CBSE Worksheet
Class 9 Maths
Chapter 1: Number System

1. It is impossible to represent a rational number in decimal form.

(a) Terminating
(b) Non- terminating
(c) Repeating or Non- Terminating
(d) Non-repeating or Non- terminating

2. Between two rational numbers

(a) There is no rational number.
(b) There is exactly one rational number.
(c) There are infinitely many rational numbers.
(d) There are only rational numbers and no irrational numbers.

3. The product of any two irrational numbers,

(a) is always an irrational number.
(b) is always a rational number.
(c) is always an integer.
(d) can be rational or irrational.

4. Which of the following is irrational?

(a) $\sqrt{7}$
(b) $\sqrt{81}$
(c) $\frac{\sqrt{12}}{\sqrt{3}}$
(d) $\frac{\sqrt{4}}{9}$

5. What is the value is $\sqrt{4} \times \sqrt{81}$?

(a) 36
(b) 18

(c) 16
(d) 42

6. Fill in the blanks;

(a) Any two integers are separated by a finite number of others …..
(b) There are an ….. amount of rational numbers between 15 and 18.
(c) X+Y is a rational number if x and y are both ……
(d) Value of $\sqrt[3]{8}$ …….

7. Match the Column:

Column I	Column II
Value of 1.9999…..	$\frac{3}{7}$
The Simplest form of a rational number $\frac{177}{413}$	Recurring decimal and Non-Terminating
0.36	2
0.18181818………	Terminating Decimal

8. Using two irrational numbers as an example:

(a) Product is an irrational number.
(b) Difference is a irrational number.
(c) Division is an irrational number.

9. Simplify; $(\sqrt{5}+\sqrt{6})(\sqrt{5}-\sqrt{6})$.

10. Simplify; $\sqrt[3]{1331}-\sqrt{100}+\sqrt{81}$.

11. Calculate the value of $\frac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$.

12. **Calculate the $\frac{x}{y}$ form of 0.777 . . . . ., where x and y are integers and y does not equal to zero.**

13. **Find three rational number between $\frac{9}{11}$ and $\frac{5}{11}$.**

14. **The value of $\frac{\sqrt{8}+\sqrt{12}}{\sqrt{32}+\sqrt{48}}$.**

15. **The value of $a^b + b^a$, if $a = 2$ and $b = 3$.**

16. **Simplify; $2^{\frac{2}{3}} \times 2^{\frac{1}{5}}$**

17. **Find the value of $\frac{1}{a^b + b^a}$, where $a = 5, b = 2$**

18. **Arrange in ascending order $\sqrt[3]{2}, \sqrt{3}, \sqrt[6]{5}$.**

19. **Simplify $(4\sqrt{5} + 3\sqrt{7})^2$**

20. **Find the value of a, If $\left(\frac{y}{x}\right)^{2a-8} = \left(\frac{x}{y}\right)^{a-1}$.**

21. **Rationalize the denominators of $\frac{1}{\sqrt{7}}$.**

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

23. Express $0.\overline{001}$ in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

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

25. Find six rational numbers between 3 and 4.

Answers to the Worksheet:

1. (d)

A rational number cannot have a non-terminating or non-repeating decimal form.

2. (c)

Between two rational numbers, there are infinitely many rational numbers.

E.g. $\frac{3}{5}$ and $\frac{4}{5}$ are two rational numbers, then $\frac{31}{50}\frac{32}{50}\frac{33}{50}\frac{34}{50}\frac{35}{50}\ldots$ are infinite rational number between them.

3. (d)

The product of two irrational numbers can be rational or irrational depending on the two numbers.

For example, $\sqrt{3}\times\sqrt{3}$ is 3 which is a rational number whereas $\sqrt{2}\times\sqrt{4}$ is $\sqrt{8}$ which is an irrational number. As $\sqrt{3},\sqrt{2},\sqrt{4}$ are irrational.

Hence, option D is correct.

4. (a) $\sqrt{7}$ is an irrational number.

5. (b)

$\sqrt{4}\times\sqrt{81} = \sqrt{2^2}\times\sqrt{9^2} = 2\times 9 = 18$

6. Fill in the blanks.

(a) Any two integers are separated by a finite number of other <u>integers</u>.
(b) There are an <u>endless</u> amount of rational numbers between 15 and 18 .
(c) $X+Y$ is a rational number if x and y are both <u>rational numbers</u>.
(d) Value of $\sqrt[3]{8}$ is $\underline{2}$

7. Match The Column:

Column I	Column II
Value of 1.9999…..	2
The Simplest form of a rational number $\frac{177}{413}$	$\frac{3}{7}$
0.36	Terminating Decimal
0.18181818………	Recurring decimal and Non-Terminating

Explanation:

	Explanation
Value of 1.9999…..	Let, $x=1.999 \quad \ldots(1)$ Since only 1 digit is repeating. So, by multiplying x by 10 , we get $10x=19.99 \quad \ldots(2)$ Subtracting equation (1) from (2), we get $9x=18$ $\Rightarrow x=\frac{18}{9}$ $\Rightarrow x=2$ The value of $1.999\ldots$ in the form $\frac{p}{q}$, where p and q are integers an $q \neq 0$, is 2 .

The Simplest form of a rational number $\frac{177}{413}$	$\frac{177}{413} = \frac{3\times 59}{7\times 59}$ 59 will cancel out, therefore, we get $= \frac{3}{7}$
0.36	A terminating decimal is a decimal, that has an end digit. It is a decimal, which has a finite number of digits(or terms). Hence, 0.36 is terminating decimal.
0.18181818………	Non-terminating decimals are the one that does not have an end term. Hence, 0.18181818……… is non-terminating decimal.

8. Given an example of two irrational numbers whose;

(a) Product is an irrational number $\sqrt{6}\times\sqrt{3}=\sqrt{6\times 3}=\sqrt{18}=3\sqrt{2}$

(b) Difference is a irrational number $\sqrt{6}-\sqrt{3} = \sqrt{3}$

(c) Division is an irrational number $\frac{\sqrt{6}}{\sqrt{3}}=\sqrt{\frac{6}{3}}=\sqrt{2}$

9. Simplify; $(\sqrt{5}+\sqrt{6})(\sqrt{5}-\sqrt{6})$

We know that, $(a+b)(a-b)=a^2-b^2$

Then,

$= \left((\sqrt{5})^2-(\sqrt{6})^2\right)$

$= 5-6$

$= -1$

10. $\sqrt[3]{1331}-\sqrt{100}+\sqrt{81}$

$= \sqrt[3]{11^3}-\sqrt{10^2}+\sqrt{9^2}$

$= 11-10+9$

$= 1+9$
$= 10$

11. $\dfrac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}}$

$\dfrac{11^{\frac{1}{2}}}{11^{\frac{1}{4}}} = 11^{\frac{1}{2}-\frac{1}{4}}$

$= 11^{\frac{2-1}{4}}$

$= 11^{\frac{1}{4}}$

12. Let,

$p = 0.777 \quad .... \quad (1)$

Multiply both side in above equation 10

Then,

$10p = 7.777 \ ....(2)$

Subtracting equation (1) from (2), we get;

$10p - p = 7.777 - 0.777$

$9p = 7$

$p = \dfrac{7}{9}$

13. Three rational number between $\dfrac{9}{11}$ and $\dfrac{5}{11}$

Rational number of $\dfrac{9}{11}$ and $\dfrac{5}{11}$ is denominator same

Then,

$= \dfrac{9}{11}, \dfrac{8}{11}, \dfrac{7}{11}, \dfrac{6}{11}, \dfrac{5}{11}$

14. $\dfrac{\sqrt{8}+\sqrt{12}}{\sqrt{32}+\sqrt{48}}$

$=\dfrac{\sqrt{2^3}+\sqrt{4\times 3}}{\sqrt{8\times 4}+\sqrt{8\times 6}}$

$=\dfrac{2\sqrt{2}+2\sqrt{3}}{4\sqrt{2}+4\sqrt{3}}$

$=\dfrac{2(\sqrt{2}+\sqrt{3})}{4(\sqrt{2}+\sqrt{3})}$

$=\dfrac{(\sqrt{2}+\sqrt{3})}{2(\sqrt{2}+\sqrt{3})}$

$=\dfrac{1}{2}$

15. If $a=2$ and $b=3$

The value of a^b+b^a

$=2^3+3^2$

$=8+9$

$=17$

16. $2^{\frac{2}{3}}\cdot 2^{\frac{1}{5}}$

$2^{\frac{2}{3}}\cdot 2^{\frac{1}{5}}=2^{\frac{2}{3}+\frac{1}{5}} \quad \because a^p\cdot a^q=a^{p+q}$

$=2^{\frac{10+3}{15}}$

$=2^{\frac{13}{15}}$

17. Value of $\dfrac{1}{a^b+b^a}$, where $a=5,b=2$

$=\dfrac{1}{5^2+2^5}$

$=\frac{1}{25+32}$

$=\frac{1}{57}$

18. Here we have : $\sqrt[3]{2},\sqrt{3},\sqrt[5]{5}$

We can also write the expression in simpler form as follows:

$2^{\frac{1}{3}},3^{\frac{1}{2}},5^{\frac{1}{6}}$

Now we can see that in the denominators of the exponents we have: 3, 2, 6

We will now take the LCM of 3, 2, 6, which is 6.

Now we will make all the denominators equal to 6, so we have to multiply by the multiples in both numerator and denominator.

We can write the numbers as:

$2^{\frac{1}{3}}\times\frac{2}{2}=2^{\frac{2}{6}}$

For the second number we can write:

$3\frac{1}{2}\times\frac{3}{3}=3\frac{3}{6}$

Since in the third number we already have the desired denominator, so the third number is

$5^{\frac{1}{6}}$

Now we will again write the numbers in the root under, but we have to keep in mind that the numerator will turn as the exponential powers inside the root.

So we have the numbers as:

$\sqrt[6]{2^2},\sqrt[5]{3^3},\sqrt[5]{5}$

We will simplify the values inside the root, so we have:

$\sqrt[5]{4},\sqrt[6]{27},\sqrt[5]{5}$

From this we can write the smaller value in the front and then the larger value:

$\sqrt[5]{4},\sqrt[6]{5},\sqrt[5]{27}$

Hence the original numbers in ascending form are:

$\sqrt[3]{2}, \sqrt[6]{5}, \sqrt{3}$

19. $(4\sqrt{5}+3\sqrt{7})^2$

We know that,

$(a+b)^2 = a^2 + b^2 + 2ab$

$= (4\sqrt{5})^2 + (3\sqrt{7})^2 + 2\times(4\sqrt{5})(3\sqrt{7})$

$= 80 + 63 + 24\sqrt{5\times 7}$

$= 143 + 24\sqrt{35}$

20. $\left(\frac{y}{x}\right)^{2a-8} = \left(\frac{x}{y}\right)^{a-1}$

Rewrite,

$\left(\frac{y}{x}\right)^{2a-8} = \left(\frac{x}{y}\right)^{8-2a} \quad \because (x)^{-a} = \frac{1}{x^a}$

Then,

$\left(\frac{x}{y}\right)^{8-2a} = \left(\frac{x}{y}\right)^{a-1}$

When the bases of both sides of an equation are the same, then their exponents are also equal.

$\Rightarrow 8-2a = a-1$

$\Rightarrow 2a + a = 8+1$

$\Rightarrow 3a = 9$

$\Rightarrow a = \frac{9}{3}$

$\Rightarrow a = 3$

21. $\frac{1}{\sqrt{7}} = \frac{1}{\sqrt{7}} \times \frac{\sqrt{7}}{\sqrt{7}}$

(Dividing and multiplying by $\sqrt{7}$)

$=\frac{\sqrt{7}}{7}$

22. Writing π as $\frac{22}{7}$ is only an approximate value and so we can't conclude that it is in the form of a rational. In fact, the value of π is calculating as non-terminating, non-recurring decimal as $\pi = 3.14159$ Whereas

If we calculate the value of $\frac{22}{7}$ it gives 3.142857 and hence $\pi \neq \frac{22}{7}$

In conclusion π is an irrational number.

23. Let $x = 0.001001\ldots\ldots$ (1)

Since 3 digits are repeated multiply both the sides of (1) by 1000

$1000x = 1.001001\ldots$

$1000x = 1 + 0.001001\ldots$

$1000x = 1 + x$

$1000x - x = 1$

$999x = 1$

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

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

24. Since we make the denominator the same first, then

$\frac{3}{4} = \frac{3\times 5}{4\times 5} = \frac{15}{20}$

$\frac{4}{5} = \frac{4\times 4}{5\times 4} = \frac{16}{20}$

Now we need to find 5 rational no.

$\frac{15}{20} = \frac{15\times 6}{20\times 6} = \frac{90}{120}$

$\frac{16}{20} = \frac{16\times 6}{20\times 6} = \frac{96}{120}$

$\therefore$ Five rational numbers between $\frac{3}{4}$ and $\frac{4}{5}$ are $\frac{91}{120}, \frac{92}{120}, \frac{93}{120}, \frac{94}{120}$ and $\frac{95}{120}$

25. We can find any number of rational numbers between two rational numbers. First of all, we make the denominators same by multiplying or dividing the given rational numbers by a suitable number. If denominator is already same then depending on number of rational no. we need to find in question, we add one and multiply the result by numerator and denominator.

$3 = \frac{3 \times 7}{7}$ and $4 = \frac{4 \times 7}{7}$

$3 = \frac{21}{7}$ and $4 = \frac{28}{7}$

We can choose 6 rational numbers as: $\frac{22}{7}, \frac{23}{7}, \frac{24}{7}, \frac{25}{7}, \frac{26}{7}$ and $\frac{27}{7}$.