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To Test whether a Given Rational number is a Terminating or non-terminating repeating Decimals

(i) Rule 1

A Rational no. is Terminating Decimal if the denominator of the Rational no. is of form $(2^m \times 5^n)$ for some whole numbers m & n.

i.e The prime factorisation of Denominator if results in only 2 as a factor or only 5 as a factor or only 2,5 as its factor, then it is terminating Decimal.

(ii) Rule 2

A Rational no is Non-Terminating Repeating Decimal, if the denominator of the Rational no. is not in the form of $(2^m \times 5^n)$ where m & n are whole nos.

i.e The prime factorisation of Denominator if results in other than 2 or 5 as factors than it is non-terminating repeating Decimals.

Ex-

(i) $\frac{17}{90} = \frac{17}{(2\times3\times3\times5)}$

$$\begin{array}{r|l} 2 & 90 \\ 3 & 45 \\ 3 & 15 \\ 5 & 5 \\ & 1 \end{array}$$

clearly '90' has 2, 3, 5 as its factor

i.e $(2\times3\times3\times5) \neq (2^m \times 5^n)$

$\therefore \frac{17}{90}$ is a non-terminating repeating Decimal.

(ii) $\frac{33}{50} = \frac{33}{(2\times5\times5)}$

$$\begin{array}{r|l} 2 & 50 \\ 5 & 25 \\ 5 & 5 \\ & 1 \end{array}$$

clearly '50' has 2 and 5 as its factors.

i.e $50 = 2^1 \times 5^2$, which is of form $(2^m \times 5^n)$

(iii) $\frac{11}{24} = \frac{11}{(2^3 \times 3)}$

$$\begin{array}{r|l} 2 & 24 \\ 2 & 12 \\ 2 & 6 \\ 3 & 3 \\ & 1 \end{array}$$

clearly '24' has factors 2 & 3.

i.e $(24) \neq (2^m \times 5^n)$

$\therefore \frac{11}{24}$ is a non-terminating repeating Decimal.

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

clearly '2' has only factor '2'

$\therefore 2 = 2^1 = 2^1 \times 1 = 2^1 \times 5^0$ which is in the form $(2^m \times 5^n)$

$\frac{1}{2}$ is terminating Decimal.

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Change of Decimal to $\frac{p}{q}$ form

① Express $0.\overline{001}$ as $\frac{p}{q}$ form in simplest form

Soln let $x = 0.001001001\ldots$ —(i)

multiplying eq(i) By 1000 we get :-

$1000x = 1.\overline{001}\,\overline{001}\ldots$ —(ii)

on Subtracting (i) from (ii), we get

$1000x - x = 1.001001\ldots - 0.001001001\ldots$

$\Rightarrow 999x = 1.001001\ldots$
$\quad - 0.001001\ldots$
$\quad 1.00000$

$\Rightarrow 999x = 1$

$\Rightarrow x = \frac{1}{999}$

$\therefore x = 0.\overline{001} = \frac{1}{999}$

② Express $0.23\overline{45}$ as $\frac{p}{q}$ form in

Soln let $x = 0.23454545\ldots$ —(i)

By multiplying 100 in eq(i), we get

$100x = 23.45454545\ldots$ —(ii)

By multiplying 100 in eq(ii) we get

$100 \times 100x = 2345.454545\ldots$

$\Rightarrow 10000x = 2345.454545\ldots$ —(iii)

Subtracting (iii) from (ii)

$10000x - 100x = 2345.4545\ldots - 23.4545\ldots$

$\Rightarrow 9900x = 2345.45545\ldots$

$\quad - 23.4545\ldots$

$\quad 2322.0000\ldots$

$\Rightarrow 9900x = 2322$

$\Rightarrow x = \frac{2322}{9900}$

$\Rightarrow x = \frac{\cancel{2322}\ \cancel{1161}\ \cancel{387}\ 129}{\cancel{9900}\ \cancel{4950}\ \cancel{1650}\ 550}$

$\Rightarrow \boxed{x = \frac{129}{550}}$

$\therefore x = 0.23\overline{45} = \frac{129}{550}$

(3) Expres $0.0\overline{3}$ as $\frac{p}{q}$ form :-

Soln let $x = 0.03333\ldots$ —— (i)

Now multiply by 10 in eq (i),

$10x = 00.3333\ldots$ (ii)

$\Rightarrow$ multiplying eq (ii) with 10 we get

$10 \times 10x = 10 \times (0.333\ldots)$

$\Rightarrow 100x = 3.333\ldots$ (iii)

Subtracting (iii) from (ii),

$100x - 10x = 3.33\ldots - 0.33\ldots$

$\Rightarrow 90x = 3$

$\Rightarrow x = \frac{\cancel{3}\,1}{\cancel{90}\,30} = \frac{1}{30}$

H.W 17.6.2020

(1) find two irrational nos between 2 and 2.5.

(II) Express the following in $\frac{p}{q}$ form:-

(a) $5.3\overline{47}$ (II) $0.\overline{8}$ (III) $0.0\overline{2}$

(3) write $4\frac{1}{8}$, $\frac{9}{35}$, $\frac{17}{320}$ is terminating or nonterminating repeating decimals.