

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

Exercise 1.2

Page: 11

1. Express each number as a product of its prime factors:

- (i) 140
- (ii) 156
- (iii) 3825
- (iv) 5005
- (v) 7429

Solutions:

(i) 140 By Taking the LCM of 140, we will get the product of its prime factor.

$$\text{Therefore, } 140 = 2 \times 2 \times 5 \times 7 \times 1 = 2^2 \times 5 \times 7$$

(ii) 156 By Taking the LCM of 156, we will get the product of its prime factor.

$$\text{Hence, } 156 = 2 \times 2 \times 13 \times 3 \times 1 = 2^2 \times 13 \times 3$$

(iii) 3825 By Taking the LCM of 3825, we will get the product of its prime factor.

$$\text{Hence, } 3825 = 3 \times 3 \times 5 \times 5 \times 17 \times 1 = 3^2 \times 5^2 \times 17$$

(iv) 5005 By Taking the LCM of 5005, we will get the product of its prime factor.

$$\text{Hence, } 5005 = 5 \times 7 \times 11 \times 13 \times 1 = 5 \times 7 \times 11 \times 13$$

(v) 7429

By Taking the LCM of 7429, we will get the product of its prime factor.

$$\text{Hence, } 7429 = 17 \times 19 \times 23 \times 1 = 17 \times 19 \times 23$$

2. Find the LCM and HCF of the following pairs of integers and verify that $\text{LCM} \times \text{HCF} = \text{product of the two numbers}$.

- (i) 26 and 91
- (ii) 510 and 92
- (iii) 336 and 54

Solutions:

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers**(i) 26 and 91**

Expressing 26 and 91 as product of its prime factors, we get, 26

$$= 2 \times 13 \times 1$$

$$91 = 7 \times 13 \times 1$$

Therefore, $\text{LCM}(26, 91) = 2 \times 7 \times 13 \times 1 = 182$

And $\text{HCF}(26, 91) = 13$

Verification

Now, product of 26 and 91 = $26 \times 91 = 2366$ And

Product of LCM and HCF = $182 \times 13 = 2366$

Hence, $\text{LCM} \times \text{HCF} = \text{product of the 26 and 91}$.

(ii) 510 and 92

Expressing 510 and 92 as product of its prime factors, we get,

$$510 = 2 \times 3 \times 17 \times 5 \times 1$$

$$92 = 2 \times 2 \times 23 \times 1$$

Therefore, $\text{LCM}(510, 92) = 2 \times 2 \times 3 \times 5 \times 17 \times 23 = 23460$

And $\text{HCF}(510, 92) = 2$

Verification

Now, product of 510 and 92 = $510 \times 92 = 46920$

And Product of LCM and HCF = $23460 \times 2 = 46920$ Hence,

$\text{LCM} \times \text{HCF} = \text{product of the 510 and 92}$.

(iii) 336 and 54

Expressing 336 and 54 as product of its prime factors, we get,

$$336 = 2 \times 2 \times 2 \times 2 \times 7 \times 3 \times 1$$

$$54 = 2 \times 3 \times 3 \times 3 \times 1$$

Therefore, $\text{LCM}(336, 54) = 2^4 \times 3^3 \times 7 = 3024$

And $\text{HCF}(336, 54) = 2 \times 3 = 6$

Verification

Now, product of 336 and 54 = $336 \times 54 = 18,144$

And Product of LCM and HCF = $3024 \times 6 = 18,144$ Hence,

$\text{LCM} \times \text{HCF} = \text{product of the 336 and 54}$.

3. Find the LCM and HCF of the following integers by applying the prime factorisation method.

(i) 12, 15 and 21

(ii) 17, 23 and 29

(iii) 8, 9 and 25

Solutions:

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(i) 12, 15 and 21

Writing the product of prime factors for all the three numbers, we get,

$$12=2 \times 2 \times 3$$

$$15=5 \times 3$$

$$21=7 \times 3$$

Therefore,

$$\text{HCF}(12,15,21) = 3$$

$$\text{LCM}(12,15,21) = 2 \times 2 \times 3 \times 5 \times 7 = 420$$

(ii) 17, 23 and 29

Writing the product of prime factors for all the three numbers, we get,

$$17=17 \times 1$$

$$23=23 \times 1$$

$$29=29 \times 1$$

Therefore,

$$\text{HCF}(17,23,29) = 1$$

$$\text{LCM}(17,23,29) = 17 \times 23 \times 29 = 11339$$

(iii) 8, 9 and 25

Writing the product of prime factors for all the three numbers, we get,

$$8=2 \times 2 \times 2 \times 1$$

$$9=3 \times 3 \times 1$$

$$25=5 \times 5 \times 1$$

Therefore,

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$$\text{HCF}(8,9,25)=1$$

$$\text{LCM}(8,9,25) = 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5 = 1800$$

4. Given that $\text{HCF}(306, 657) = 9$, find $\text{LCM}(306, 657)$.

Solutions: As we know that,

$\text{HCF} \times \text{LCM} = \text{Product of the two given numbers}$

Therefore,

$$9 \times \text{LCM} = 306 \times 657$$

$$\text{LCM} = \frac{306 \times 657}{9} = 22338$$

Hence, $\text{LCM}(306, 657) = 22338$

5. Check whether 6^n can end with the digit 0 for any natural number n .

Solutions: If the number 6^n ends with the digit zero (0), then it should be divisible by 5, as we know any number with unit place as 0 or 5 is divisible by 5.

Prime factorization of $6^n = (2 \times 3)^n$

Therefore, the prime factorization of 6^n doesn't contain prime number 5.

Hence, it is clear that for any natural number n , 6^n is not divisible by 5 and thus it proves that 6^n cannot end with the digit 0 for any natural number n .

6. Explain why $7 \times 11 \times 13 + 13$ and $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ are composite numbers.

Solutions: By the definition of composite number, we know, if a number is composite, then it means it has factors other than 1 and itself. Therefore, for the given expression; $7 \times 11 \times 13 + 13$

Taking 13 as common factor, we get,

$$= 13(7 \times 11 \times 1 + 1) = 13(77 + 1) = 13 \times 78 = 13 \times 3 \times 2 \times 13$$

Hence, $7 \times 11 \times 13 + 13$ is a composite number.

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

Now let's take the other number,

$$7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$$

Taking 5 as a common factor, we get,

$$=5(7 \times 6 \times 4 \times 3 \times 2 \times 1 + 1) = 5(1008 + 1) = 5 \times 1009$$

Hence, $7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 + 5$ is a composite number.

7. There is a circular path around a sports field. Sonia takes 18 minutes to drive one round of the field, while Ravi takes 12 minutes for the same. Suppose they both start at the same point and at the same time, and go in the same direction. After how many minutes will they meet again at the starting point?

Solutions: Since, Both Sonia and Ravi move in the same direction and at the same time, the method to find the time when they will be meeting again at the starting point is LCM of 18 and 12.

$$\text{Therefore, } \text{LCM}(18, 12) = 2 \times 3 \times 3 \times 2 \times 1 = 36$$

Hence, Sonia and Ravi will meet again at the starting point after 36 minutes.

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

Exercise 1.3

Page: 14

1. Prove that $\sqrt{5}$ is irrational.**Solutions:** Let us assume, that $\sqrt{5}$ is rational number.i.e. $\sqrt{5} = \frac{x}{y}$ (where, x and y are co-primes)

$$y\sqrt{5} = x$$

Squaring both the sides, we get,

$$(y\sqrt{5})^2 = x^2$$
$$\Rightarrow 5y^2 = x^2 \dots\dots\dots (1)$$

Thus, x^2 is divisible by 5, so x is also divisible by 5.Let us say, $x = 5k$, for some value of k and substituting the value of x in equation (1), we get,

$$5y^2 = (5k)^2$$
$$\Rightarrow y^2 = 5k^2$$

 y^2 is divisible by 5 it means y is divisible by 5.Therefore, x and y are co-primes. Since, our assumption about $\sqrt{5}$ is rational is incorrect.Hence, $\sqrt{5}$ is irrational number.

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

2. Prove that $3 + 2\sqrt{5}$ is irrational.

Solutions: Let us assume $3 + 2\sqrt{5}$ is rational.

Then we can find co-prime x and y ($y \neq 0$) such that $3 + 2\sqrt{5} = \frac{x}{y}$.

Rearranging, we get,

$$2\sqrt{5} = \frac{x}{y} - 3$$

$$\sqrt{5} = \frac{1}{2} \left(\frac{x}{y} - 3 \right)$$

Since, x and y are integers, thus, $\frac{1}{2} \left(\frac{x}{y} - 3 \right)$ is a rational number.

Therefore, $\sqrt{5}$ is also a rational number. But this contradicts the fact that $\sqrt{5}$ is irrational.

So, we conclude that $3 + 2\sqrt{5}$ is irrational.

3. Prove that the following are irrationals:

(i) $1/\sqrt{2}$

(ii) $7\sqrt{5}$

(iii) $6 + \sqrt{2}$

Solutions: (i) $1/\sqrt{2}$

Let us assume $1/\sqrt{2}$ is rational.

Then we can find co-prime x and y ($y \neq 0$) such that $1/\sqrt{2} = \frac{x}{y}$.

Rearranging, we get,

$$\sqrt{2} = \frac{y}{x}$$

Since, x and y are integers, thus, $\sqrt{2}$ is a rational number, which contradicts the fact that $\sqrt{2}$ is irrational.

Hence, we can conclude that $1/\sqrt{2}$ is irrational.

(ii) $7\sqrt{5}$

Let us assume $7\sqrt{5}$ is a rational number.

Then we can find co-prime a and b ($b \neq 0$) such that $7\sqrt{5} = \frac{x}{y}$.

Rearranging, we get,

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

$$\sqrt{5} = \frac{x}{7y}$$

Since, x and y are integers, thus, $\sqrt{5}$ is a rational number, which contradicts the fact that $\sqrt{5}$ is irrational.

Hence, we can conclude that $7\sqrt{5}$ is irrational.

(iii) $6 + \sqrt{2}$

Let us assume $6 + \sqrt{2}$ is a rational number.

Then we can find co-primes x and y ($y \neq 0$) such that $6 + \sqrt{2} = \frac{x}{y}$.

Rearranging, we get,

$$\sqrt{2} = \frac{x}{y} - 6$$

Since, x and y are integers, thus, $\frac{x}{y} - 6$ is a rational number and therefore, $\sqrt{2}$ is rational. This contradicts

the fact that $\sqrt{2}$ is an irrational number.

Hence, we can conclude that $6 + \sqrt{2}$ is irrational.

Exercise 1.4

Page: 17

1. Without actually performing the long division, state whether the following rational numbers will have a terminating decimal expansion or a non-terminating repeating decimal expansion:

(i) $\frac{13}{3125}$ (ii) $\frac{17}{8}$ (iii) $\frac{64}{455}$ (iv) $\frac{15}{1600}$ (v) $\frac{29}{343}$ (vi) $\frac{23}{2^3 5^2}$ (vii) $\frac{129}{2^2 5^7 7^5}$ (viii) $\frac{6}{15}$ (ix) $\frac{35}{50}$ (x) $\frac{77}{210}$

Solutions:

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

Note: If the denominator has only factors of 2 and 5 or in the form of $2^m \times 5^n$ then it has terminating decimal expansion.

If the denominator has factors other than 2 and 5 then it has a non-terminating decimal expansion.

(i) $\frac{13}{3125}$

Factorizing the denominator, we get,

$$3125 = 5 \times 5 \times 5 = 5^5$$

Since, the denominator has only 5 as its factor, $\frac{13}{3125}$ has a terminating decimal expansion.

(ii) $\frac{17}{8}$

Factorizing the denominator, we get,

$$8 = 2 \times 2 \times 2 = 2^3$$

Since, the denominator has only 2 as its factor, $\frac{17}{8}$ has a terminating decimal expansion.

(iii) $\frac{64}{455}$

Factorizing the denominator, we get,

$$455 = 5 \times 7 \times 13$$

Since, the denominator is not in the form of $2^m \times 5^n$, thus $\frac{64}{455}$ has a non-terminating decimal expansion.

(iv) $\frac{15}{1600}$

Factorizing the denominator, we get,

$$1600 = 2^6 \times 5^2$$

Since, the denominator is in the form of $2^m \times 5^n$, thus $\frac{15}{1600}$ has a terminating decimal expansion.

(v) $\frac{29}{343}$

Factorizing the denominator, we get,

$$343 = 7 \times 7 \times 7 = 7^3$$

Since, the denominator is not in the form of $2^m \times 5^n$, thus $\frac{29}{343}$ has a non-terminating decimal expansion.

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

(vi) $\frac{23}{2^3 5^2}$

Clearly, the denominator is in the form of $2^m \times 5^n$.

Hence, $\frac{23}{2^3 5^2}$ has a terminating decimal expansion.

(vii) $\frac{129}{2^2 5^7 7^5}$

As you can see, the denominator is not in the form of $2^m \times 5^n$.

Hence, $\frac{129}{2^2 5^7 7^5}$ has a non-terminating decimal expansion.

(viii) $\frac{6}{15}$

$$\frac{6}{15} = \frac{2}{5}$$

Since, the denominator has only 5 as its factor, thus, $\frac{6}{15}$ has a terminating decimal expansion.

(ix) $\frac{35}{50}$
 $\frac{35}{50} = \frac{7}{10}$

Factorising the denominator, we get,

$$10 = 2 \times 5$$

Since, the denominator is in the form of $2^m \times 5^n$, thus, $\frac{35}{50}$ has a terminating decimal expansion.

(x) $\frac{77}{210}$

$$\frac{77}{210} = \frac{7 \times 11}{7 \times 30} = \frac{11}{30}$$

Factorising the denominator, we get,

$$30 = 2 \times 3 \times 5$$

As you can see, the denominator is not in the form of $2^m \times 5^n$.

Hence, $\frac{77}{210}$ has a non-terminating decimal expansion.

2. Write down the decimal expansions of those rational numbers in Question 1 above which have terminating decimal expansions.

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

Solutions:

(i) $\frac{13}{3125}$

3125)13.00000(0.00416

0

130

0

13000

- 12500

5000

-3125

18750

18750

00000

$$\frac{13}{3125} = 0.00416$$

(ii) $\frac{17}{8}$

8) 17 (2.125

-16

10

-8

20

-16

40

-40

00

$$\frac{17}{8} = 2.125$$

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

(iii) $\frac{64}{455}$ has a Non terminating decimal expansion

(iv) $\frac{15}{1600}$

1600) 15.000000 (0.009375

0

150

0

1500

0

15000

-14400

6000

-4800

12000

-11200

8000

-8000

0000

 $\frac{15}{1600} = 0.009375$

(v) $\frac{29}{343}$ has a Non terminating decimal expansion

(vi) $\frac{23}{2^3 5^2} = \frac{23}{8 \times 25} = \frac{23}{200}$

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

200) 23.000(0.115

0

23

-0

230

-200

300

-200

1000

-1000

0000

$$\frac{23}{2^3 5^2} = 0.115$$

(vii) $\frac{129}{2^2 5^7 7^5}$ has a Non terminating decimal expansion

(viii) $\frac{6}{15} = \frac{2}{5}$

5) 2.0 (0.4

0

20

-20

00

(ix) $\frac{35}{50} = \frac{7}{10}$

10) 7 (0.7

0

70

-70

00

NCERT Solution for Class 10 Maths Chapter 1 Real Numbers

$$\frac{35}{50} = 0.7$$

(x) $\frac{77}{210}$ has a non-terminating decimal expansion.

3. The following real numbers have decimal expansions as given below. In each case, decide whether they are rational or not. If they are rational, and of the form, $\frac{p}{q}$ what can you say about the prime factors of q ?

(i) 43.123456789

(ii) 0.120120012000120000...

(iii) $43.\overline{123456789}$

Solutions:

(i) 43.123456789

Since it has a terminating decimal expansion, it is a rational number in the form of $\frac{p}{q}$ and q has factors of 2 and 5 only.

(ii) 0.120120012000120000...

Since, it has non-terminating and non-repeating decimal expansion, it is an irrational number.

(iii) $43.\overline{123456789}$

Since it has non-terminating but repeating decimal expansion, it is a rational number in the form of $\frac{p}{q}$ and q has factors other than 2 and 5.

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