

**HOLY TRINITY INTERNATIONAL SCHOOL**  
**Melpalai, Edaicode Post, K.K.Dist.**  
**Grade IX**  
**Mathematics**  
**Irrational numbers**

Note :

- Convert the fractions in decimal number in the form of non-terminating and non-recurring.
- There will be infinitely many such decimals.

Example:

- Find an irrational number between  $\frac{1}{7}$  and  $\frac{2}{7}$ . Find the decimal form of  $\frac{1}{7}$  and  $\frac{2}{7}$ .

Soln. :  $\frac{1}{7} = 0.\overline{142857}$  [ie., 0.142857142857142857.....]

$\frac{2}{7} = 0.\overline{285714}$  [ie., 0.285714285714285714....]

Here we want to find an irrational number between 0.142857 and 0.285714. There are infinitely many irrational numbers. One such number is 0.150150015000150000...

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

Soln. : Express the rational numbers as decimals  $\frac{5}{7} = 0.\overline{714285}$  and  $\frac{9}{11} = 0.8181... = 0.\overline{81}$

There are infinite number of irrational numbers between  $0.\overline{714285}$  and  $0.\overline{81}$ , out of these three of there can be

- 0.750750075000750....
  - 0.7670767007670007670000...
  - 0.780780078000...
- Classify the following numbers as rational or irrational.

Study :

- A rational number is a number exactly either as a whole number, a fraction or a mixed fraction, but not always exactly as a decimal.
- An irrational number can never be known in any form. (Non recurring, not repeating ...)

A.  $\sqrt{23} = 4.79583...$

ie.,  $\sqrt{23}$  is not a perfect square.

$\sqrt{23}$  is an irrational number.

B.  $\sqrt{225}$

$225 = 15 \times 15 = 15^2$

225 is a perfect square.

$\sqrt{225} = 15$

Thus  $\sqrt{225}$  is a rational number.

C. 0.3796

Here 0.3796 is a terminating decimal

It is a rational number.

$$\begin{array}{r}
 479583 \\
 4 \overline{) 23,00,00,00,00} \\
 \underline{16} \\
 87 \phantom{00} \\
 \underline{609} \\
 9585 \phantom{00} \\
 \underline{9100} \\
 95908 \phantom{00} \\
 \underline{8541} \\
 95908 \phantom{00} \\
 \underline{55900} \\
 95908 \phantom{00} \\
 \underline{47925} \\
 959163 \phantom{00} \\
 \underline{797500} \\
 959163 \phantom{00} \\
 \underline{767264} \\
 959163 \phantom{00} \\
 \underline{3023600} \\
 959163 \phantom{00} \\
 \underline{2877489}
 \end{array}$$

D. 7.478478...

•  $7.478478... = 7.\overline{478}$

It is a non-terminating and recurring (repeating) decimal.

E. 1.101001000100001....

It is a non-terminating and non-repeating decimal number.

It is an irrational number.

4. Express 0.99999..... in the form of  $\frac{p}{q}$

Soln. : Let  $x = 0.99999.....$  (1)

Multiply by 10 on both sides,

$$10x = 10x(0.99999...)$$

$$10x = 9.9999..... \quad (2)$$

Subtract equation (1) from equation (2), we get

$$10x - x = (9.9999...) - (0.9999...)$$

$$9x = 9$$

$$x = \frac{9}{9} = 1$$

Thus  $0.9999 \dots = 1$ . [Because there is no gap between 1 and 0.99999....]

Home work.

1. Express 0.66666..... in the form of  $\frac{p}{q}$ .

2. Write the following in decimals.

(i)  $\frac{1}{11}$       (ii)  $\frac{3}{13}$       (iii)  $\frac{329}{400}$       (iv)  $\frac{1}{17}$

3. Express  $0.\overline{38}$  as a rational number.

Example 5.

Check whether

(i)  $7\sqrt{5}$ ,  $\frac{7}{\sqrt{5}}$ ,  $\sqrt{2+21}$ ,  $\pi-2$  are irrational numbers or not.

Soln. :  $7\sqrt{5}$ ;  $\sqrt{5}=2.236.....$

$$7\sqrt{5} = 15.652....$$

It is non-terminating and non-recurring. So it is an irrational numbers.

$$(ii) \quad \frac{7}{\sqrt{5}} = \frac{7\sqrt{5}}{\sqrt{5}\times\sqrt{5}} = \frac{7\times 2.236}{5} = \frac{15.652}{5} = 3.1504...$$

It is also non-terminating and non-recurring decimal. So it is an irrational number.

$$(iii) \quad \sqrt{2+21} = 1.4142... + 21 = 22.4142....$$

It is an irrational number because non-terminating and non-recurring.

$$(iv) \quad \pi-2=3.1415..... -2=1.1415.....$$

It is an irrational number because the decimal is non-terminating and non-recurring.

Home work:

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)  $\sqrt{4}$

**Note : Study by heart the following values.**

$$\sqrt{2} = 1.4142.....$$

$$\sqrt{3} = 1.732....$$

$$\sqrt{5} = 2.236...$$

$$\pi = 3.1415$$