CBSE NCERT Solutions for Class 9 mathematics Chapter 1

Exercise

Q.1. Is zero a rational number? Can you write it in the form of pq, where p and q are integers and q≠0?

Solution: A number 'r' is said to be a rational number, if it can be represented in the form pq, where p and q are integers and q≠0.

The number 0 can be written as: 01 or 02 or 03... or 0n, where n can be any integer, except 0.

Since 0 can be represented in the pq form, where q≠0, Hence, zero is a rational number.

Q.2. Find six rational numbers between 3 and 4.

Solution: We know that, an infinite number of rational numbers are present between 3 and 4.

To find six of these numbers, let us first represent 3 and 4 as rational numbers with denominator 6+1=7.

Multiplying and dividing the numbers by 7, we get, 3=3×77=217 and 4=4×77=287 The required rational numbers will be the numbers which are in between 217 and 287. Therefore, six rational numbers between 3 and 4 are 227, 237, 247, 257, 267, 277.

Q.3. Find five rational numbers between 35 and 45.

Solution: There are a infinite number of rational numbers between 35 and 45.

We can find them, by multiplying and dividing the numerator and denominator by the same number.

We can choose any number to multiply and divide but ideally, we choose the number that is more than the required number of rational numbers So, let us choose 7. Now, 35=3×75×7=2135 and 45=4×75×7=2835. Therefore, the required numbers are 2235,2335,2435,2535,2635. Note:
There are a infinite number of rational numbers in between two given rational numbers, so answer is not unique. It depends upon the numbers you have taken.

Q.4. Every natural number is a whole number.
True

Solution: True, because we can say that whole numbers are nothing but natural numbers including zero.

Therefore, every natural number is a whole number, but every whole number is not a natural number.

As 0 is a whole number, but it is not a natural number. Hence, the given statement is true.

False

Q.5. Every integer is a whole number.
TrueFalse

Solution: The whole numbers include all the positive integers and 0.

An integer is a whole number that can be positive, negative, or zero.

Therefore, all the negative integers are not whole numbers. So, every integer is not a whole number. Therefore, the given statement is false.

Q.6. Every rational number is a whole number.
TrueFalse

Solution: Given statement: Every rational number is a whole number.

We know that,

Whole numbers are all natural numbers, including zero. ⇒0, 1, 2, 3, 4,........, represents the set of whole numbers. Also, a number that can be expressed as the quotient or fraction of two integers p and q as pq, where p,q are integers and q≠0. Then, ...-67, -2, -1, 0, 1,12,23,......., represents the set of rational numbers. It can be seen that, The rational numbers 12 or 23 are fractions, but not whole numbers. Also, the set of rational numbers contain negative numbers, which are not whole numbers. So, Every whole number is a rational number, but every rational number is not a whole number. Hence, the given statement is false.

Q.7. Every irrational number is a real number.
True

Solution: A number is said to be an Irrational Number, if it cannot be written in the form pq, where p and q are integers and q≠0.

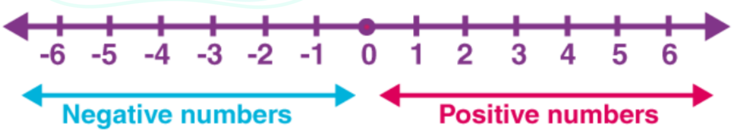
For example: 2, π, etc.

Now, the collection of all Irrational and Rational Numbers is called Real Numbers, as shown below: So, every Irrational Number is a Real Number. Hence, the given statement is True.

False

Q.8. Every point on the number line is of the form m, where m is a natural number.
TrueFalse

Solution: On number line positive numbers are placed to the right of zero and negative numbers are placed to the left of zero.



We know that, Square root of negative numbers cannot be determined. Therefore, The negative numbers on the number line cannot be expressed in the form m. Hence, The given statement is false.

Q.9. Every real number is an irrational number.
TrueFalse

Solution: We know that real numbers contain both rational and irrational numbers.

For example, 45 is a rational number, so it is a real number but not an irrational number.

Therefore, every real number cannot be irrational. Hence, the statement is false.

Q.10. Are the square roots of all positive integers irrational? If not, give an example of the square root of a number, that is a rational number.

Solution: No, the square root of all positive numbers need not be irrational.

For example, 4=2 and 9=3.

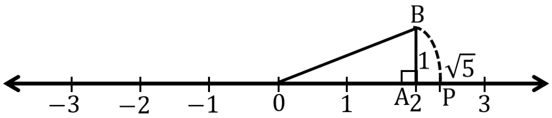
Here, 2 and 3 are rational numbers, because these can be written in the form of ratio of integers. Therefore, the square roots of all positive integers are not irrational.

Q.11. Show how 5 can be represented on the number line.

Solution: To represent 5 on the number line, take OA=2 units and make a perpendicular at A, so that AB=1 unit, as shown in the figure.

Then, ΔOAB is a right-angled triangle

So, by applying Pythagoras theorem, we get, OB2=OA2+AB2. ⇒OB2=22+12 ⇒OB2=5 ⇒OB=5 units.



Now, taking O as Centre and OB as radius, draw an arc intersecting the number line at P. Hence, OP is the required distance that represents 5.

Q.12. Write 36100 in decimal form and say what kind of decimal expansion it has?

Solution: Decimal numbers with the finite number of digits are called as terminating decimals.

Decimals with the infinite number of digits are called as non-terminating decimals.

Then, 36100=0.36 Here, we observe that the number of digits are finite. Hence, 36100 has terminating decimal expansion.

Q.13. Write 111 in decimal form and say what kind of decimal expansion it has?

Solution: If the division process does not end means we don't get remainder as equal to zero.

Then, such decimal is known as non-terminating decimal.

In some cases, a digit or a block of digits repeats itself in the decimal part, then the decimal is non-terminating recurring decimal. Now, 111=0.909090……=0.90¯ Hence, 111 has non-terminating and recurring decimal expansion.

Q.14. Write 418 in decimal form and say what kind of decimal expansion each has?

Solution: Decimal numbers with the finite number of digits are called as terminating decimals.

Decimals with the infinite number of digits are called as non-terminating decimals.

Now, 418=338=4.125 So, 418 has the finite number of decimals Hence, 418 has terminating decimal expansion.

Q.15. Write 313 in decimal form and say what kind of decimal expansion it has?

Solution: We know that, if the division process is not complete, we do not get a remainder equal to zero.

Then, such a decimal is known as non-terminating decimal.

In some cases, a digit or a block of digits repeats itself in the decimal part, then the decimal is a non-terminating recurring decimal. So, 313 = 0.230769230769230........ = 0.230769 Here, we observe that, the number of digits is infinite, but some block of digits is repeating. Hence, 313 has non-terminating and recurring decimal expansion.

Q.16. Write 211 in decimal form and say what kind of decimal expansion it has?

Solution: If the division process does not end, we do not get a remainder equal to zero.

Then, such a decimal is known as non-terminating decimal.

In some cases, a digit or a block of digits repeats itself in the decimal part, then the decimal is a non-terminating recurring decimal. Then, 211=0.1818181818……=0.18¯ Hence, 211 has non-terminating and recurring decimal expansion.

Q.17. Write 329400 in decimal form and say what kind of decimal expansion it has?

Solution: Decimal numbers with the finite number of digits are called as terminating decimals.

Decimals with the infinite number of digits are called as non-terminating decimals.

Then, 329400=0.8225 Hence, the number of decimal digits is finite. Hence, 329400 has terminating decimal expansion.

Q.18. You know that 17=0.142857¯. Can you predict what the decimal expansions of 27,37,47,57,67 are, without actually doing the long division? If so, how?

Solution: Yes, we can predict the expansions without actually doing the long division.

Given, 17=0.142857¯

To get the decimal expansions of 27,37,47,57,67, we need to multiply the numerator of each rational number by 0.142857. Then, we get 27=2×17=2×0.142857¯=0.285714¯. 37=3×17=3×0.142857¯=0.428571¯. 47=4×17=4×0.142857¯=0.571428¯. 57=5×17=5×0.142857¯=0.714285¯. 67=6×17=6×0.142857¯=0.857142¯.

Q.19. Express 0.6- in the form pq (in the simplest form), where p and q are integers and q≠0.
23

Solution: We know that,

0.6-=0.66666…

Let us consider, x=0.66666……(i)

Multiplying 10 on both the sides of equation (i), we get,
10x=6.6666....

RHS can also be written as, 6+0.6666....

⇒10x=6+x [as, x=0.6666...] ⇒9x=6 ⇒x=69 ∴x=23. Hence, 0.6=69=23.

Q.20. Express 0.47 in the form pq, where p and q are integers and q≠0.
4390

Solution: We know that,

0.47=0.4777.....

Let us consider, x=0.4777……(i)

Multiplying 10 on both the sides of equation (i), we get, 10x=4.777 …(ii)

Multiplying 10 on both the sides of equation (ii), we get, 100x=47.777....

RHS can also be written as, 43+4.777....

⇒100x=43+10x [as, 10x=4.777...]

⇒90x=43

∴x=4390

Hence, 0.47=4390.

Q.21. If 0.001 is expressed in the simplest form as pq, where p and q are integers and q≠0, then find the value of p+q.
1000

Solution: Given, 0.001=0.001001001…
Let us consider,
x=0.001001001… …(i)
Multiplying 1000 on both the sides of equation (i) we get,
1000x=1.001001001....
RHS can also be written as, 1+0.0010001001...
⇒1000x=1+x
⇒999x=1
⇒x=1999

On comparison with pq, we get
p=1, q=999
Hence, p+q=1000.

Q.22. Express 0.99999…… in the form pq. Are you surprised by your answer? With your teacher and classmates discuss why the answer makes sense.

Solution: Let us consider,

x = 0.99999 ....…..(i)

Number of decimal places which are repeating =1. Multiplying 101 = 10 on both the sides of equation (i) , We get, 10x=9.9999 RHS can also be written as, 9+0.9999 10x=9+x Substituting x=0.9999, we get, ⇒9x=9 ⇒x=99 Hence, x=11=1. The answer really surprises us. But, by the inspection we see that, 0.9999…. is very close to 1. Therefore, 0.99999 can be approximated to 1. Hence, they are equal.

Q.23. What can the maximum number of digits be in the repeating block of digits in the decimal expansion of 117? Perform the division to check your answer.

Solution: 1By performing the actual division operation, we get,

0.0588235294117647 05....171.00000000000000000 85 150 136 140 136 40 34 60 51 90

We observed that, 117 = 0.05882352941176470588.....=0.0588235294117647 Therefore, the maximum number digits that can be in the repeating block of digits in the above expansion are 16

Q.24. Look at several examples of rational numbers in the form pq q≠0, where p and q are integers with no common factors other than 1 and having terminating decimal representations (expansions). Can you guess, what property q must satisfy?

Solution: Let us look at some examples,

54=1.25, 218=2.625, 345=6.8

Also, 54=522×50, 218=2123×50, 345=3420×51 From the above examples, we may generally conclude that, Terminating decimal expansion will occur, when denominator 'q' of a rational number pq is in the form, 2a×5b, where 'a' and 'b' are integers.

Q.25. Write three numbers whose decimal expansions are non-terminating non-recurring.

Solution: There are infinite numbers of non-terminating and non-recurring decimals.

Further, we observe that all irrational numbers are non-terminating non-recurring.

Some examples are, (i) 0.645238456364… (ii) 3=1.73205087… (iii) 0.7235432436…

Q.26. Find three different irrational numbers between the rational numbers 57 and 911.

Solution: The given rational numbers are 57 and 911.

We know that,

A number whose decimal expansion is non-terminating non-recurring is irrational number. There are infinitely many irrational numbers in between two numbers. By performing long division, the numbers can be represented as, 57=0.714285… and 911=0.81818181........=0.81 Now, any three non-terminating non-recurring numbers between these numbers will satisfy the given question. Therefore, the required numbers can be, (i) 0.72534345029... (ii) 0.7523028734… (iii) 0.77623402347…

Q.27. Write rational or irrational for the number 23.
irrational

Solution: We have, 23=4.79583152331…

In the above expansion, the number is non-terminating and non-recurring.

Therefore, it is an irrational number.

Q.28. Check whether, 225 is rational or irrational?
Rational

Solution: We know that, 225=15

Also, 15 can be written as,

15=151
So, it can be represented in pq form, where q≠0. Hence, 225 is a rational number.

Q.29. Classify the number 0.3796 as Rational Number / Irrational Number.
Rational Number

Solution: Given number, 0.3796

We know that, the rational numbers are the numbers that can be written in the form of pq, where p and q are integers and q is not equal to zero.

As the above number is terminating, we can represent it in the form of pq as follows,

0.3796=379610000

Hence, it is a rational number.

Q.30. Identify whether the number 7.478478.... is Rational Number / Irrational Number.
Rational Number

Solution: Here, the given number can be represented as 7.478478…=7.478

This decimal number is recurring and non-terminating.

Therefore, it is a rational number.

Q.31. Identify whether the number 1.101001000100001 is Rational Number / Irrational Number.
Rational Number

Solution: The given number is 1.101001000100001.

We see that the decimal expansion of this number is non-recurring.

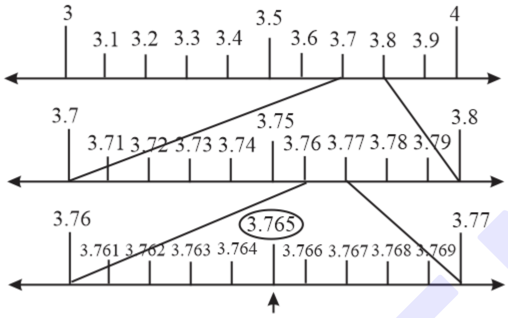
So, 1.101001000100001=11010010001000011000000000000000 which is of the form pq, where q≠0. Therefore, it is a rational number.

Q.32. Visualize 3.765 on the number line, using successive magnification.

Solution: To visualize 3.765 on the number line, we must follow these steps:

(i) First, we see that 3.765 lies between 3 and 4. Now, divide this portion into 10 equal parts.

(ii) Next, we should locate 3.76. We can observe that, this lies between 3.7 and 3.8. (iii) To get a more accurate visualization, we further divide this portion into 10 parts and locate it. (iv) Further, we visualize 3.765 and observe that it lies between 3.76 and 3.77. (v) To locate this, we divide the portion between 3.76 and 3.77 into 10 equal parts and hence, locate 3.765.

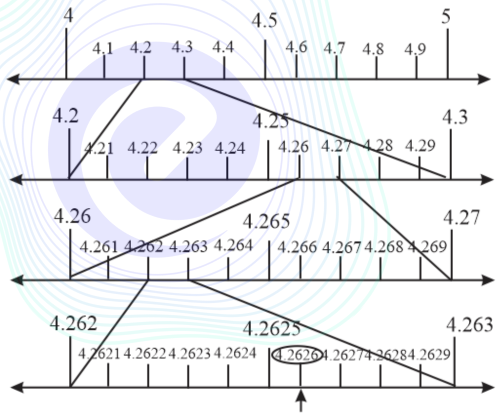


Q.33. Visualize 4.26¯ on the number line, up to 4 decimal places.

Solution: To visualize 4.26- on the number line, we must follow these steps:

(i) First, we see that 4.2 lies between 4 and 5

(ii) Now, divide this portion into 10 equal parts. (iii) Next, we locate 4.26. We observe that this lies between 4.2 and 4.3 (iv) To get a more accurate visualization, we further divide this portion into 10 parts and locate it. (v) Further, we visualize 4.262 and observe that it lies between 4.26 and 4.27 (vi) To locate this, we divide the portion between 4.26 and 4.27 into 10 equal parts and locate 4.262 (vii) We observe that, 4.2626 lies between 4.262 and 4.263. (viii) To find this, we divide the portion further into 10 parts and hence, locate 4.2626.



Q.34. 2-5 is: Rational Number or Irrational Number?
Irrational Number

Solution: Given number is 2-5.

Here, 2 is rational number and 5=2.2360679... which is non-terminating and non-recurring.

Thus, 5 is irrational. The difference of rational and irrational number is always irrational. Hence, 2-5 is irrational.

Q.35. Is 3+23-23 rational or irrational?
Rational

Solution: Given, 3+23-23

Then, let us find the value of the given number, we get

3+23-23=3=31 Now, we see that, the number can be represented in pq form, where q≠0. Therefore, it is a rational number.

Q.36. Identify whether the number 2777 is Rational Number / Irrational Number.
Rational Number

Solution: 2777=27, which represents in the form of pq, where p and q are integers and q≠0.

Therefore, it is a rational number.

Q.37. Classify the number 12 as: Rational Number / Irrational Number.
Irrational Number

Solution: The given number can be written as,

12=12×22

=22 We know that, 2 is an irrational number. ⇒22 is also an irrational number Therefore, 12 is an irrational number.

Q.38. Is 2π rational or irrational?
Irrational

Solution: Given number is 2π .

We know that, the approximate value of π is 3.1415…

Then, 2π=23.1415… =6.2830.... The decimal expansion of this expression is non-terminating and non-recurring. Therefore, 2π is an irrational number.

Q.39. If the simplified form of 3+32+2 is a+bc+cb+a, then find the value of a+b+c (where a, b, c are positive integers) as the final answer.
11

Solution: Given expression is: 3+32+2

Simplifying the above,

3+32+2 =32+2+32+2 ∵x+yp+q=xp+q+yp+q =6+32+23+6. Comparing the answer with the given form a+bc+cb+a we get, a+b+c = 6+3+2 = 11

Q.40. Simplify the expression: 3+33-3
6

Solution: The given expression is 3+33-3.

We know that,

a+ba-b=a2-b2 Thus, 3+33-3=32-32 =9-3=6 Hence, the value of the expression is 6.

Q.41. If the simplified form of the expression 5+22 is a+bc, then what is the value of a+b+c.
19

Solution: The given expression is 5+22.

We know that,

a+b2=a2+b2+2ab Thus, 5+22=52+22+252 =5+2+210 =7+210 Comparing 7+210 with a+bc, we get, a+b+c=7+2+10=19.

Q.42. Simplify 5-25+2.
3

Solution: Given expression is: 5-25+2

We know that,

a+ba-b=a2-b2 Thus, 5-25+2 =52-22 =5-2 =3 Hence, the value of the expression is 3.

Q.43. Recall, π is defined as the ratio of the circumference (say c) of a circle to its diameter (say d). That is, π=cd. This seems to contradict the fact that π is irrational. How will you resolve this contradiction?

Solution: There is no contradiction at all.

When we measure a length with scale or any other instrument, we only obtain an approximate rational value like 227 which is rational.

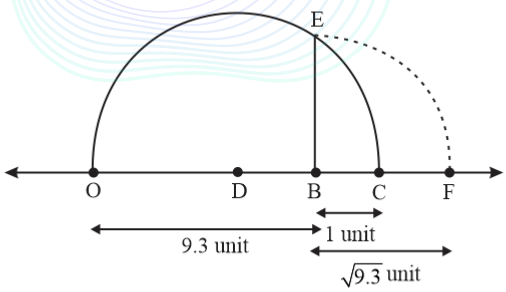
We never obtain, the exact value. For this reason, we may not realize, that either c or d is irrational. Therefore, the fraction cd is irrational. Hence, π is irrational.

Q.44. Represent 9.3 on the number line.

Solution: To represent 9.3 on the number line, we first need to mark a line segment OB=9.3 on number line.

Now, take BC of 1 unit.

Find the mid-point D of OC and draw a semi-circle on OC while taking D as its Centre. Draw a perpendicular to line OC passing through point B. Let it intersect the semi-circle at E. Taking B as Centre and BE as radius, draw an arc intersecting number line at F. BF is 9.3. Now, BE=BF=9.3.



Hence, 9.3 is located on the number line.

Q.45. If 17 can be expressed as kk, then find the value of k.
7

Solution: We need to rationalize the denominator of 17.

Multiplying and dividing by 7, we get:

17=1×77×7 =77 Therefore, the value of 17 with rational denominator is 77. Hence, the value of k is 7.

Q.46. If the rationalised form of 17-6 is in the form a+b then, write the value of a+b as final answer.

13

Solution: To rationalise the denominator, multiply the denominator and numerator of the given number by the conjugate of its denominator.

17-6

=17+67-67+6 =7+672-62 =7+67-6 =7+61 =7+6 Hence, the value of a+b is 13.

Q.47. If the rationalized form of 15+2 is 5-2k, then find the value of k.
3

Solution: Given, 15+2

The rationalising factor of 5+2 5-2.

Then, multiplying the numerator and the denominator by 5-2, we get, 15+2×5-25-2 =15-25+25-2 =5-252-22=5-25-2 =5-23 So, 5-2k=5-23⇒k=3 Therefore, the value of k is 3.

Q.48. When we Rationalise the denominator of 17-2 we get a+bc. Find the value of c
3

Solution: Given irrational number is: 17-2

Multiplying both numerator and denominator by 7+2, we get,

17+27-27+2 =7+272-22 ∵a+ba-b=a2-b2 =7+27-4 =7+23 Hence, the rationalised form of the given number is 7+23. Thus, c=3

Q.49. Find the value of 6412.
8

Solution: Given, 6412

On simplifying, we get,

6412=2612 Using amn=amn, we obtain,

=26×12

=23 =8 Hence, required answer is 8.

Q.50. Find 3215?
2

Solution: We need to find the value of 3215.

We have: 3215=2515 [Expressing 32 as 25]

=25×15 amn=amn

=21=2
Therefore, the value of 3215 is 2.

Q.51. Find the value of 12513.
5

Solution: Given, 12513.

On simplifying, we get,

12513=5313

Using amn=amn, we get, =53×13

=51=5

Hence, the required answer is 5.

Q.52. Find 932.
27

Solution: Given: 932

=3232

=32×32 amn=amn =33 =27 ∴932=27.

Q.53. Simplify: 3225.
4

Solution: Here, we need to simplify 3225.

3225=2525

=25×25 amn=amn =22=4 Hence, 3225=4.

Q.54. Find 1634.
8

Solution: The given expression is 1634.

⇒1634=2434

Use the laws of exponents, amn=amn

=24×34

=23=8 Hence, 1634=8.

Q.55. If the value of 125-13 is in the form of kl, then find the value of k+l.
6

Solution: Given, 125-13

Using a-m=1am, we get,

=112513 =15313 Applying amn=amn, we obtain, =153×13 =15 Here, required answer is in the form of kl. Hence, k+l=1+5=6.

Q.56. If the simplified value of 223·215 is in the form 2k15, then write the value of k as the final answer.
13

Solution: Given expression is: 223·215

Using the law of exponents, am·an=am+n.

223·215 =223+15 =210+315 =21315 Hence, k=13.

Q.57. If the simplified form of 1337 is km, then find the value of k+m.
-18

Solution: Given, 1337

Using amn=amn, we get,

1337=133×7

=1321 Now, on applying 1am=a-m

⇒3-21 =km Hence, k+m=3+(-21)=-18.

Q.58. Find the value of x.

11121114=11x
14

Solution: Here, we need to simplify 11121114.

We know that,

aman=am-n ⇒11121114 =1112-14 =112-14 =1114 Hence, the value of x is 14.

Q.59. If the value of 712· 812 is in the form of klm, then find the value of k+l+m.
59

Solution: Given, 712.812

Using am. bm=abm, we get,

712. 812 =7×812 =5612 The required answer is in the form of klm. Hence, k+l+m=56+1+2=59.