Class 10th - NCERT Solutions Math: Chapter 1 Real Numbers

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# NCERT Solutions for Class 10th Mathematics: Chapter 1 Real Numbers

Class 10: Mathematics Chapter 1 solutions. Complete Class 10 Mathematics Chapter 1 Notes.

## NCERT Solutions for Class 10th Mathematics: Chapter 1 Real Numbers

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**Exercise 1.1**

1. Use Euclid's division algorithm to find the HCF of:

(i) 135 and 225

(ii) 196 and 38220

(iii) 867 and 255

**Answer**

(i) 225 > 135 we always divide greater number with smaller one.

Divide 225 by 135 we get 1 quotient and 90 as remainder so that

225= 135 × 1 + 90

Divide 135 by 90 we get 1 quotient and 45 as remainder so that

135= 90 × 1 + 45

Divide 90 by 45 we get 2 quotient and no remainder so we can write it as

90 = 2 × 45+ 0

As there are no remainder so divisor 45 is our HCF.

(ii) 38220 > 196 we always divide a greater number with smaller one.

Divide 38220 by 196 then we get quotient 195 and no remainder so we can write it as

38220 = 196 × 195 + 0

As there is no remainder so divisor 196 is our HCF.

(iii) 867 > 255 we always divide greater number with smaller one.

Divide 867 by 255 then we get quotient 3 and remainder is 102 so we can write it as

867 = 255 × 3 + 102

Divide 255 by 102 then we get quotient 2 and remainder is 51 so we can write it as

255 = 102 × 2 + 51

Divide 102 by 51 we get quotient 2 and no remainder so we can write it as

102 = 51 × 2 + 0

As there is no remainder so divisor 51 is our HCF.

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**2. Show that any positive odd integer is of the form 6*q* + 1, or 6*q* + 3, or 6*q* + 5, where *q* is some integer.**

**Answer**

Let take *a* as any positive integer and *b* = 6.

Then using Euclid's algorithm we get a = 6*q* + *r* here *r* is remainder and value of *q* is more than or equal to 0 and *r* = 0, 1, 2, 3, 4, 5 because 0 ≤ *r* < b and the value of *b* is 6

So total possible forms will 6*q* + 0 , 6*q* + 1 , 6*q* + 2,6*q* + 3, 6*q* + 4, 6*q* + 5

6 is divisible by 2 so it is a even number

6 is divisible by 2 but 1 is not divisible by 2 so it is a odd number

6 is divisible by 2 and 2 is also divisible by 2 so it is a even number

6*q* +3

6 is divisible by 2 but 3 is not divisible by 2 so it is a odd number

6 is divisible by 2 and 4 is also divisible by 2 it is a even number

6*q* + 5

6 is divisible by 2 but 5 is not divisible by 2 so it is a odd number

So odd numbers will in form of 6q + 1, or 6q + 3, or 6q + 5.

**3. An army contingent of 616 members is to march behind an army band of 32 members in a parade. The two groups are to march in the same number of columns. What is the maximum number of columns in which they can march?**

**Answer**

HCF (616, 32) will give the maximum number of columns in which they can march.

We can use Euclid's algorithm to find the HCF.

616 = 32 × 19 + 8

32 = 8 × 4 + 0

The HCF (616, 32) is 8.

Therefore, they can march in 8 columns each.

**4. Use Euclid's division lemma to show that the square of any positive integer is either of form 3*m* or 3*m* + 1 for some integer m.**

**[Hint: Let *x* be any positive integer then it is of the form 3*q*, 3*q* + 1 or 3*q* + 2. Now square each of these and show that they can be rewritten in form 3*m* or 3*m* + 1.]**

**Answer**

Let a be any positive integer and $b = 3$.

Then $a = 3q + r$ for some integer $q \geq 0$

And $r = 0, 1, 2$ because $0 \leq r < 3$

Therefore, $a = 3q$ or $3q + 1$ or $3q + 2$

Or,

$a^2 = (3q)^2$ or $(3q + 1)^2$ or $(3q + 2)^2$

$a^2 = (9q)^2$ or $9q^2 + 6q + 1$ or $9q^2 + 12q + 4$

$= 3 \times (3q^2)$ or $3(3q^2 + 2q) + 1$ or $3(3q^2 + 4q + 1) + 1$

$= 3k_1$ or $3k_2 + 1$ or $3k_3 + 1$

Where $k_1$, $k_2$, and $k_3$ are some positive integers

Hence, it can be said that the square of any positive integer is either of the form 3*m* or 3*m* + 1.

**5. Use Euclid's division lemma to show that the cube of any positive integer is of the form 9*m*, 9*m* + 1 or 9*m* + 8.**

**Answer**

Let a be any positive integer and b = 3

$a = 3q + r$, where $q \geq 0$ and $0 \leq r < 3$

$\therefore$ $a = 3q$ or $3q + 1$ or $3q + 2$

Therefore, every number can be represented as these three forms. There are three cases.

Case 1: When $a = 3q$,

$a^3 = (3q)^3 = 27q^3 = 9(3q)^3 = 9m$,

Where $m$ is an integer such that $m = 3q^3$

Case 2: When $a = 3q + 1$,

$a^3 = (3q + 1)^3$

$a^3 = 27q^3 + 27q^2 + 9q + 1$

$a^3 = 9(3q^3 + 3q^2 + q) + 1$

$a^3 = 9m + 1$

Where $m$ is an integer such that $m = (3q^3 + 3q^2 + q)$

Case 3: When $a = 3q + 2$,

$a^3 = (3q + 2)^3$

$a^3 = 27q^3 + 54q^2 + 36q + 8$

$a^3 = 9(3q^3 + 6q^2 + 4q) + 8$

$a^3 = 9m + 8$

Where $m$ is an integer such that $m = (3q^3 + 6q^2 + 4q)$

Therefore, the cube of any positive integer is of the form $9m$, $9m + 1$,

or $9m + 8$.

NCERT 10th Mathematics Chapter 1

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

(i) 140

(ii) 156

(iii) 3825

(iv) 5005

(v) 7429

**Answer**

(i) 140 = 2 × 2 × 5 × 7 = $2^2$ × 5 × 7

(ii) 156 = 2 × 2 × 3 × 13 = $2^2$ × 3 × 13

(iii) 3825 = 3 × 3 × 5 × 5 × 17 = $3^2$ × $5^2$ × 17

(iv) 5005 = 5 × 7 × 11 × 13

(v) 7429 = 17 × 19 × 23

**2. Find the LCM and HCF of the following pairs of integers and verify that LCM × HCF = product of the two numbers.**

(i) 26 and 91

(ii) 510 and 92

(i) 26 = 2 × 13

91 =7 × 13

HCF = 13

LCM =2 × 7 × 13 =182

Product of two numbers 26 × 91 = 2366

Product of HCF and LCM 13 × 182 = 2366

Hence, product of two numbers = product of HCF × LCM

(ii) 510 = 2 × 3 × 5 × 17

92 =2 × 2 × 23

HCF = 2

LCM =2 × 2 × 3 × 5 × 17 × 23 = 23460

Product of two numbers 510 × 92 = 46920

Product of HCF and LCM 2 × 23460 = 46920

Hence, product of two numbers = product of HCF × LCM

(iii) 336 = 2 × 2 × 2 × 2 × 3 × 7

54 = 2 × 3 × 3 × 3

HCF = 2 × 3 = 6

LCM = 2 × 2 × 2 × 2 × 3 × 3 × 3 × 7 =3024

Product of two numbers 336 × 54 =18144

Product of HCF and LCM 6 × 3024 = 18144

Hence, product of two numbers = product of HCF × LCM.

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

(i) 12, 15 and 21

(ii) 17, 23 and 29

(iii) 8, 9 and 25

**Answer**

(i) 12 = 2 × 2 × 3

15 =3 × 5

21 =3 × 7

HCF = 3

LCM = 2 × 2 × 3 × 5 × 7 = 420

(ii) 17 = 1 × 17

23 = 1 × 23

29 = 1 × 29

HCF = 1

LCM = 1 × 17 × 19 × 23 = 11339

(iii) 8 =1 × 2 × 2 × 2

9 =1 × 3 × 3

25 =1 × 5 × 5

HCF =1

LCM = 1 × 2 × 2 × 2 × 3 × 3 × 5 × 5 = 1800

**4. Given that HCF (306, 657) = 9, find LCM (306, 657).**

**Answer**

We have the formula that

Product of LCM and HCF = product of number

LCM × 9 = 306 × 657

Divide both side by 9 we get

LCM = (306 × 657) / 9 = 22338

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

**Answer**

If any digit has last digit 10 that means it is divisible by 10 and the factors of 10 = 2 × 5.

So value 6*n* should be divisible by 2 and 5 both 6*n* is divisible by 2 but not divisible by 5 So it can not end with 0.

**6. Explain why 7 × 11 × 13 + 13 and 7 × 6 × 5 × 4 × 3 × 2 × 1 + 5 are composite numbers.**

**Answer**

7 × 11 × 13 + 13

Taking 13 common, we get

13 (7 x 11 +1 )

13(77 + 1 )

13 (78)

It is product of two numbers and both numbers are more than 1 so it is a composite number.

7 × 6 × 5 × 4 × 3 × 2 × 1 + 5

Taking 5 common, we get

5(7 × 6 × 4 × 3 × 2 × 1 +1)

5(1008 + 1)

5(1009)

It is product of two numbers and both numbers are more than 1 so it 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?**

**Answer**

They will be meet again after LCM of both values at the starting point.

18 = 2 × 3 × 3

12 = 2 × 2 × 3

LCM = 2 × 2 × 3 × 3 = 36

Therefore, they will meet together at the starting point after 36 minutes.

**Exercise 1.3**

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**1. Prove that √5 is irrational.**

**Answer**

Let take √5 as rational number

If *a* and *b* are two co prime number and *b* is not equal to 0.

We can write $\sqrt{5} = a/b$

Multiply by b both side we get

$b\sqrt{5} = a$

To remove root, Squaring on both sides, we get

$5b^2 = a^2$ … **(i)**

Therefore, 5 divides $a^2$ and according to theorem of rational number, for any prime number *p* which is divides $a^2$ then it will divide *a* also.

That means 5 will divide *a*. So we can write

$a = 5c$

Putting value of *a* in equation **(i)** we get

$5b^2 = (5c)^2$

$5b^2 = 25c^2$

Divide by 25 we get

$b2/5 = c^2$

Similarly, we get that *b* will divide by 5 and we have already get that $a$ is divide by 5

but $a$ and $b$ are co prime number. so it contradicts.

Hence $\sqrt{5}$ is not a rational number, it is irrational.

**2. Prove that 3 + 2√5 is irrational.**

**Answer**

Let take that $3 + 2\sqrt{5}$ is a rational number.

So we can write this number as

$3 + 2\sqrt{5} = a/b$

Here a and b are two co prime number and b is not equal to 0

Subtract 3 both sides we get

$2\sqrt{5} = a/b – 3$

$2\sqrt{5} = (a-3b)/b$

Now divide by 2, we get

$\sqrt{5} = (a-3b)/2b$

Here $a$ and $b$ are integer so $(a-3b)/2b$ is a rational number so $\sqrt{5}$ should be a rational number But $\sqrt{5}$ is a irrational number so it contradicts.

Hence, $3 + 2\sqrt{5}$ is a irrational number.

**3. Prove that the following are irrationals:**

(i) $1/\sqrt{2}$ (ii) $7\sqrt{5}$ (iii) $6 + \sqrt{2}$

**Answer**

(i) Let take that $1/\sqrt{2}$ is a rational number.

So we can write this number as

$1/\sqrt{2} = a/b$

Here *a* and *b* are two co prime number and *b* is not equal to 0

Multiply by √2 both sides we get

1 = (*a*√2)/*b*

Now multiply by *b*

*b* = *a*√2

divide by a we get

*b*/*a* = √2

Here *a* and *b* are integer so b/a is a rational number so √2 should be a rational number But √2 is a irrational number so it contradicts.

Hence, 1/√2 is a irrational number

(ii) Let take that 7√5 is a rational number.

So we can write this number as

7√5 = *a*/*b*

Here *a* and *b* are two co prime number and *b* is not equal to 0

Divide by 7 we get

√5 = *a*/(7*b*)

Here *a* and *b* are integer so *a*/7*b* is a rational number so √5 should be a rational number but √5 is a irrational number so it contradicts.

Hence, 7√5 is a irrational number.

(iii) Let take that 6 + √2 is a rational number.

So we can write this number as

6 + √2 = *a*/*b*

Here a and b are two co prime number and b is not equal to 0

Subtract 6 both side we get

$\sqrt{2} = a/b - 6$

$\sqrt{2} = (a-6b)/b$

Here $a$ and $b$ are integer so $(a-6b)/b$ is a rational number so $\sqrt{2}$ should be a rational number.

But $\sqrt{2}$ is a irrational number so it contradicts.

Hence, $6 + \sqrt{2}$ is a irrational number.

## Exercise 1.4

**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) 13/3125

(ii) 17/8

(iii) 64/455

(iv) 15/1600

(v) 29/343

(vi) $23/2^3 \times 5^2$

(vii) $129/2^2 \times 5^7 \times 7^5$

(viii) 6/15

(ix) 35/50

(x) 77/210

**Answer**

(i) 13/3125

Factorize the denominator we get

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

So denominator is in form of $5^m$ so it is terminating .

(ii) 17/8

Factorize the denominator we get

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

So denominator is in form of $2^m$ so it is terminating .

(iii) 64/455

Factorize the denominator we get

$455 = 5 \times 7 \times 13$

There are 7 and 13 also in denominator so denominator is not in form of $2^m \times 5^n$ . so it is not terminating.

(iv) 15/1600

Factorize the denominator we get

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

so denominator is in form of $2^m \times 5^n$

Hence it is terminating.

(v) 29/343

Factorize the denominator we get

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

There are 7 also in denominator so denominator is not in form of $2^m \times 5^n$

Hence it is non-terminating.

(vi) $23/(2^3 \times 5^2)$

Denominator is in form of $2^m \times 5^n$

Hence it is terminating.

(vii) $129/(2^2 \times 5^7 \times 7^5)$

Denominator has 7 in denominator so denominator is not in form of $2^m \times 5^n$

Hence it is none terminating.

(viii) 6/15

divide nominator and denominator both by 3 we get 2/5

Denominator is in form of $5^m$ so it is terminating.

(ix) 35/50 divide denominator and nominator both by 5 we get 7/10

Factorize the denominator we get

$10=2 \times 5$

So denominator is in form of $2^m \times 5^n$ so it is terminating.

(x) 77/210

simplify it by dividing nominator and denominator both by 7 we get 11/30

Factorize the denominator we get

$30=2 \times 3 \times 5$

Denominator has 3 also in denominator so denominator is not in form of $2^m \times 5^n$

Hence it is none terminating.

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

**Answer**

(i) $13/3125 = 13/5^5 = 13\times2^5/5^5\times2^5 = 416/10^5 = 0.00416$ (ii) $17/8 = 17/2^3 = 17\times5^3/2^3\times5^3 = 17\times5^3/10^3 = 2125/10^3 = 2.125$

(iv) $15/1600 = 15/2^4\times10^2 = 15\times5^4/2^4\times5^4\times10^2 = 9375/10^6 = 0.009375$

(vi) $23/2^35^2 = 23\times5^3\times2^2/2^3\ 5^2\times5^3\times2^2 = 11500/10^5 = 0.115$

(viii) $6/15 = 2/5 = 2\times2/5\times2 = 4/10 = 0.4$

(ix) 35/50 = 7/10 = 0.7.

**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 *p* , *q* you say about the prime factors of *q*?**

(i) 43.123456789

(ii) 0.120120012000120000...

(iii) 43.123456789

**Answer**

(i) Since this number has a terminating decimal expansion, it is a rational number of the form *p*/q, and *q* is of the form $2^m \times 5^n$.

(ii) The decimal expansion is neither terminating nor recurring. Therefore, the given number is an irrational number.

(iii) Since the decimal expansion is non-terminating recurring, the given number is a rational number of the form *p*/q, and *q* is not of the form $2^m \times 5^n$.

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