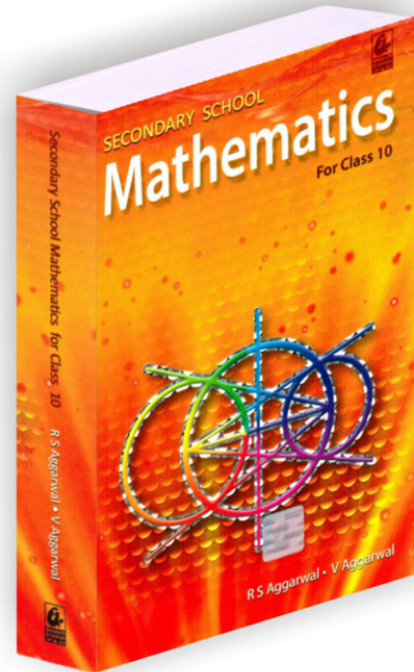


RS Aggarwal Solutions for Class 10 Maths Chapter 1–Real Numbers

Class 10 - Chapter 1 Real Numbers



For any clarifications or questions you can write to info@indcareer.com

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RS Aggarwal Solutions for Class 10 Maths Chapter 1–Real Numbers

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

RS Aggarwal Solutions for Class 10 Maths Chapter 1–Real Numbers

RS Aggarwal 10th Maths Chapter 1, Class 10 Maths Chapter 1 solutions

Exercise 1A

Questions 1:

For any two given positive integers a and b there exist unique whole numbers q and r such that

Here, we call ' a ' as dividend, b as divisor, q as quotient and r as remainder.

Dividend = (divisor quotient) + remainder

Questions 2:

By Euclid's Division algorithm we have:

Dividend = (divisor * quotient) + remainder

$= (61 * 27) + 32 = 1647 + 32 = 1679$

Questions 3:

By Euclid's Division Algorithm, we have:

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Dividend = (divisor quotient) + remainder

$$1365 = (\text{divisor} \times 31) + 32$$

$$\frac{1365 - 32}{31} = \text{divisor}$$

$$\Rightarrow \frac{1331}{31} = \text{divisor}$$

$$\therefore \text{Divisor} = 43$$

Questions 4:

(i) On dividing 2520 by 405, we get

Quotient = 6, remainder = 90

$$2520 = (405 \times 6) + 90$$

Dividing 405 by 90, we get Quotient = 4, Remainder = 45

$$405 = 90 \times 4 + 45$$

Dividing 90 by 45 We get Quotient = 2, remainder = 0

$$90 = 45 \times 2$$

H.C.F. of 405 and 2520 is 45

$$\begin{array}{r} 405 \overline{)2520} \quad (6 \\ \underline{2430} \\ 90 \quad 405 \quad (4 \\ \underline{360} \\ 45 \overline{)90} \quad (2 \\ \underline{90} \\ \times \end{array}$$

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(ii) Dividing 1188 by 504, we get Quotient = 2, remainder = 180

$$1188 = 504 \times 2 + 180$$

Dividing 504 by 180 Quotient = 2, remainder = 144

$$504 = 180 \times 2 + 144$$

Dividing 180 by 144, we get Quotient = 1, remainder = 36

Dividing 144 by 36

Quotient = 4, remainder = 0

H.C.F. of 1188 and 504 is 36

$$\begin{array}{r} 504 \overline{)1188} \quad (2 \\ \underline{1008} \\ 180 \end{array} \quad \begin{array}{r} 504 \overline{)180} \quad (2 \\ \underline{360} \\ 144 \end{array} \quad \begin{array}{r} 180 \overline{)144} \quad (1 \\ \underline{144} \\ 0 \end{array}$$

(iii) Dividing 1575 by 960, we get

Quotient = 1, remainder = 615

$$1575 = 960 \times 1 + 615$$

Dividing 960 by 615, we get Quotient = 1, remainder = 345

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$$960 = 615 \times 1 + 345$$

Dividing 615 by 345 Quotient = 1, remainder = 270

$$615 = 345 \times 1 + 270$$

Dividing 345 by 270, we get Quotient = 1, remainder = 75

$$345 = 270 \times 1 + 75$$

Dividing 270 by 75, we get Quotient = 3, remainder = 45

$$270 = 75 \times 3 + 45$$

Dividing 75 by 45, we get Quotient = 1, remainder = 30

$$75 = 45 \times 1 + 30$$

Dividing 45 by 30, we get Remainder = 15, quotient = 1

$$45 = 30 \times 1 + 15$$

Dividing 30 by 15, we get Quotient = 2, remainder = 0

H.C.F. of 1575 and 960 is 15

$$\begin{array}{r}
 960 \overline{)1575} \text{ (1} \\
 \underline{960} \\
 615 \overline{)960} \text{ (1} \\
 \underline{615} \\
 345 \overline{)615} \text{ (1} \\
 \underline{345} \\
 270 \overline{)345} \text{ (1} \\
 \underline{270} \\
 75 \overline{)270} \text{ (3} \\
 \underline{225} \\
 45 \overline{)75} \text{ (1} \\
 \underline{45} \\
 30 \overline{)45} \text{ (1} \\
 \underline{30} \\
 15 \overline{)30} \text{ (2} \\
 \underline{30} \\
 \times
 \end{array}$$

Questions 5:

(i) By prime factorization, we get

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2	144
2	72
2	36
2	18
3	9
3	3
	1

2	198
3	99
3	33
11	11
	1

$$\therefore 144 = 2 \times 2 \times 2 \times 2 \times 3 \times 3 = 2^4 \times 3^2$$

$$\therefore 198 = 2 \times 3^2 \times 11$$

$$\therefore \text{H.C.F. of } (144, 198) = 2 \times 3^2 = 2 \times 3 \times 3 = 18$$

$$\begin{aligned} \text{L.C.M of } 144 \text{ and } 198 &= 2^4 \times 3^2 \times 11 \\ &= 16 \times 9 \times 11 = 1584 \end{aligned}$$

(ii) By prime factorization. We get

2	396
2	198
3	99
3	33
11	11
	1

2	1080
2	540
2	270
3	135
3	45
3	15
5	5
	1

$$\therefore 396 = 2^2 \times 3^2 \times 11$$

$$\therefore 1080 = 2^3 \times 3^3 \times 5$$

$$\therefore \text{H.C.F. of } (396, 1080) = 2^2 \times 3^2 = 4 \times 9 = 36$$

$$\text{L.C.M of } 396 \text{ and } 1080 = 2^3 \times 3^3 \times 5 \times 11 = 11880$$

(iii) By prime factorization, we get

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2	1152	2	1664
2	576	2	832
2	288	2	416
2	144	2	208
2	72	2	104
2	36	2	52
2	18	2	26
3	9	13	13
3	3		1
	1		

$$\therefore 1152 = 2^7 \times 3^2$$

$$\therefore 1664 = 2^7 \times 13$$

$$\therefore \text{H.C.F. of } (1152, 1664) = 2^7 = 128$$

$$\text{L.C.M of } 1152 \text{ and } 1664 = (2^3 \times 3^3 \times 13) = 128 \times 9 \times 13 = 14976$$

Questions 6:

(i) By prime factorization, we get

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2	24
2	12
2	6
3	3
	1

2	36
2	18
3	9
3	3
	1

2	40
2	20
2	10
5	5
	1

$$\therefore 24 = 2^3 \times 3$$

$$36 = 2^2 \times 3^2$$

$$40 = 2^3 \times 5$$

$$\therefore \text{H.C.F. of } (24, 36, 40) = 2^2 = 4$$

$$\text{L.C.M of } 24, 36 \text{ and } 40 = (2^3 \times 3^2 \times 5) = (8 \times 9 \times 5) = 360$$

(ii) By prime factorization, we get

2	30	2	72	2	432
3	15	2	36	2	216
5	5	2	18	2	108
1		3	9	2	54
		3	3	3	27
		1		3	9
				3	3
				1	

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

$$72 = 2^3 \times 3^2$$

$$432 = 2^4 \times 3^3$$

$$\therefore \text{H.C.F. of } (30, 72, 432) = 2 \times 3 = 6$$

$$\begin{aligned}\text{L.C.M of } 30, 72 \text{ and } 432 &= (2^4 \times 3^3 \times 5) \\ &= (16 \times 27 \times 5) \\ &= 27 \times 80 = 2160\end{aligned}$$

(iii) By prime factorization, we get

3	21
7	7
	1

2	28
2	14
7	7
	1

2	36
2	18
3	9
3	3
	1

3	45
3	15
5	5
	1

$$\therefore 1152 = 2^7 \times 3^2$$

$$\therefore 1664 = 2^7 \times 13$$

$$\therefore \text{H.C.F. of } (1152, 1664) = 2^7 = 128$$

$$\text{L.C.M of } 1152 \text{ and } 1664 = (2^3 \times 3^3 \times 13) = 128 \times 9 \times 13 = 14976$$

Questions 7:

$$\text{H.C.F} = 23; \text{L.C.M,} = 1449$$

For any two numbers a and b, we have

$$a \times b = \text{L.C.M} \times \text{H.C.F}$$

$$\therefore b = \frac{\text{L.C.M} \times \text{H.C.F}}{a}$$

$$\Rightarrow b = \frac{1449 \times 23}{161} = 207$$

Questions 8:

$$\text{H.C.F. of two numbers} = 11, \text{ their L.C.M} = 7700$$

One number = 275, let the other number be b

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Now, $275 \times b = 11 \times 7700$

$$\therefore b = \frac{11 \times 7700}{275} = 308$$

Questions 9:

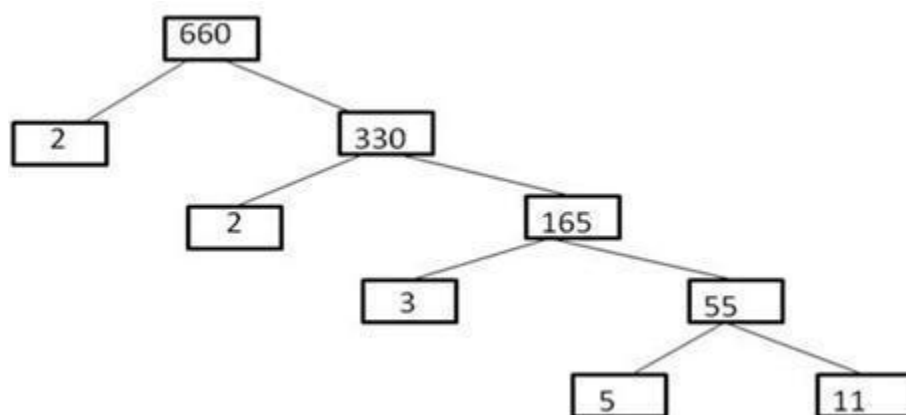
By going upward

$$5 \times 11 = 55$$

$$55 \times 3 = 165$$

$$165 \times 2 = 330$$

$$330 \times 2 = 660$$



Questions 10:

Subtracting 6 from each number:

$$378 - 6 = 372, 510 - 6 = 504$$

Let us now find the HCF of 372 and 504 through prime factorization:

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$$372 = 2 \times 2 \times 3 \times 31$$

2	372	2	504
2	186	2	252
3	93	2	126
	31	7	63
		3	9
			3

$$504 = 2 \times 2 \times 2 \times 3 \times 3 \times 7$$

The required number is 12.

$$= 2^3 \times 3^2 \times 7$$

$$\text{H.C.F of } 372 \text{ and } 504 = 2^2 \times 3 = 12$$

Questions 11:

Subtracting 5 and 7 from 320 and 457 respectively:

$$320 - 5 = 315,$$

$$457 - 7 = 450$$

Let us now find the HCF of 315 and 405 through prime factorization:

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$\begin{array}{r l} 3 & 315 \\ \hline 3 & 105 \\ \hline 5 & 35 \\ \hline & 7 \end{array}$	$\begin{array}{r l} 2 & 450 \\ \hline 3 & 225 \\ \hline 3 & 75 \\ \hline 5 & 25 \\ \hline & 5 \end{array}$	$315 = 3 \times 3 \times 5 \times 7$ $= 3^2 \times 5 \times 7$ $450 = 2 \times 3 \times 3 \times 5 \times 5$ $= 2 \times 3^2 \times 5^2$
---	--	--

The required number is 45.

Questions 12:

(i) $\frac{69}{92} = \frac{3 \times 23}{2 \times 2 \times 23} = \frac{3}{4}$

$\begin{array}{r l} 3 & 69 \\ \hline & 23 \end{array}$	$\begin{array}{r l} 2 & 92 \\ \hline 2 & 46 \\ \hline & 23 \end{array}$
--	---

(ii) $\frac{561}{748} = \frac{3 \times 11 \times 17}{2 \times 2 \times 11 \times 17} = \frac{3}{4}$

$\begin{array}{r l} 3 & 561 \\ \hline 11 & 187 \\ \hline & 17 \end{array}$	$\begin{array}{r l} 2 & 748 \\ \hline 2 & 374 \\ \hline 11 & 187 \\ \hline & 17 \end{array}$
--	--

(iii) $\frac{1695}{1168} = \frac{3 \times 5 \times 73}{2 \times 2 \times 2 \times 2 \times 73} = \frac{15}{16}$

$\begin{array}{r l} 3 & 1095 \\ \hline 5 & 365 \\ \hline & 73 \end{array}$	$\begin{array}{r l} 2 & 1168 \\ \hline 2 & 584 \\ \hline 2 & 292 \\ \hline 2 & 146 \\ \hline & 73 \end{array}$
--	--

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Questions 13:

The prime factorization of 42, 49 and 63 are:

$$42 = 2 \times 3 \times 7, 49 = 7 \times 7, 63 = 3 \times 3 \times 7$$

Therefore, H.C.F. of 42, 49, 63 is 7

Hence, greatest possible length of each plank = 7 m

Questions 14:

$$7 \text{ m} = 700\text{cm}, 3\text{m } 85\text{cm} = 385 \text{ cm}$$

$$12 \text{ m } 95 \text{ cm} = 1295 \text{ cm}$$

Let us find the prime factorization of 700, 385 and 1295:

2	700	5	385	5	1295
2	350	7	77	7	259
5	175		11		37
5	35				
	7				

$$\text{Now, } 700 = 2 \times 2 \times 5 \times 5 \times 7 = 2^2 \times 5^2 \times 7$$

$$385 = 5 \times 7 \times 11$$

$$1295 = 5 \times 7 \times 37$$

$$\therefore \text{H.C.F.} = 5 \times 7 = 35\text{cm}$$

Greatest possible length = 35cm.

Questions 15:

Let us find the prime factorization of 1001 and 910:

$$1001 = 11 \times 7 \times 13$$

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$$910 = 2 \times 5 \times 7 \times 13$$

11	1001	2	910
7	91	5	455
	13	7	91
			13

H.C.F. of 1001 and 910 is $7 \times 13 = 91$

Maximum number of students = 91

Questions 16:

Let us find the HCF of 336, 240 and 96 through prime factorization:

2	336	2	240	2	96
2	168	2	120	2	48
2	84	2	60	2	24
2	42	2	30	2	12
3	21	3	15	2	6
	7		5		3

$$336 = 2 \times 2 \times 2 \times 2 \times 3 \times 7 = 2^4 \times 3 \times 7$$

$$240 = 2 \times 2 \times 2 \times 2 \times 3 \times 5 = 2^4 \times 3 \times 5$$

$$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$$

$$\text{H.C.F} = 2^4 \times 3 = 16 \times 3 = 48$$

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Each stack of book will contain 48 books

Number of stacks of the same height

$$= \frac{240}{48} + \frac{336}{48} + \frac{96}{48} = 5 + 7 + 2 = 14$$

Questions 17:

Length of ceiling = 15m 17cm = 1517 cm

Its breadth = 9m 2cm = 902 cm

$$\begin{array}{r} 902 \overline{)1517} \quad 1 \\ \underline{902} \\ 615 \quad 902 \quad 1 \\ \underline{615} \\ 287 \quad 615 \quad 2 \\ \underline{574} \\ 41 \overline{)287} \quad 7 \\ \underline{287} \\ \times \end{array}$$

$\therefore$ H.C.F. of 1517 and 902 = 41

Maximum size of tile = 41cm $\times$ 41cm

$$\text{Least number of tiles} = \frac{1517 \times 902}{41 \times 41} = 37 \times 22 = 814$$

Questions 18:

Let us find the LCM of 64, 80 and 96 through prime factorization:

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2	64
2	32
2	16
2	8
2	4
	2

2	80
2	40
2	20
2	10
	5

2	96
2	48
2	24
2	12
2	6
	3

$$64 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$$

$$80 = 2 \times 2 \times 2 \times 2 \times 5 = 2^4 \times 5$$

$$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$$

L.C.M of 64, 80 and 96 =

$$= 2^6 \times 5 \times 3 = 64 \times 15 = 960\text{cm} = 9.6\text{m}$$

Therefore, the least length of the cloth that can be measured an exact number of times by the rods of 64cm, 80cm and 96cm = 9.6m

Questions 19:

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Let us find the LCM of 48, 72 and 108 through prime factorization:

2	48	2	72	2	108
2	24	2	36	2	54
2	12	2	18	3	27
2	6	3	9	3	9
	3		3		3

$$48 = 2 \times 2 \times 2 \times 2 \times 3 = 2^4 \times 3$$

$$72 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$$

$$108 = 2 \times 2 \times 3 \times 3 \times 3 = 2^2 \times 3^3$$

$$\therefore \text{LCM of } 48, 72, 108 \text{ is } 2^4 \times 3^3$$

$$= 16 \times 27 \text{ sec} = 432 \text{ sec} = 7 \text{ min } 12 \text{ sec}$$

Three bells toll together after 7 min 12 sec

Questions 20:

Interval of beeping together = LCM (60 seconds, 62 seconds)

The prime factorization of 60 and 62:

$$60 = 30 \times 2, 62 = 31 \times 2$$

$$\text{L.C.M of } 60 \text{ and } 62 \text{ is } 30 \times 31 \times 2 = 1860 \text{ sec} = 31 \text{ min}$$

electronic device will beep after every 31 minutes

After 10 a.m., it will beep at 10 hrs 31 minutes

Questions 21:

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$$2 = 2 \times 1$$

$$4 = 2 \times 2$$

$$6 = 2 \times 3$$

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

$$10 = 2 \times 5$$

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

L.C.M of 2, 4, 6, 8, 10, 12 minutes

$$= 2 \times 2 \times 2 \times 3 \times 5 = 120 \text{ minutes} = 2 \text{ hours}$$

After every 2 hours they toll together.

$$\text{Required number of times} = \left(\frac{30}{2} + 1 \right) = 16 \text{ times}$$

Exercise 1B

Questions 1:

<https://www.indcareer.com/schools/rs-aggarwal-solutions-for-class-10-maths-chapter-1-real-numbers/>

(i) $\frac{11}{2^3 \times 3}$

Its denominator, $(2^3 \times 3) \neq (2^m \times 5^n)$

$\therefore$ it is a non – terminating repeating decimal

(ii) $\frac{73}{2^2 \times 3^3 \times 5}$

Its denominator, $(2^2 \times 3^3 \times 5) \neq (2^m \times 5^n)$

$\therefore$ it is a non – terminating repeating decimal

(iii) $\frac{9}{35} = \frac{9}{5 \times 7}$

Its denominator, $(5 \times 7) \neq (2^m \times 5^n)$

$\therefore$ it is a non terminating repeating decimal

(iv) $\frac{32}{147} = \frac{32}{7 \times 3 \times 7} = \frac{32}{3 \times 7^2}$

Its denominator, $(3 \times 7^2) \neq (2^m \times 5^n)$

$\therefore$ it is a non- terminating repeating decimal

(v) $\frac{64}{455} = \frac{64}{5 \times 7 \times 13}$

Its denominator, $(5 \times 7 \times 11) \neq (2^m \times 5^n)$

$\therefore$ it is a non – terminating repeating decimal

(vi) $\frac{77}{210} = \frac{77}{3 \times 2 \times 5 \times 7}$

Its denominator, $(2 \times 3 \times 5 \times 7) \neq (2^m \times 5^n)$
 $\therefore$ it is a non – terminating repeating decimal

(vii) $\frac{29}{343} = \frac{29}{7 \times 7 \times 7} = \frac{29}{7^3}$

Its denominator, $(7^3) \neq (2^m \times 5^n)$
 $\therefore$ it is a non – terminating repeating decimal

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

Its denominator, $(2^2 \times 5^7 \times 7^5) \neq (2^m \times 5^n)$
 $\therefore$ it is a non – terminating repeating decimal

Questions 2:

<https://www.indcareer.com/schools/rs-aggarwal-solutions-for-class-10-maths-chapter-1-real-numbers/>

(i) $\frac{23}{2^3 \times 5^2}$ has 2 and 5 as factors in denominator
 $\frac{23}{2^3 \times 5^2} = \frac{23}{2 \times 100} = \frac{11.5}{100} = 0.115$

(ii) $\frac{24}{125} = \frac{24}{5^3}$ has 5 as its factor in denominator
 $\frac{24 \times 8}{125 \times 8} = \frac{192}{1000} = 0.192$

(iii) $\frac{170}{320} = \frac{17}{2^6 \times 5}$ has 2 and 5 as factors in the denominator.
 $\frac{17}{32 \times 10} = \frac{17 \times 5^5}{2^5 \times 5^5 \times 10} = \frac{53125}{10^5 \times 10} = 0.053125$

(iv) $\frac{171}{800} = \frac{171}{2^5 \times 5^2}$ has 2 and 5 as its factors in the denominator
 $\frac{171}{2^5 \times 5^2} = \frac{171 \times 5^3}{2^5 \times 5^2 \times 5^3} = \frac{21375}{10^5} = 0.21375$

(v) $\frac{15}{1600} = \frac{15}{2^6 \times 5^2}$ has 2 and 5 as its factors in the denominator
 $\frac{15}{2^6 \times 5^2} = \frac{15 \times 5^4}{2^6 \times 5^2 \times 5^4} = \frac{9375}{10^6} = 0.009375$

(vi) $\frac{19}{3125} = \frac{19}{5^5}$ has 5 as its factors denominator
 $\frac{19}{5^5} = \frac{19 \times 2^5}{5^5 \times 2^5} = 0.00608$

Questions 3:

<https://www.indcareer.com/schools/rs-aggarwal-solutions-for-class-10-maths-chapter-1-real-numbers/>

(i) $x = 0.\overline{8}$ then,
 $x = 0.8888.....$ -----(1)
 $\therefore 10x = 8.8888.....$ -----(2)
 On subtracting (1) from (2), we get
 $9x = 8 \Rightarrow x = \frac{8}{9}$
 Hence, $0.\overline{8} = \frac{8}{9}$

(ii) $x = 2.\overline{4}$ then,
 $x = 2.4444.....$ -----(1)
 $\therefore 10x = 24.444.....$ -----(2)
 On subtracting (1) from (2), we get
 $9x = 22 \Rightarrow x = \frac{22}{9}$

(iii) $x = 0.\overline{24}$ then,
 $x = 0.242424.....$ -----(1)
 $100x = 24.242424.....$ -----(2)
 On subtracting (1) from (2), we get
 $99x = 24 \Rightarrow x = \frac{24}{99} = \frac{8}{33}$
 $0.\overline{24} = \frac{8}{33}$

(iv) $x = 0.1\overline{2}$, then
 $x = 0.12222.....$
 $10x = 1.2222.....$ -----(1)
 $100x = 12.2222.....$ -----(2)
 Subtracting (1) from (2), we get
 $90x = 11 \therefore x = \frac{11}{90}$
 $0.1\overline{2} = \frac{11}{90}$

(v) $x = 2.2\overline{4}$, then,
 $x = 2.24444 \dots$ -----(1)
 $10x = 22.4444 \dots$ -----(2)
And $100x = 224.4444 \dots$ -----(3)
On subtracting (2) from (3), we get
 $\therefore 90x = 202 \Rightarrow x = \frac{202}{90} = \frac{101}{45}$

(vi) $x = 0.3\overline{65}$, then
 $x = 0.3656565 \dots$ -----(1)
 $10x = 3.656565 \dots$ -----(2)
 $1000x = 365.656565 \dots$ -----(3)
Subtracting (2) from (3), we get
 $x = 362 \Rightarrow x = \frac{362}{990} = \frac{181}{495}$
 $0.3\overline{65} = \frac{181}{495}$

Questions 4:

(i) 53.123456789 is a rational number since it is a terminating decimal.

(ii)

$$31.\overline{123456789}$$

is a rational number because it is a non – terminating repeating decimal.

(iii) 0.12012001200012..... is not a rational number as it is a non-terminating, non – repeating decimal.

Exercise 1C

Questions 1:

<https://www.indcareer.com/schools/rs-aggarwal-solutions-for-class-10-maths-chapter-1-real-numbers/>

Rational Numbers: The numbers of the form $\frac{p}{q}$, where p

and q are integers and $q \neq 0$ are called rational number.

Irrational Numbers : The numbers which when expressed in decimal form and expressible as non-terminating and non-repeating decimal are known as irrational number.

Real numbers: A number which is rational or irrational is called real number.

Questions 2:

- (i) $\frac{22}{7}$ is rational
- (ii) 3.1416 is a terminating and non-repeating decimal, so it is rational.
- (iii) π is irrational
- (iv) $\overline{3.142857}$ is in non-terminating repeating decimal form, so it is rational
- (v) 5.636363..... is a non-terminating repeating decimal. So it is a rational.
- (vi) 2.040040004.... is a non-terminating and non-repeating decimal, so it is irrational.
- (vii) 0.535335333..... is a non-terminating and non-repeating decimal, so it is irrational.
- (viii) $\overline{3.121221222}$ is a non-terminating and non-repeating decimal. So it is an irrational number.
- (ix) If 21 is a positive integer which is not a perfect square, then $\sqrt{21}$ is irrational.
- (x) If 3 is a positive integer which is not a perfect cube, then $\sqrt[3]{3}$ is irrational.

Questions 3:

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- (i) If possible, let $\sqrt{6}$ be rational and let its simplest form be $\frac{a}{b}$ then, a and b are integers having no common factor other than 1, and $b \neq 0$.

$$\text{Now, } \sqrt{6} = \frac{a}{b} \Rightarrow 6 = \frac{a^2}{b^2} [\text{on squaring both sides}]$$

$$\Rightarrow 6b^2 = a^2 \dots\dots(1)$$

$$\Rightarrow 6 \text{ divides } a^2 \quad [\because 6 \text{ divides } 6b^2]$$

$$\Rightarrow 6 \text{ divides } a$$

Let $a = 6c$ for some integer c

Putting $a = 6c$ in (1), we get

$$6b^2 = 36c^2 \Rightarrow b^2 = 6c^2$$

$$\Rightarrow 6 \text{ divides } b^2 \quad [\because 6 \text{ divides } 6c^2]$$

$$\Rightarrow 6 \text{ divides } b \quad [\because 6 \text{ divides } b^2 = 6 \text{ divides } b]$$

Thus, 6 is a common factor of a and b

But, this contradicts the fact that a and b have no common factor other than 1

The contradiction arises by assuming that $\sqrt{6}$ is rational.

Hence $\sqrt{6}$ is irrational.

- (ii) If possible let $2 - \sqrt{3}$ is rational

$$\Rightarrow 2 - (2 - \sqrt{3}) \text{ is rational}$$

[$\because$ difference of two rationals is rational]

$$\therefore \sqrt{3} \text{ is rational}$$

This contradicts the fact $\sqrt{3}$ is irrational

Since the contradiction arises by assuming $2 - \sqrt{3}$ rational.

Hence, $2 - \sqrt{3}$ is irrational.

- (iii) If possible let $3 + \sqrt{2}$ is rational
 $\Rightarrow (3 + \sqrt{2}) - 3 = \sqrt{2}$ is rational
[$\because$ difference of two rational is rational]
 $\therefore \sqrt{2}$ is rational
This contradicts the fact that $\sqrt{2}$ is irrational
Since the contradiction arises by assuming that $3 + \sqrt{2}$ is rational.
Hence $3 + \sqrt{2}$ is irrational.
- (iv) If possible, let $2 + \sqrt{5}$ is rational.
 $\Rightarrow (2 + \sqrt{5}) - 2 = \sqrt{5}$ is rational
[$\because$ difference of two rational is rational]
 $\therefore \sqrt{5}$ is rational.
This contradicts the fact that $\sqrt{5}$ is irrational
Since, the contradiction arises by assuming $2 + \sqrt{5}$ is rational.
Hence, $2 + \sqrt{5}$ is irrational.
- (v) If possible, let $5 + 3\sqrt{2}$ is rational
Now, $(5 + 3\sqrt{2}) - 5 = 3\sqrt{2}$ is rational
[$\because$ Difference of two rational is rational]
Also, $\frac{1}{3} \times 3\sqrt{2} = \sqrt{2}$ is rational
[$\because$ Product of two rational is rational]
 $\therefore \sqrt{2}$ is rational.
This contradicts the fact that $\sqrt{2}$ is irrational.
Since, the contradiction arises by assuming that $5 + 3\sqrt{2}$ is irrational.
Hence, $5 + 3\sqrt{2}$ is irrational

(vi) If possible, let $3\sqrt{7}$ be rational.

Let its simplest form be $3\sqrt{7} = \frac{a}{b}$, where a and b are positive integers having no common factor other than 1, then

$$3\sqrt{7} = \frac{a}{b} \Rightarrow$$

$$\sqrt{7} = \frac{a}{3b} \text{ --- (2)}$$

Since, a and $3b$ are non -integers, so $\frac{a}{3b}$ is rational.

Thus, from (2), it follows that $\sqrt{7}$ is rational.

This contradicts the fact that $\sqrt{7}$ is irrational.

The contradiction arises by assuming that $3\sqrt{7}$ is rational.

Hence, $3\sqrt{7}$ is irrational.

$$(vii) \quad \frac{3}{\sqrt{5}} = \frac{3}{\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} = \frac{3}{5} \cdot \sqrt{5} \quad \text{-----}(3)$$

If possible, let $\frac{3}{\sqrt{5}}$ be rational.

Then, from (3), it follows that $\frac{3}{5} \cdot \sqrt{5}$ is rational

Let $\frac{3}{5} \sqrt{5} = \frac{a}{b}$, where a and b are non-zero integers

having no common factor other than 1.

Now,

$$\frac{3\sqrt{5}}{5} = \frac{a}{b} \Rightarrow$$

$$\sqrt{5} = \frac{5a}{3b} \quad \text{-----}(4)$$

But, 3a and 5b are non-zero integers.

$\therefore \frac{5a}{3b}$ is rational.

Thus, from (4), it follows that $\sqrt{5}$ is rational.

This contradicts the fact that $\sqrt{5}$ is irrational.

The contradiction arises by assuming that $\frac{3}{\sqrt{5}}$ is rational.

Hence $\frac{3}{\sqrt{5}}$ is irrational.

(viii) If possible, let $2 - 3\sqrt{5}$ is rational.

$$\Rightarrow (2 - 3\sqrt{5}) - 2 = -3\sqrt{5} \text{ is rational.}$$

[$\because$ Difference of two rational is rational]

$$\Rightarrow \left(-\frac{1}{3}\right) \times (-3\sqrt{5}) = \sqrt{5} \text{ is rational.}$$

[$\because$ Product of two rationals is rational]

This contradicts that fact that $\sqrt{5}$ is irrational.

Since, the contradiction arises by assuming $2 - 3\sqrt{5}$ is rational.

Hence, $2 - 3\sqrt{5}$ is irrational.

(ix) If possible, let $(\sqrt{3} + \sqrt{5})$ be rational

Let $\sqrt{3} + \sqrt{5} = a$, where a is rational.

$$\therefore \sqrt{3} = a - \sqrt{5}$$

Squaring both sides, we get

$$3 = (a - \sqrt{5})^2 = a^2 + 5 - 2a\sqrt{5}$$

$$\Rightarrow a^2 + 2 - 2a\sqrt{5} = 0$$

$$\therefore \sqrt{5} = \frac{a^2 + 2}{2a} \text{ ----- (5)}$$

But, $\frac{a^2 + 2}{2a}$ is a rational number.

Thus from (5), $\sqrt{5}$ is rational.

This contradicts the fact that $\sqrt{5}$ is irrational.

Since, the contradiction arises by assuming $(\sqrt{3} + \sqrt{5})$ is rational.

Hence $(\sqrt{3} + \sqrt{5})$ is irrational.

Questions 4:

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Let us rewrite $\frac{1}{\sqrt{3}}$ as follows:

$$\frac{1}{\sqrt{3}} = \frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{1}{3} \sqrt{3} \text{ ---- (1)}$$

If possible, let $\frac{1}{\sqrt{3}}$ be rational

Then, from (1) it follows that $\frac{1}{3} \sqrt{3}$ is rational.

Let $\frac{1}{3} \sqrt{3} = \frac{a}{b}$ where a and b are non-zero integers having no common factor other than 1.

$$\text{Now, } \frac{1}{3} \sqrt{3} = \frac{a}{b} \Rightarrow \sqrt{3} = \frac{3a}{b} \text{ ---- (2)}$$

But $3a$ and b are non-zero integers

$\therefore \frac{3a}{b}$ is rational.

Thus, from (2), it follows that $\sqrt{3}$ is rational.

This contradicts the fact that $\sqrt{3}$ is irrational

The contradiction arises by assumed that $\frac{1}{\sqrt{3}}$ is rational.

Hence $\frac{1}{\sqrt{3}}$ is irrational.

Questions 5:

- (i) Consider the irrational numbers $2 + \sqrt{3}$ and $2 - \sqrt{3}$.
Their sum $= (2 + \sqrt{3}) + (2 - \sqrt{3}) = 4 = \text{Rational}$
- (ii) Consider the irrational numbers $2 + \sqrt{3}$ and $2 - \sqrt{3}$.
Their product $= (2 + \sqrt{3})(2 - \sqrt{3})$
 $= 4 - 3 = 1 = \text{Rational}.$

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Questions 6:

- (i) The sum of two rationals is always rational – True
- (ii) The product of two rationals is always rational – True
- (iii) The sum of two irrationals is an irrational – False
- (iv) The product of two irrationals is an irrational – False
- (v) The sum of a rational and an irrational is irrational – True
- (vi) The product of a rational and an irrational is irrational – True



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He was born on January 2, 1946 in a village of Delhi. He graduated from Kirori Mal College, University of Delhi. After completing his M.Sc. in Mathematics in 1969, he joined N.A.S. College, Meerut, as a lecturer. In 1976, he was awarded a fellowship for 3 years and joined the University of Delhi for his Ph.D. Thereafter, he was promoted as a reader in N.A.S. College, Meerut. In 1999, he joined M.M.H. College, Ghaziabad, as a reader and took voluntary retirement in 2003. He has authored more than 75 titles ranging from Nursery to M. Sc. He has also written books for competitive examinations right from the clerical grade to the I.A.S. level.

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