Standard 10

Real Numbers

Revisiting Rational Numbers And Their *Decimal* Expansions

Total Questions: 31

Hence, the correct answer is

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Question 2:

State whether the following statement is True or False:
Sum of two rationals always rational.

rational numbers

Options

False

True

Solution

Step 1 : The sum of two rational numbers is rational.

Step 2 : So, adding two rationals is the same as adding two such fractions, which wi
another fraction of this same form since integers are closed under addition and multi

$$9999x = 240$$

Step 4 : Divide by 9999 we get

$$x = \frac{240}{9999}$$

$$x = \frac{80}{3333}$$

Step 5 : Therefore $0.\overline{0240}$ can be written in the form of $\frac{a}{b}$ as $\frac{80}{3333}$

Hence, the correct answer is $\frac{80}{3333}$.

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Question 5:

Represent the following decimal in the form of $\frac{p}{q}$, whe

6.028028028028028

Solution

Terminating decimals :- Terminating decimals are those numbers which come to an end after few repetitions after decimal point.

Example: 0.5, 2.456, 123.456, etc. are all examples of terminating decimals.

Non terminating decimals :- Non terminating decimals are those which keep on continuing after decimal point (i.e. they go on forever). They don't come to end or if they do it is after a long interval.

For example: = π(Pi) = (3.14159265358979323846264338327950288419716939937510582097 4.....) is an example of non terminating decimal as it keeps on continuing after decimal point.

Step 1 : We have converted a real number whose decimal expansion terminates into a rational number of the form $\frac{p}{q}$, where p and q are coprime, and the prime factorisation of the denominator (that is, q) has only powers of 2, or powers of 5, or both.

Step 2 : We find that this real number is a rational number of the form $\frac{p}{q}$,

Where the prime factorisation of q is of the form $2^n \times 5^m$, and n, m are some non-negative integers.

Step 3 : If denominator of rational number in the form of $2^n \times 5^m$ then it will be terminated decimal number and highest power of 2 or 5 will be number of digits after its terminated.

Step 4 : Here we have to check that the given rational numbers will have a terminating decimal expansion or a non-terminating repeating decimal expansion.

$$\frac{9}{4^4 \times 6^2 \times 2^6} \qquad \text{...(Given)}$$

Step 5 : So here denominator of given number is not in the form of $2^n \times 5^m$.

Step 4 : Divide by

$$x = \frac{235}{99}$$

$$x = \frac{235}{99}$$

Step 5 : Therefore $2.\overline{37}$ can be written in the form of $\frac{p}{q}$ as $\frac{235}{99}$.

Hence, the correct answer is $\frac{235}{99}$.

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Question 8:

Which is the correct decimal expansions of this rational number :

Options

- 0.005403158769742311
- 1.0054031587697423

Step 1 : Given Number $\sqrt{3}$

Step 2 : Let us assume to the contrary , that $\sqrt{3}$ is rational.

Step 3 : That is, we can find co prime a and b ($b \neq 0$) such that $\sqrt{3} = \frac{a}{b}$

Step 4 : Suppose a and b have common factor other than 1 ,

then we divide by the common factors other than 1 , to get $\sqrt{3} = \frac{a}{b}$, where a and b are co - primes.

Step 5 : So , $\sqrt{3}\ b = a$

$a^2 = 3b^2$ ...[squaring on both sides]

Step 6 : By the fundamental theorem of arithmetic 3 divides a^2, then 3 divides a also.

Step 7 : Here we can write

$a = 3c$

$a = 3c$ ...[squaring on both sides]

$a^2 = 9c^2$

$3b^2 = 9c^2$

$b^2 = 3c^2$

3 divides b^2, then 3 divides b also.

Step 8 : By this contradiction has arisen because of our assumption $\sqrt{3}$ is rational.

So, we conclude that $\sqrt{3}$ is irrational.

Hence, the correct answer is No.

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Question 11:

State whether the following statement is True or False:
The product of two rationals is always rational.

rational numbers

Options

- False
- True

Solution

Step 1 : The product of two rational numbers is rational.

Step 2 : Again, by definition, a rational number can be expressed as a fraction with integer values in the numerator and denominator (denominator not zero).

So, multiplying two rationals is the same as multiplying two such fractions, which will result in another fraction of this same form since integers are closed under multiplication.

Thus, multiplying two rational numbers produces another rational number.

Step 3 : Lets take a example,

$$\frac{3}{6} \times \frac{9}{6}$$

$$\frac{9 \times 3}{6 \times 6}$$

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Question 13:

Which of the following is a rational number ?

Options

- 0.1201200120001200000...
- $\frac{1}{5}$
- π
- $\sqrt{4} \to \sqrt{41}$

Solution

Rational Numbers :-

A number 'r' is called a rational number, if it can be written in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Notice that all the numbers now in the bag can be written in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

For example, -25 can be written as $\frac{25}{1}$ here $p = -25$ and $q = 1$.

Irrational Numbers :-

A number 's' is called irrational, if it cannot be written in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Some examples are: $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5\pi}$, 0.10110111011110...

Step 1 : According to definition of the number $\sqrt{4} \to \sqrt{41}$.

This is irrational number because it can not be change in $\frac{p}{q}$.

Step 2 : π(Pi) has a value of 3.1415 which has a decimal expansion that is both non recurring and non terminating and goes on forever.

So, by the definition Pi is an irrational number.

However, to solve practical sums and for our satisfaction we consider the value of pi as $\frac{22}{7}$ and 3.14 so that they become rational as they can be shown in the form $\frac{p}{q}$ where both p and q are integers.

Step 3 : 0.1201200120001200000.... is an irrational number because it can not be change in $\frac{p}{q}$.

Step 4 : $\frac{1}{5}$ is a rational number because this is in the form of $\frac{p}{q}$.

Hence, the correct answer $\frac{1}{5}$.

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Question 14:

Find the rational form of 0.8888888888.

Options

Step 4 : Subtracting equation (i) from equation (ii) then we get

$$10x - x = [8.8888888888] - [0.8888888888]$$

$$9x = 8$$

Step 5 : Divide by 9 we get

$$x = \frac{8}{9}$$

$$= \frac{8}{9}$$

Step 6 : Therefore, 0.8888888888 can be written in the form of $\frac{p}{q}$ as $\frac{8}{9}$.

Hence, the correct answer is $\frac{8}{9}$.

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Question 15:

Write the denominator of the rational number $\frac{28}{4000000}$ in the form of $2^m \times 5^n$, where m, n are non-negative integers. hence, write its decimal expansion without actual division.

Hence,

Options

- Denominator of the rational number = $2^8 \times 5^6$ Decimal expansion = 28
- Denominator of the rational number = $5^8 \times 2^6$ Decimal expansion = 0.000007
- Denominator of the rational number = $2^6 \times 5^8$ Decimal expansion = 0.000007
- Denominator of the rational number = $2^8 \times 5^6$ Decimal expansion = 0.000007

Solution

Step 1 : If $\frac{28}{4000000} = \frac{28}{2^m \times 5^n}$

Step 2 : Now $\frac{28}{4000000}$ it can we written as

$$= \frac{700}{(2 \times 5)^8}$$

$$= \frac{700}{10^8} = \frac{7}{10^6}$$

$= 0.000007$

Step 6 : So decimal expansion of $\frac{28}{4000000} = 0.000007$ and value of $m = 8$ and $n = 6$

Step 7 : Therefore, Denominator of the rational number $= 2^8 \times 5^6$ Decimal expansion = 0.0000

Hence, the correct answer is Denominator of the rational number = $2^8 \times 5^6$ Decimal expansion = 0.000007.

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Question 16:

The decimal representation of $\frac{3}{8}$ will be:

Options

- non terminating non repeating
- non terminating

it can we written as

$x = 2.757575757575$ $x = 2.74747474747474$ ...(1)

Step 2 : There is only two repeating digit so multiply by 100 we get

$100x = 274.747474747474747$ ...(2) $275.7575757575\ 75$

Step 3 : Subtracting equation (1) from equation (2) then we get

$100x - x = [274.747474747474747] - [2.7474747474747474]$

$99x = 272$ $275.75757575\ 757575 - 2.757575\ 757575$

273

Step 4 : Divide by 99 we get

$$x = \frac{272}{99}$$ 273

$$x = \frac{272}{99}$$ 273

Step 5 : Therefore $2.\overline{75}$ can be written in the form of $\frac{p}{q}$ as $\frac{272}{99}$ 273

Step 6 : Therefore,$2.\overline{75}$ is A rational number.

Hence, the correct answer is A rational number.

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Solution

Step 1 : The real number is a rational number of the form $\frac{p}{q}$

Step 2 : The prime factorisation of q is of the form $2^n \times 5^m$, and n,m are some non-negative integers.

Step 3 : If denominator of rational number in the form of $2^n \times 5^m$ then it will be terminated decimal number and highest power of 2 or 5 will be ______ number of digits after its terminated.

Step 4 : A real number whose decimal expansion terminates into a rational number of the form $\frac{p}{q}$, where p and q are coprime, and the prime

No space required

factorisation of the denominator (that is, q) has only powers of 2, or powers of 5, or both.

Hence, the correct answer is 2 or 5 only

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Question 20:

Is that $7 + 3\sqrt{2}$ is not a rational number?

Options

$$3\sqrt{2} = \left(\frac{}{b}\right) - \frac{}{1}$$

$$3\sqrt{2} = \frac{(a - 7b)}{b}$$

$$\sqrt{2} = \frac{(a - 7b)}{3b}$$

Step 5 : Since 7, 3 , a and b are integers, $\frac{(a - 7b)}{3b}$ is rational, and so $\sqrt{2}$ is rational.

Step 6 : But this contradicts the fact that $\sqrt{2}$ is irrational .

Step 7 : So, we conclude that $7 + 3\sqrt{2}$ is irrational.

Hence, the correct answer is Yes.

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Question 21:

Find two rational numbers between 0.5 and 0.6.

Options

- $\frac{5}{10}$ and $\frac{18}{30}$

15 18

Solution

Step 1 : Between any two given rational numbers there exist uncountable rational numbers.

This property of rational numbers is called the property of density.

Step 2 : Here we have,

$$0.5 = \frac{5}{10}$$

$$= \frac{3 \times 5}{3 \times 10}$$

$$= \frac{15}{30}$$

$$0.6 = \frac{6}{10}$$

$$= \frac{3 \times 6}{3 \times 10}$$

$$= \frac{18}{30}$$

two

Step 3 : Therefore, Two numbers between $0.5 = \frac{5}{10}$ and $0.6 = \frac{6}{10}$ are $\frac{16}{30}$ and $\frac{17}{30}$.

Hence, the correct answer is $\frac{16}{30}$ and $\frac{17}{30}$.

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Question 22:

Can 0.23002421307506055 be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

Options

- No
- Yes

Solution

Terminating decimals:- Terminating decimals are those numbers which come to an end after few repetitions after decimal point.

Example: 0.5, 2.456, 123.456, etc. are all examples of terminating decimals.

Non terminating decimals:- Non terminating decimals are those which keep on continuing after decimal point (i.e. they go on forever). They don't come to end or if they do it is after a long interval.

For example: = π(Pi) = (3.14159265358979323846264338327950288419716939937510582097 4.....) is an example of non terminating decimal as it keeps on continuing after decimal point.

Step 1 : Given,

We have to check that the 0.23002421307506055 can expressed in the rational form or not.

Step 2 : Given number can not be expressed in the form of $\frac{p}{q}$ because it's a non-terminating and non-recurring decimal number and these types of number are called irrational number and we can not express an irrational number in the form of $\frac{p}{q}$.

Hence, the correct answer is No.

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Question 23:

Express 0.298 as a rational number in the form $\frac{a}{b}$.

Options

- $\frac{149}{500}$
- $\frac{308}{1000}$
- $\frac{0.298}{1000}$
- $\frac{298}{100}$

Solution

Step 1 : Express 0.298 as a rational number in the form $\frac{a}{b}$,

Step 2 : Multiply and divide by 1000 with number 0.298 to remove decimal point.

$$\frac{0.298 \times 1000}{1000}$$

$$\frac{298}{1000}$$

Step 3 : Now to simplify $\frac{298}{1000}$,

$$\frac{149}{500} = 0.298$$

Step 4 : Thus, 0.298 can be written in the form of $\frac{a}{b}$ as $\frac{149}{500}$.

Hence, the correct answer is $\frac{149}{500}$.

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Question 24:

The decimal representation of a rational number $\frac{p}{q}$ is a terminating decimal only if for non-negative integers m and n, prime factors of q are the form:

Options

- $2^m \times 5^n$ 2^n
- $5^n \times 5^m$
- $2^n \times 5^m$

$5^n \times 2^m$

5^{-n}

Solution

Terminating decimals :- Terminating decimals are those numbers which come to an end after few repetitions after decimal point.

Example :- 0.5, 2.456, 123.456, etc. are all examples of terminating decimals.

Non terminating decimals :- Non terminating decimals are those which keep on continuing after decimal point (i.e. they go on forever). They don't come to end or if they do it is after a long interval.

Example :- π(Pi) = (3.14159265358979323846264338327950288419716939937510582097 4.....) is an example of non terminating decimal as it keeps on continuing after decimal point.

Step 1 : We have converted a real number whose decimal expansion terminates into a rational number of the form $\frac{p}{q}$, where p and q are coprime, ________ No space required ________ and the prime factorisation of the denominator (that is, q) has only powers of 2, or powers of 5, or both.

Step 2 : We find that this real number is a rational number of the form $\frac{p}{q}$,

Step 3 : Where the prime factorisation of q is of the form $2^n \times 5^m$, and n,m are some non-negative integers.

Step 4 : If denominator of rational number in the form of $2^n \times 5^m$ then it will be terminated decimal number and highest power of 2 or 5 will be number of digits after its terminated.

digits after its terminated

Step 5 : Therefore, from the all of the option $2^n \times 5^m$ is correct form.

Hence, the correct answer is $2^n \times 5^m$.

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Question 25:

Step 2 : The decimal representation of $\frac{744}{522}$ will be:

We need write decimal expansion of $\frac{744}{522} = 1.4252873563218391$

Step 3 : Therefore, its has a non-terminating decimal number expansion.

Hence, the correct answer is non-terminating.

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Question 27:

If $\frac{294}{1600000} = \frac{294}{2^m \times 5^n}$, find the values of m and n are non-negative integers. Hence, write its decimal expansion without actual division.

Options

- **m = 9, n = 5 Decimal expansion = 0.00018375**
- **m = 5, n = 9 Decimal expansion = 0.00018375**
- **m = 9, n = 5 Decimal expansion = 294**
- **m = 9, n = 6 Decimal expansion = 0.00018375**

Options

- $\frac{21}{9}$
- $\frac{13}{9}$
- $\frac{18}{9}$
- $\frac{8}{9}$

Solution

Step 1 : Given number = 0.8888888888

Step 2 : Let x = 0.8888888888 ...(i)

Step 3 : There is only one repeating digit so multiply by 10, we get

$10x = 8.8888888888$ ...(ii)

Step 4 : Subtracting equation (i) from equation (ii) then we get

$$10x - x = [8.8888888888] - [0.8888888888]$$

$$9x = 8$$

Step 5 : Divide by 9 we get

$$x = \frac{8}{9}$$

$$= \frac{8}{9}$$

Step 6 : Therefore, 0.8888888888 can be written in the form of $\frac{p}{q}$ as $\frac{8}{9}$.

Hence, the correct answer is $\frac{8}{9}$.

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Question 29:

The decimal expansion of the rational number $\frac{7127}{2^3 \times 5^4}$, will terminate after how many places of decimal ?

Options

- 4 place of decimal
- 7 place of decimal
- 6 place of decimal
- 5 place of decimal

Solution

Terminating decimals :- Terminating decimals are those numbers which come to an end after few repetitions after decimal point.

Example :- 0.5, 2.456, 123.456, etc. are all examples of terminating decimals.

Non terminating decimals :- Non terminating decimals are those which keep on continuing after decimal point (i.e. they go on forever). They don't come to end or if they do it is after a long interval.

Example :- π(Pi) = (3.141592653589793238462643383279502884197169399375105820974.....) is an example of non terminating decimal as it keeps on continuing after decimal point.

If denominator of rational number in the form of $2^a \times 5^b$ then it will be terminated decimal number and highest power of 2 or 5 will be number of digits after its terminated.

Step 1 : The real number is a rational number of the form $\frac{m}{y}$.

Step 2 : The prime factorisation of y is of the form $2^n \times 5^m$, and n, m are some non-negative integers.

Step 3 : If denominator of rational number in the form of $2^n \times 5^m$ then it will be terminated decimal number and highest power of 2 or 5 will be number of digits after its terminated.

Step 4 : A real number whose decimal expansion terminates into a rational number of the form $\frac{m}{y}$, where m and y are coprime, and the prime factorization of the denominator has only powers of 2, or powers of 5, or both.

Hence, the correct answer is $2^n \times 5^m$.

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Question 31:

After how many digits will the decimal expansion of $\frac{3}{8}$ come to an end ?

Options

- 6
- 5

Solution

Step 1 : Given,

$$\text{number} = \frac{3}{8}$$

Step 2 : After how many digits will the decimal expansion of $\frac{3}{8}$ come to an end.

We have converted a real number whose decimal expansion terminates into a rational number of the form $\frac{p}{q}$, where p and q are coprime

and the prime factorization of the denominator (that is, q) has only powers of 2, or powers of 5, or both.

Step 3 : We need write decimal expansion of $\frac{3}{8}$

$$\frac{3}{8} = 0.375$$

Step 4 : So, after 3 digits it will be terminated.

Hence, the correct answer is 3.

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