



## MATHS

### BOOKS - CENGAGE

### NUMBER SYSTEM

#### Worked Examples

1. Find the product of  $4\sqrt{3}$  and  $5\sqrt{3}$ .

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2. Find the product of  $5\sqrt{2}$  and  $6\sqrt{3}$ .

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3. Divide  $\sqrt{108}$  by  $\sqrt{147}$ .

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4. Rationalise the denominator of  $\frac{1}{\sqrt{5}}$  without changing its value .

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5. Rationalise the denominator of  $\frac{1}{\sqrt{3} - \sqrt{2}}$  without changing its value.

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6. Rationalise the denominator of  $\frac{\sqrt{5} - 1}{\sqrt{5} + 1}$ .

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7. What kind of decimal expansions do the following numbers have ?

$$\frac{5}{8}, \frac{22}{3}, \frac{1}{7}$$

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8. Express the recurring decimal  $0.123123123\dots$  as a fraction.

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9. Simplify  $5\sqrt{300} + 2\sqrt{75} - 4\sqrt{108}$ .

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10. Rationalise the denominator and simplify  $\frac{3 - \sqrt{8}}{3 + \sqrt{8}}$

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11. If the number  $2x348$  is divisible by 9, what is the value of  $x$  ?

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12. Find all possible two-digit numbers such that the number plus the number formed by reversing its digits, is a perfect square.

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13. What is the square root of  $3 + 2\sqrt{2}$ , given that it is a square number ?

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14. What is the square root of  $8 - 2\sqrt{15}$ , given that it is a square number ?

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15. Write the decimal equivalent of  $(10011)_2$ .



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16. Write 136 in the base 5 system.



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17. Write  $(2132)_5$  in decimal system.



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18. Write  $(245)_{10}$  in the binary system.



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19. Write  $(13)_{10}$  in the binary system.

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20. Write 0.4375 in the binary system.

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21. write 53.8125 in the binary system.

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## Test Yourself Level 1

1. Represent the number  $\frac{3}{5}$  on the numbr line.

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2. Find a fraction between  $\frac{3}{8}$  and  $\frac{2}{5}$ .

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3. Which of the following fractions yield/s a recurring decimal ?

$$\frac{5}{3}, \frac{7}{16}, \frac{9}{14}, \frac{5}{7}, \frac{12}{5}, \frac{6}{11}$$

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4. Find an irrational number between  $\frac{1}{5}$  and  $\frac{5}{16}$ ,

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5. Which of the following numbers are not rational ?

(1.256, 0.45454545..., , 0.0500500500005..., ), (5.51551555151..., , 2. 0123401

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6. Represent  $1.129129129\dots$  as a fraction.

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7. What is the simplest form of  $\sqrt{200} - \sqrt{50}$ ?

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8. Rationalise the denominator of  $\frac{5}{\sqrt{10} + \sqrt{5}}$ .

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9. If  $x = \sqrt{2} - 1$ , then what is the value of  $x - \frac{1}{x}$ ?

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10. Simplify  $(\sqrt{5} + 1)^2 + (\sqrt{5} - 1)^2$ .



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11. Find the immediate predecessor to  $(110)_2$ .

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12. Find the immediate predecessor to  $(4320)_5$ .

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13. Convert  $(321)_5$  to the danary ststem.

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14. Convert  $(1011)_2$  to the decimal system.

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15. Convert  $(29)_{10}$  to the quinary system.

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16. Convert  $(487)_{10}$  to the quinary system.

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17. Find the sum of  $(232)_5$  and  $(443)_5$ .

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18. Subtract  $(321)_5$  from  $(432)_5$ .

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19. Find the product of  $(201)_5 \times (130)_5$ .

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## Test Yourself Level 2

1. Represent  $\sqrt{6}$  on the number line.

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2. Find two irrational numbers between  $\sqrt{5}$  and  $\sqrt{6}$ .

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3. Find the square root of  $10 + 2\sqrt{21}$ .

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4. Find the square root of  $12 - 4\sqrt{5}$ .

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5. Find the square root of  $(2x - 3) - 2\sqrt{x^2 - 3x + 2}$ .

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6. Which is greater,  $\sqrt{15} - \sqrt{14}$  or  $\sqrt{23} - \sqrt{22}$ ?

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7. If  $\sqrt{8 - x\sqrt{2}} = \sqrt{12} - \sqrt{6}$ , then what is the value of  $x$ ?

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8. Which is smaller,  $\sqrt{13} + \sqrt{10}$  or  $\sqrt{12} + \sqrt{11}$ ?

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9. If  $x = \frac{\sqrt{5} - 2}{\sqrt{5} + 2}$ , then the value of  $x + \frac{1}{x}$ .

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10. If  $x > 0$ , then what is the expression  $\sqrt{x\sqrt{x\sqrt{x\dots\text{to}\infty}}}$  equal to ?

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11. Convert  $(526)_{10}$  to the ternary system.

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12. Convert  $(340)_5$  to the ternary system.

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13. Convert  $(2153)_{10}$  to the octal system.



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14. Convert  $(489)_{10}$  to the octal system.



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15. Find the sum of  $(2010)_3 + (1011)_2$ .



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16. Find the sum of  $(2012)_3 + (1011)_2$ .



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17. Find the product of  $(22)_3 + (1011)_3$ .



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18. Find the product of  $(11)_2 \times (32)_5$ .

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19. Find the product of  $(111)_2 \times (212)_3$ .

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20. In the base - x system, the equality  $(434)_x + (344)_x = (1000)_x$  holds true. Find x.

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21. Convert 73.625 decimal numbers into the corresponding octal numbers.

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22. Convert 567.21875 decimal numbers into the corresponding octal numbers.



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23. Write the first fifteen numbers in duodenary system.



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24. Add  $(7468)_{12}$  and  $(3743)_{12}$ .



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25. Subtract  $(6468)_{12}$  from  $(3843)_{12}$ .



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1. What is the value of following expression

$$2 - \frac{1}{20 \frac{2}{2 + \frac{2}{2}}} ?$$

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2. Arrange the surds  $(\sqrt{10} - \sqrt{5})$ ,  $(\sqrt{19}, \sqrt{14})$ ,  $(\sqrt{22} - \sqrt{17})$  in ascending order of magnitude.

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3. If  $x = a + \sqrt{a^2 - 1}$ , then express a in terms of x.

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4. Simplify

$$\frac{x}{x + \frac{1}{x - \frac{x}{1+x}}}$$



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5. How many times does the digit 7 appear when integers from 1 to 1000 are written ?



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6. A three-digit number consists of 5, 9 and an unknown digit. When the digits are written in the reverse order and subtracted from the original number, the resulting number contains the same digits in a different order. What is the unknown digit?



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7. A natural number when divided by  $d$  leaves 24 as remainder. When twice the original number is divided by  $d$ , then the remainder is 11. Calculate the value of  $d$ .



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8. How many keystrokes are needed to type all the integers from 1 to 1000?



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9. If a natural number is multiplied by 18 and another by 21 and the products are added. Which one of the following numbers could be the sum of the products?

A. 2002

B. 2003

C. 2004

D. 2005

**Answer: C**



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10. If  $x = 0.\bar{8}$  then  $2x$  is

A.  $1.\bar{6}$

B.  $1.\bar{5}$

C.  $1.\bar{7}$

D.  $1.\bar{8}$

**Answer: C**



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11. If  $a = 2 + \sqrt{5}$  and  $b = 2 - \sqrt{5}$  then the value of  $\frac{1}{a} + \frac{1}{b}$  is

A. 2

B.  $2\sqrt{5}$

C. 4

D. -4

**Answer: D**



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12. If  $a = \frac{\sqrt{5} + 2}{\sqrt{5} - 2}$  and  $b = \frac{\sqrt{5} - 2}{\sqrt{5} + 2}$  then the value of  $a + b$  is

A.  $4\sqrt{5}$

B. 18

C.  $-4\sqrt{5}$

D. -18

**Answer: B**



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13. If  $x = \frac{1}{7 - 4\sqrt{3}}$  and  $y = \frac{1}{7 + 4\sqrt{3}}$  then the value of  $x^2 + y^2$  is

A. 193

B. 194

C. 195

D. 196

**Answer: B**



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14. The ratioal form of  $a. \overline{72}$  is

A.  $\frac{8}{11}$

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

C.  $\frac{3}{11}$

D.  $\frac{14}{99}$

**Answer: B**



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15. Which of the following is a multiplicative inverse of 3 ?

A. 1

B.  $\frac{1}{3}$

C.  $-3$

D. 0

**Answer: B**



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16. If the number  $2x348$  is divisible by 3 then the value of  $x$  CANNOT be

A. 1

B. 4

C. 6

D. 7

**Answer: C**



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**17.** If the number  $34x576$  is divisible by 4 then the value of  $x$  CANNOT be

A. 1

B. 2

C. 0

D. none of these

**Answer: D**



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**18.** The multiplicative inverse of 0 is

A. 1



B. any real number

C. 0

D. not defined

**Answer: D**



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19. If  $x = \sqrt{2} + 1$  then value of  $x^3 - \frac{1}{x^3}$  is

A. 14

B.  $14\sqrt{2}$

C. 7

D.  $7\sqrt{2}$

**Answer: A**



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20. Square root of  $\frac{5}{2} - \sqrt{6}$  is

A.  $1 - \frac{\sqrt{3}}{2}$

B.  $\sqrt{\frac{3}{2}} - 1$

C.  $1 - \sqrt{\frac{2}{3}}$

D.  $\frac{\sqrt{5}}{3} - 1$

**Answer: B**



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21. For  $x > 0$ , then value of  $x\sqrt{x\sqrt{x\sqrt{x}\dots}}$  is

A.  $x$

B.  $x^2$

C.  $x^3$

D.  $x^{3/2}$

**Answer: B**



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22. If  $x + \sqrt{3} = \sqrt{7 + 4\sqrt{3}}$  then the value of  $x$  is

A.  $-2$

B.  $2$

C.  $-4$

D.  $4$

**Answer: B**



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23. If  $a = \sqrt{13} + \sqrt{12}$  and  $b = \sqrt{14} + \sqrt{11}$  then which of the following true ?

A.  $a > b$

B.  $a < b$

C.  $a = b$

D. none of these

**Answer: A**

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24.  $\sqrt{10 + \sqrt{91}} + \sqrt{10 - \sqrt{91}}$  is equal to

A.  $\sqrt{26}$

B.  $2\sqrt{26}$

C.  $\sqrt{13}$

D.  $2\sqrt{13}$

**Answer: A**

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

A. 3

B.  $\frac{82}{25}$

C.  $\frac{25}{82}$

D. none of these

**Answer: B**



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26. The value of  $2 - \frac{1}{20 \frac{1}{2 - \frac{1}{2 - \dots}}}$  is

A.  $1/2$

B.  $3/2$

C. 1

D. none of these

**Answer: C**



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27. The value of  $\frac{\sqrt{14}}{\sqrt{6 + \sqrt{35}} + \sqrt{6 - \sqrt{35}}}$  is

A. 1

B.  $1/2$

C. 2

D.  $3/2$

**Answer: A**



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28. The value of  $\sqrt{13 + 4\sqrt{10}} - \sqrt{13 - 4\sqrt{10}}$  is

A.  $\sqrt{20}$

B.  $\sqrt{10}$

C.  $\sqrt{40}$

D.  $\sqrt{5}$

**Answer: A**

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29. Then the value of  $\sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}}$  is

A.  $-1$

B.  $2$

C.  $4$

D. none of these

**Answer: B**

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30. Square root of  $(x - 2) - \sqrt{x^2 - 4x + 3}$  is

A.  $(\sqrt{x - 3} - \sqrt{x - 1})$

B.  $\frac{(\sqrt{x - 3} - \sqrt{x - 1})}{2}$

C.  $\frac{(\sqrt{x - 3} - \sqrt{x - 1})}{\sqrt{2}}$

D. none of these

**Answer: C**



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31. The square root of  $x^2 + x + 4 + 2\sqrt{x^3 + 4x}$  is

A.  $\sqrt{x}$

B.  $\sqrt{x^2 + 4}$

C.  $\sqrt{x} - \sqrt{x^2 + 4}$



D.  $\sqrt{x} + \sqrt{x^2 + 4}$

**Answer: D**



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32. If  $x = 7 + 4\sqrt{3}$  then value of  $\sqrt{x} + \frac{1}{x}$  is

A. 4

B.  $\sqrt{x}$

C.  $\sqrt{3}$

D. 2

**Answer: A**



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33. Value of  $0.\overline{76} + 0.\overline{34}$  is

A.  $\frac{110}{99}$

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

C.  $\frac{90}{99}$

D.  $\frac{42}{99}$

**Answer: A**



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**34.** If  $x = \sqrt{13} - \sqrt{11}$  and  $y = \sqrt{35} - \sqrt{33}$  then which of the following is correct ?

A.  $x > y$

B.  $x < y$

C.  $x = y$

D. none of these

**Answer: A**

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35. The value of  $\frac{1}{3 + \sqrt{2}} - \frac{1}{3 - \sqrt{2}}$  is ( $\sqrt{2} = 1.414$ )

- A. 0.404
- B. - 0.404
- C. 0.202
- D. - 0.202

**Answer: B**

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### Test Yourself Level 3 Olympiad And Ntse Level Exercises

1. If the number 258a4 is divisible by 6, then what is the value of a ?

- A. 1

B. 2

C. 3

D. 4

**Answer: B**



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2. The LCM of two numbers is  $(a + b)$  and their HCF is  $k(a-b)$ . If one number is  $k$ , then the other number is

A.  $\frac{ka}{b}$

B.  $kab$

C.  $a^2 - b^2$

D.  $\frac{ka + b}{ka - b}$

**Answer: C**



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3. If we write November 8, 1988 as 8.11.88, we see  $8 \times 11 = 88$ . How many such days are in 1972?

A. 6

B. 4

C. 3

D. 2

**Answer: A**



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4. A five-digit number  $abcde$  is such that the number  $abcde1$  is the product of  $1\ abcde$  and 3. The sum of the digits of  $abcde$  is

A. 25

B. 26

C. 27

D. 28

**Answer: B**

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5. If  $\frac{\sqrt{x}}{11} = 0.1$  then  $x =$

A. 12.1

B.  $\sqrt{1.1}$

C. 1.21

D.  $\sqrt{11}$

**Answer: C**

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6. The sum of the digits of the number  $10^n - 1$  is 3375. The value of  $n$  is

A. 337

B. 375

C. 335

D. 3375

**Answer: B**



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7. Fill in the blanks.

(i) Sum of rational and irrational is \_\_\_ P \_\_\_.

(ii) Square root of an odd number is \_\_\_ Q \_\_\_.

(iii) Number ending with \_\_\_ R \_\_\_ number of zeroes is never a perfect square.

A.  $P$              $Q$      $R$   
Irrational    Odd    Even

- B.  $P$        $Q$        $R$   
Irrational   Odd   Odd
- C.  $P$        $Q$        $R$   
Rational   Even   Odd
- D.  $P$        $Q$        $R$   
Rational   Odd   Odd

**Answer: B**

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8. Read the following statements.

Statement 1: Square root of an irrational number is rational.

Statement 2: All those real numbers which are not rational are irrational.

- A. Both Statement 1 and Statement 2 are true .
- B. Statement 1 is true and Statement 2 is false.
- C. Statement 1 is false and Statement 2 is true .
- D. Both Statement 1 and Statement 2 are false.

**Answer: C**



9. Match the following.

Column I		Column II	
(P)	If $\frac{5}{12-x} = \frac{7}{12+x}$ , then $x =$	(i)	4
(Q)	If $\frac{3^{3x-1} \times 9^{x-1}}{27^{x-1}} = 81$ , then $x =$	(ii)	-2
(R)	If $3^x - 3^{x-1} = 54$ , then $x =$	(iii)	5
(S)	If $5^{x+2} = 625$ , then $x =$	(iv)	2

- A.  $P$     $Q$     $R$     $S$   
        $(iv)$     $(ii)$     $(i)$     $(ii)$
- B.  $P$     $Q$     $R$     $S$   
        $(iv)$     $(i)$     $(iii)$     $(ii)$
- C.  $P$     $Q$     $R$     $S$   
        $(iii)$     $(i)$     $(ii)$     $(iv)$
- D.  $P$     $Q$     $R$     $S$   
        $(ii)$     $(iii)$     $(i)$     $(iv)$

Answer: A

10. The value of

$$\frac{1}{1 + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{5}} + \frac{1}{\sqrt{5} + \sqrt{7}} + \frac{1}{\sqrt{7} + \sqrt{9}} + \dots + \frac{1}{\sqrt{23} + \sqrt{25}}$$
 is

- A. -1
- B. 0
- C. 1
- D. 2

**Answer: D**



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