $b = \frac{\sqrt{2} - 1}{\sqrt{2} + 1}$ then value of $a^2 + ab + b^2$ is

A. 70

B. 35

C. 40

D. 34

Answer: B



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47. If $\frac{3 + 2\sqrt{5}}{4 - 2\sqrt{5}} = p + q\sqrt{5}$ where p and q are rational numbers, then values of p and q respectively are

A. 8, $-7/2$

B. -8 , $-7/2$

C. $+4, +7$

D. $-4, -7$

Answer: B



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48. $2.\bar{6} - 0.\bar{82}$ is equal to

A. $\frac{181}{999}$

B. $\frac{182}{99}$

C. $\frac{82}{99}$

D. None of these

Answer: B



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49. If $x = 3\sqrt{5} + 2\sqrt{2}$ and $y = 3\sqrt{5} - 2\sqrt{2}$, then the value of $(x^2 - y^2)^2$ is

A. 240

B. 140

C. 5760

D. 5300

Answer: C



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50. If $x = \frac{\sqrt{3} + 1}{\sqrt{3} - 1} + \frac{\sqrt{3} - 1}{\sqrt{3} + 1} + \frac{\sqrt{3} - 2}{\sqrt{3} + 2}$, then the value of $x^2 + \left(\frac{39}{x}\right)^2$ is

A. 114

B. 110

C. 112

D. 113

Answer: A



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Exercise Match The Following

1. Match the following :

List-I

$$(P) \left(\frac{81}{16}\right)^{-\frac{3}{4}} \times \left\{ \left(\frac{25}{9}\right)^{-\frac{3}{2}} \div \left(\frac{5}{2}\right)^{-3} \right\}$$

$$(Q) \frac{\sqrt[3]{0.125} \times \sqrt[5]{(0.00032)^{-2}}}{\sqrt[5]{(0.00243)^{-3}} \times (27)^{2/3}}$$

$$(R) \sqrt[4]{(81)^{-2}}$$

$$(S) \frac{2\sqrt{6} + \sqrt{5}}{3\sqrt{5} - 2\sqrt{6}}$$

List-II

$$(1) \frac{3}{80}$$

$$(2) \frac{39 + 8\sqrt{30}}{21}$$

$$(3) \frac{1}{9}$$

$$(4) 1$$

A. P-1, Q-2, R-4, S-3

B. P-3, Q-2, R-1, S-4

C. P-2, Q-3, R-4, S-1

D. P-4, Q-1, R-3, S-2

Answer: D



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2. Match the following if $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, $\sqrt{5} = 2.236$ and $\pi = 3.141$.

List-I

List-II

(P) $\frac{2}{\sqrt{5} - \sqrt{3}}$

(1) 4.357

(Q) $\frac{\pi}{2} + \frac{3}{\sqrt{5}}$

(2) 3.968

(R) $\frac{1}{2\sqrt{5} - 3\sqrt{2}}$

(3) 2.912

(S) $\pi + 1/\sqrt{2}$

(4) 3.848

A. P-2, Q-3, R-1, S-4

B. P-1, Q-2, R-3, S-4

C. P-4, Q-1, R-2, S-3

D. P-3, Q-1, R-2, S-4

Answer: A



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3. Match the following :

List-I

List-II

(P) If $x = \frac{\sqrt{7}}{5}$ and $\frac{5}{x} = p\sqrt{7}$,
then $p =$ (1) 7

(Q) If $x = \sqrt{5} - 2$, then
 $\left(x^2 + \frac{1}{x^2}\right) =$ (2) 0

(R) If $5^{x-3} \cdot 3^{2x-8} = 455625$,
then $x =$ (3) 18

(S) If $2^x = 3^y = 6^z$,
then $1/x + 1/y + 1/z =$ (4) 25/7

A. P-1, Q-2, R-3, S-4

B. P-4, Q-3, R-1, S-2

C. P-3, Q-2, R-4, S-1

D. P-4, Q-3, R-2, S-1

Answer: B



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Exercise Assertion Reason Type

1. Assertion : 0.271 is a terminating decimal and we can express this number as $\frac{271}{1000}$ which is of the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Reason : A terminating or non-terminating decimal expansion can be expressed as rational number .

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false.

D. If assertion is false but reason is true .

Answer: C



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2. Assertion : Rational number lying between two rational numbers a and b is $a + b/2$.

Reason : There is one rational number lying between any two rational numbers .

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false.

D. If assertion is false but reason is true .

Answer: C



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3. Assertion : $\sqrt{2}$, $\sqrt{3}$ are examples of irrational numbers .

Reason : An irrational number can be expressed in the form p/q .

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false.

D. If assertion is false but reason is true .

Answer: C



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4. Assertion : If $\sqrt{2} = 1.414$, $\sqrt{3} = 1.732$, then $\sqrt{5} = \sqrt{2} + \sqrt{3}$.

Reason : Square root of a positive real number always exists .

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. If both assertion and reason are true but reason is not the correct explanation of assertion .
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true .

Answer: D



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5. Assertion : $5 - \sqrt{2} = 5 - 1.414 = 3.586$ is an irrational number .

Reason : The difference of a rational number and an irrational number is an irrational number .

- A. If both assertion and reason are true and reason is the correct explanation of assertion .
- B. If both assertion and reason are true but reason is not the correct explanation of assertion .
- C. If assertion is true but reason is false.
- D. If assertion is false but reason is true .

Answer: A



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Exercise Comprehension Type

1. $(\sqrt{x} + \sqrt{y})^2 = x + y + 2\sqrt{xy}$ and $\sqrt{x}\sqrt{y} = \sqrt{xy}$, where x and y are positive real numbers .

If $x = 2\sqrt{5} + \sqrt{3}$ and $y = 2\sqrt{5} - \sqrt{3}$, then $x^4 + y^4 =$

A. 1538

B. 1200

C. 1048

D. 149

Answer: A



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2. $(\sqrt{x} + \sqrt{y})^2 = x + y + 2\sqrt{xy}$ and $\sqrt{x}\sqrt{y} = \sqrt{xy}$, where x and y are positive real numbers .

If $x = \sqrt{3} + 3\sqrt{2}$ and $y = \sqrt{3} - 3\sqrt{2}$, then $x^4 + y^4 - 8x^2y^2 =$

A. 3914

B. 3010

C. -486

D. -856

Answer: C



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3. $\left(\sqrt{x} + \sqrt{y}\right)^2 = x + y + 2\sqrt{xy}$ and $\sqrt{x}\sqrt{y} = \sqrt{xy}$, where x and y are positive real numbers .

If $a = 1 + \sqrt{2} + \sqrt{3}$ and $b = 1 + \sqrt{2} - \sqrt{3}$, then $a^2 + b^2 - 2a - 2b =$

A. 11

B. 8

C. 152

D. 15

Answer: B

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4. For $\frac{1}{a\sqrt{x} + b\sqrt{y}}$ the rationalising factor is a $a\sqrt{x} - b\sqrt{y}$.

If $x = \frac{1}{3 - 2\sqrt{2}}$ and $y = \frac{1}{3 + 2\sqrt{2}}$, then value of $xy^2 + x^2y$ is

A. 4

B. 12

C. 6

D. 9

Answer: C

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5. For $\frac{1}{a\sqrt{x} + b\sqrt{y}}$ the rationalising factor is a $a\sqrt{x} - b\sqrt{y}$.

If $x = \frac{\sqrt{5} + \sqrt{3}}{\sqrt{80} + \sqrt{48} - \sqrt{45} - \sqrt{27}}$ then value of $4x^2 + 3x + 5$ is

A. 15

B. 2

C. 12

D. 5

Answer: C



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6. For $\frac{1}{a\sqrt{x} + b\sqrt{y}}$ the rationalising factor is $a\sqrt{x} - b\sqrt{y}$.

If $x = \frac{7\sqrt{3}}{\sqrt{10} + \sqrt{3}} - \frac{3\sqrt{2}}{\sqrt{15} + 3\sqrt{2}} - \frac{2\sqrt{5}}{\sqrt{6} + \sqrt{5}}$, then value of $x^4 + x^2$ is

A. 2

B. 1

C. 0

D. 12

Answer: A

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Exercise Subjective Problems Very Short Answer Type

1. If $x = \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$ and $y = \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$, find $x^2 + y^2$

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2. If $\sqrt{x} + \sqrt{x - \sqrt{1-x}} = 1$, then show that $x = \frac{16}{25}$.

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3. If $x = 3 + 3^{2/3} + 3^{1/3}$, then the value $x^3 - 9x^2 + 18x - 12$ is :

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4. If $x = (4 + \sqrt{15})^{1/3} + (4 - \sqrt{15})^{1/3}$, then show that $x^3 - 3x - 8 = 0$.



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5. If $\sqrt{x} - \sqrt{12} = \sqrt{4} - \sqrt{x}$, then find x .



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6. Show that $\frac{1}{\sqrt{2} + \sqrt{3}} - \frac{2}{\sqrt{5} - \sqrt{3}} + \frac{3}{\sqrt{5} - \sqrt{2}} = 0$.



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7. If $\sqrt{15 - x\sqrt{14}} = \sqrt{8} - \sqrt{7}$, then find the value of x .



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8. Solve : $\sqrt{9+2x} - \sqrt{2x} = \frac{5}{\sqrt{9+2x}}$.



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9. Find the value of $y = \sqrt{\frac{1}{2} \sqrt{\frac{1}{2} \sqrt{\frac{1}{2} \dots \infty}}}$



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10. Is 5.25 a rational number ? Can you write it in the form p/q , where p and q are integers and $q \neq 0$?



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Exercise Subjective Problems Short Answer Type

1. If $x = \frac{1}{2} \left(\sqrt{a} + \frac{1}{\sqrt{a}} \right)$, then show that $\frac{\sqrt{x^2 - 1}}{x - \sqrt{x^2 - 1}} = \frac{a - 1}{2}$.



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2. If $a^{1/3} + b^{1/3} + c^{1/3} = 0$, then show that $(a + b + c)^3 = 27abc$.



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3. Find 10 rational numbers between $-\frac{1}{9}$ and $\frac{4}{9}$.



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4. Find the value of $\sqrt{1 + 2\sqrt{1 + 2\sqrt{1 + 2\sqrt{1 + \dots}}}}$



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5. Convert $5/11$ into decimal form.



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6. If $a = \frac{\sqrt{5} + 1}{\sqrt{5} - 1}$ and $b = \frac{\sqrt{5} - 1}{\sqrt{5} + 1}$, the value of $\left(\frac{a^2 + ab + b^2}{a^2 - ab + b^2} \right)$ is



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7. Represent $0.\overline{23}$ in the form m/n .



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8. Given that $\sqrt{3} = 1.732$ and $\sqrt{5} = 2.236$ then find the value of $\left(\frac{6}{\sqrt{5} - \sqrt{3}} \right)$.



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9. Simplify the following expressions :

(a) $(\sqrt{3} + \sqrt{5})^2$

(b) $(\sqrt{5} - \sqrt{2})^2$



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10. Simplify :

(a) $(9)^{3/2}$

(b) $(9)^{-3/2}$

(c) $(25)^{3/2}$

(d) $(36)^{3/2}$

(e) $(49)^{-3/2}$

(f) $(0.0001)^{-3/4}$



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Exercise Subjective Problems Long Answer Type

1. Express the following recurring decimal expansions in the form p/q , where p and q are integers and $q \neq 0$.

(a) $0.\bar{7}$

(b) $0.2\bar{57}$



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2. Show that $\sqrt[3]{ax^2 + by^2 + cz^2} = \sqrt[3]{a} + \sqrt[3]{b} + \sqrt[3]{c}$, if $ax^3 = by^3 = cz^3$ and $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$.

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3. Prove that

$$\frac{1}{1 + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \dots + \frac{1}{\sqrt{8} + \sqrt{9}} = 2$$

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4. If $a = \frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} - \sqrt{2}}$ and $b = \frac{\sqrt{3} - \sqrt{2}}{\sqrt{3} + \sqrt{2}}$, then find the value of $3(a^2 - b^2)$.

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5. If $x = \frac{7 - \sqrt{45}}{2}$, find the value of $\left(x^3 + \frac{1}{x^3}\right) - 7\left(x^2 + \frac{1}{x^2}\right) + \left(x + \frac{1}{x}\right)$.



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Exercise Integer Numerical Value Type

1. If $x = 9 + 4\sqrt{5}$ and $xy = 1$, then find the value of $\left(\frac{1}{x^2} + \frac{1}{y^2}\right)$.



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2. The value of $\frac{1}{\sqrt{4} + \sqrt{5}} + \frac{1}{\sqrt{5} + \sqrt{6}} + \frac{1}{\sqrt{6} + \sqrt{7}} + \frac{1}{\sqrt{7} + \sqrt{8}} + \frac{1}{\sqrt{8} + \sqrt{9}}$ is



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3. If $N = \frac{\sqrt{\sqrt{5}+2} + \sqrt{\sqrt{5}-2}}{\sqrt{\sqrt{5}+1}} - \sqrt{3-2\sqrt{2}}$, then $N + 2$ equals

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4. Find the value of $9x$, if $5^{x-3} \cdot 3^{2x-8} = 225$.

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5. If $\frac{9^n \times 3^2 \times (3^{-n/2})^{-2} - (27)^n}{3^{3m} \times 2^3} = \frac{1}{27}$, then find $m-n$.

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6. If $a^2bc^3 = 25$ and $ab^2 = 5$, then abc equals

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7. If $x + 1/x = 3$, then $3(x^2 + 1/x^2)$ is equal to



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8. If a and b are two rational numbers and $\frac{2 + \sqrt{3}}{2 - \sqrt{3}} = a + b\sqrt{3}$, what is the value of b ?



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9. If $x = \frac{\sqrt{3} + 1}{2}$, find the value of $4x^3 + 2x^2 - 8x + 7$.



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10. Simplify: $\frac{999813 \times 999815 + 1}{(999814)^2}$



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1. Which of the following statements is incorrect ?

- A. There can be a real number which is both rational and irrational .
- B. The sum of any two irrational numbers is not always irrational .
- C. For any positive integers x and y , $x < y \Rightarrow x^2 < y^2$
- D. Every integer is a rational number .

Answer: A



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2. Find the value of
$$\frac{9^{3/2} - 3 \times 5^0 - \left[\frac{1}{81}\right]^{-1/2}}{\left(\frac{64}{125}\right)^{-2/3} + \frac{1}{\left(\frac{256}{625}\right)^{1/4}} + \left(\frac{\sqrt{25}}{\sqrt[3]{64}}\right)}$$

A. $15/13$

B. 0

C. $16/5$

D. $48/13$

Answer: D



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3. If $x = \frac{\sqrt{a+2b} + \sqrt{a-2b}}{\sqrt{a+2b} - \sqrt{a-2b}}$ then $bx^2 + b =$

A. ax

B. 0

C. $-ax$

D. -1

Answer: A



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4. The value of $\sqrt{6 + 2\sqrt{3} + 2\sqrt{2} + 2\sqrt{6}} - \frac{1}{\sqrt{5 - 2\sqrt{6}}}$ is

A. 2

B. -1

C. $\sqrt{3} + \sqrt{2}$

D. 1

Answer: D



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5. If $a = 2 + \sqrt{3} + \sqrt{5}$ and $b = 3 + \sqrt{3} - \sqrt{5}$, then

$a^2 + b^2 - 4a - 6b - 3$ is equal to

A. 2

B. -1

C. 1

D. 0

Answer: D



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6. Find the values of the integers a and b respectively, for which the solution of the equation $x\sqrt{24} = x\sqrt{3} + \sqrt{6}$ is $\frac{a + \sqrt{b}}{7}$.

A. 4, 2

B. 2, 6

C. 3, 2

D. 9, 5

Answer: A



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7. The value of expression $\frac{(0.6)^0 - (0.1)^{-1}}{\left(\frac{3}{2^3}\right)^{-1} \cdot \left(\frac{3}{2}\right)^3 + \left(-\frac{1}{3}\right)^{-1}}$ is

A. $-3/2$

B. $2/3$

C. $3/2$

D. $9/4$

Answer: A



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8. Expressing $0.\overline{23} + 0.2\overline{3}$ as a single decimal, we get

A. $0.46\overline{5}$

B. $0.4\overline{65}$

C. $0.\overline{465}$

D. $0.465\overline{4}$

Answer: B



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9. If $\frac{4\sqrt{3} + 5\sqrt{2}}{\sqrt{48} + \sqrt{18}} = \frac{a + b\sqrt{6}}{15}$ and $\left(\frac{a}{b}\right)^x \left(\frac{b}{a}\right)^{2x} = \frac{64}{729}$, then find x .

A. 3

B. 2

C. 1

D. 4

Answer: A



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10. If $\sqrt{2^n} = 1024$, then $3^{2\left(\frac{n}{4}-4\right)} =$ 3 (b) 9 (c) 27 (d) 81

A. 3

B. 9

C. 27

D. 81

Answer: B



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11. Express $1 - \frac{1}{1 + \sqrt{3}} + \frac{1}{1 - \sqrt{3}}$ in the form $a + b\sqrt{3}$, where a and b

are rational numbers, then the values of a and b respectively are

A. 1, 2

B. 1, - 1

C. 3, 1

D. 2, 1

Answer: B



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12. If $\frac{3 + 2\sqrt{3}}{3 - \sqrt{3}} = a + \sqrt{3}b$, then the value of $\sqrt{a + b}$, where a and b are rational numbers, is

- A. 5
- B. 8
- C. 2
- D. 16

Answer: C



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13. Simplify: $\frac{2}{\sqrt{5} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{2}} - \frac{3}{\sqrt{5} + \sqrt{2}}$

- A. 3
- B. 2
- C. 4

D. 0

Answer: D



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14. What is the value of $2.\bar{6} - 1.\bar{9}$?

A. $0.\bar{6}$

B. $0.\bar{9}$

C. $0.\bar{7}$

D. 0.7

Answer: A



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15. The sum of $0.\bar{6}$ and $0.\bar{7}$ is

A. $1.\bar{3}$

B. 1.3

C. $1.\bar{4}$

D. an irrational number

Answer: C



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16. If $2^x = 4^y = 8^z$ and $\left(\frac{1}{2x} + \frac{1}{4y} + \frac{1}{6z}\right) = \frac{24}{7}$, then find the value of

z.

A. $7/16$

B. $7/32$

C. $7/48$

D. $7/64$

Answer: C

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17. If $3\sqrt{3} \times 3^3 \div 3^{-3/2} = 3^{a+2}$, then $a =$

A. 2

B. $1/2$

C. 4

D. 0

Answer: C

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18. Find the value of a and b respectively, if $\frac{5 + \sqrt{3}}{7 - 4\sqrt{3}} = 47a + \sqrt{3}b$.

A. 2, 1

B. 1, 27

C. 11, 28

D. 2, 38

Answer: B



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19. If $2^{x+3} = 32$, then what is the value of 3^{6-x} ?

A. 7

B. 9

C. 27

D. 81

Answer: D



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20. The numbers $7.478478.\dots$ and $1.101001000100001\dots$ are

- A. Rational and irrational respectively
- B. Both rationals
- C. Both irrationals
- D. None of these

Answer: A



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