Real Numbers — Made Easy!

Class 9 · Chapter 1 · Exercise 1.1 · Slow & Simple Notes

Read this first — do not memorise, just understand

Every number is either RATIONAL or IRRATIONAL. That is the whole game of Q.1. The rest of this exercise is only 3 small skills: putting a number on a line, changing a repeating decimal into a fraction, and naming a rule.

1) RATIONAL — the friendly numbers

- Can be written as p / q (example: 3/4 , 5 , -2/7)
- Decimal ENDS -> 0.5 , 0.625 , 2.35
- Decimal REPEATS -> 0.333... , 0.3737... , 0.4545...
- q is not zero. p and q are whole / integer numbers.

2) IRRATIONAL — the never-ending numbers

- Can NOT be written as a simple p / q
- Decimal NEVER ends and NEVER repeats -> 2.236067...
- Most roots: √2 , √3 , √7 , √11 and π and e
- Remember: √4 = 2 and √9 = 3 are RATIONAL — they finish!

Memory trick: End or Repeat = Rational.
No end, no repeat = Irrational.

Tip for slow learners: Go question by question. Say the reason out loud in one short line. That one line is your exam answer.

Q.1 Rational or Irrational?

For each: look -> decide -> give 1 small reason

(i) 2.353535	**RATIONAL**	— decimal ENDS - it just stops
(ii) 0.6666...	**RATIONAL**	— 6 repeats again and again
(iii) 2.236067...	**IRRATIONAL**	— never ends, never repeats
(iv) $\sqrt{7}$	**IRRATIONAL**	— root of a non-square number
(v) e	**IRRATIONAL**	— special number, never ends
(vi) π (pi)	**IRRATIONAL**	— 3.14159... never ends / repeats
(vii) $5 + \sqrt{11}$	**IRRATIONAL**	— 5 is fine, but $\sqrt{11}$ is irrational
(viii) $\sqrt{3} + \sqrt{13}$	**IRRATIONAL**	— both roots are irrational
(ix) 15 / 4	**RATIONAL**	— already in p/q form (= 3.75)
(x) $(2-\sqrt{2})(2+\sqrt{2})$	**RATIONAL**	— see the small working below

Working for (x) — do not skip it!

$(2 - \sqrt{2})(2 + \sqrt{2}) = 2^2 - (\sqrt{2})^2$ using $(a-b)(a+b) = a^2 - b^2$

$= 4 - 2 = 2$ -> 2 is a whole number, so it is **RATIONAL.**

Check yourself: root 9 = 3 -> Rational!

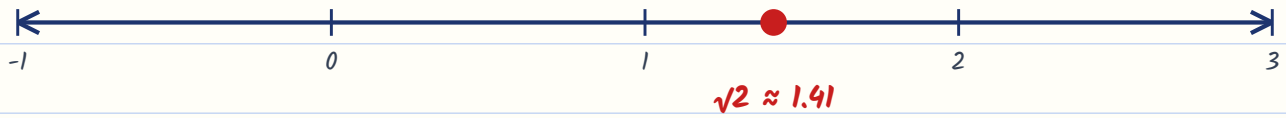
0.121221222... -> Irrational (never ends, never repeats)

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Q.2 Put the Number on a Number Line

Easy method: 1) Change to decimal 2) See between which 2 numbers it lives 3) Mark it

(i) $\sqrt{2} = 1.41$ — Between 1 and 2, a little past 1.4



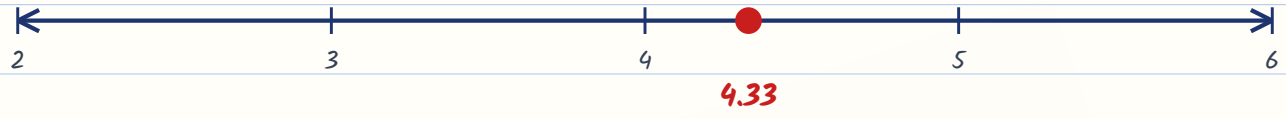
$\sqrt{2} \approx 1.41$

(ii) $\sqrt{3} = 1.73$ — Between 1 and 2, close to 1.7



$\sqrt{3} \approx 1.73$

(iii) $4\ 1/3 = 13/3 = 4.33$ — Between 4 and 5, one-third past 4



4.33

(iv) $-2\ 1/7 = -15/7 = -2.14$ — Between -3 and -2, a little left of -2



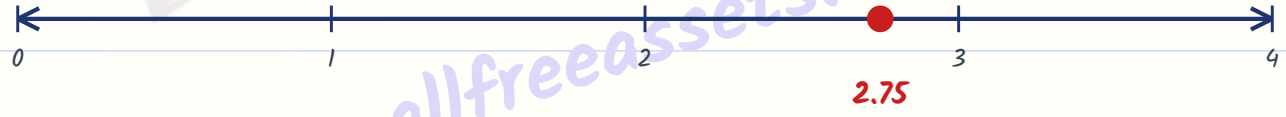
-2.14

(v) $5/8 = 0.625$ — Between 0 and 1, a little past half (0.5)



0.625

(vi) $2\ 3/4 = 11/4 = 2.75$ — Between 2 and 3, three-quarters past 2



2.75

Note: Your book writes these in short form - 1.4 , 1.7 , 4.3 , -2.1 , 0.6 , 2.7. I have written one extra digit in some places (1.41, 0.625...). It is the same point on the line.

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Q.3 Changing Repeating Decimals to p/q

Same 4 steps every time. Learn the steps, not the answer.

THE 4 STEPS

- *Step 1: Let x = the given decimal*
- *Step 2: Multiply x — by 10 if 1 digit repeats, by 100 if 2 digits repeat*
- *Step 3: Subtract the small x. The repeating part disappears!*
- *Step 4: Divide and write x = p/q*

(i) 0.4444...

x = 0.444... -> 10x = 4.444... -> 10x - x = 4 -> 9x = 4 -> x = 4/9

(ii) 0.373737...

x = 0.3737... -> 100x = 37.3737... -> 100x - x = 37 -> 99x = 37 -> x = 37/99

(iii) 0.212121...

x = 0.2121... -> 100x = 21.2121... -> 100x - x = 21 -> 99x = 21 -> x = 21/99 = 7/33

Why multiply by 100 in (ii) and (iii)? Because TWO digits repeat (37 and 21). One digit repeating = ×10. Two digits repeating = ×100. Simple!

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Q.4 Name the Property

Do not learn long names first. First see WHAT changed.

5 EASY CLUES

- Order / sides SWAP -> Commutative (a+b = b+a)
- Only BRACKETS move -> Associative ((a+b)+c = a+(b+c))
- Number stays SAME: +0 or ×1 -> Identity
- Number becomes ZERO: x - x = 0 -> Additive Inverse
- Outside number goes INSIDE -> Distributive a(b+c) = ab+ac

(i) $(a+4)+b = a+(4+b)$	**Associative — addition** only brackets moved
(ii) $\sqrt{2}+\sqrt{3} = \sqrt{3}+\sqrt{2}$	**Commutative — addition** order swapped
(iii) $x - x = 0$	**Additive Inverse** same number minus itself = 0
(iv) $a(b+c) = ab+ac$	**Distributive (left)** a went inside the bracket
(v) $16 + 0 = 16$	**Additive Identity** adding 0 changed nothing
(vi) $100 \times 1 = 100$	**Multiplicative Identity** ×1 changed nothing
(vii) $4\times(5\times8) = (4\times5)\times8$	**Associative — multiplication** only brackets moved
(viii) $ab = ba$	**Commutative — multiplication** order swapped

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Q.5 Properties of Inequalities (< , >)

Inequality = a sign like < (smaller) or > (bigger)

(i) $-3 < -1 \Rightarrow 0 < 2$	**Additive Property** 3 was added to BOTH sides
(ii) $a < b \Rightarrow 1/a > 1/b$	**Reciprocal Property** reciprocal flips the direction of <
(iii) $a < b \Rightarrow a+c < b+c$	**Additive Property** same c added to both sides
(iv) $ac < bc$, $c>0 \Rightarrow a < b$	**Cancellation Property** c cut from both sides, sign same
(v) $ac < bc$, $c<0 \Rightarrow a > b$	**Cancellation Property** c is negative, so direction FLIPS
(vi) $a>b$ or $a=b$ or $a<b$	**Trichotomy Property** only these 3 choices exist

Q.6 Insert 2 Rational Numbers Between Two Numbers

GOLDEN TRICK: Take the AVERAGE

Middle number = (first + second) ÷ 2 . Then do it again with the new number. Done!

(i) Between 1/3 and 1/4:

1st: (1/3 + 1/4) ÷ 2 = 7/24 2nd: (1/3 + 7/24) ÷ 2 = 15/48

(ii) Between 3 and 4:

1st: (3 + 4) ÷ 2 = 7/2 = 3.5 2nd: (3 + 7/2) ÷ 2 = 13/4 = 3.25

(iii) Between 3/5 and 4/5:

1st: (3/5 + 4/5) ÷ 2 = 7/10 2nd: (3/5 + 7/10) ÷ 2 = 13/20

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1-Page Revision — Read Before the Test!

If you remember only this page, you can do the whole exercise.

1. Rational = ends OR repeats. Irrational = never ends, never repeats.
2. $\sqrt{2} \approx 1.41$, $\sqrt{3} \approx 1.73$, $\pi \approx 3.14$ — all irrational.
3. Number line: first make a decimal, then find its home between 2 numbers.
4. Repeating decimal -> fraction: let x, multiply by 10 or 100, subtract, divide.
5. Swap = Commutative. Brackets move = Associative. +0 / ×1 = Identity.
6. $x - x = 0$ is Inverse. $a(b+c)=ab+ac$ is Distributive.
7. Multiply / divide an inequality by a negative? The < / > direction flips.
8. Number between two numbers? Take their average: $(a+b) \div 2$.

TRY YOURSELF (answers are upside-small below)

A) Is 0.454545... rational or irrational? Why?

B) Change 0.777... into p/q.

C) Name the property: 7 + 9 = 9 + 7

D) Write one rational number between 2 and 3.

Answers: A) Rational — 45 repeats B) 7/9 C) Commutative (addition) D) (2+3)÷2 = 5/2 = 2.5

You did it! Go slow, one step at a time — that is how maths is won.

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