🧮 Class 9 Math – Chapter 1: Number Systems (🌟 Super Easy Notes with Emojis 🌟)

1️⃣ What Are Rational Numbers? ➗

🟢 A number is rational if it can be written as p/q, where:
👉 p and q are integers
👉 q ≠ 0

💡 These can be positive, negative, or zero.

✅ Examples:
- ◆ 3 = 3/1
- ◆ −5/7
- ◆ 0 = 0/1

2️⃣ What Are Irrational Numbers? 🤯

🔴 A number is irrational if it cannot be written as p/q.

🌁 **Decimal form:**

- 🚫 Never ends (non-terminating)
- 🚫 Never repeats (non-repeating)

✅ Examples:
- ◆ √2 = 1.4142135…
- ◆ √3, √5
- ◆ π (pi) = 3.14159…

3️⃣ Real Numbers = Rational ➕ Irrational ✅

🧡 All rational and irrational numbers together are called real numbers.

📍 You can plot real numbers on the number line — including decimals, roots, negatives, and fractions!

4️⃣ Decimal Expansions 🔢

✅ **Rational Numbers:**

- 🔚 Terminating: e.g. 1/4 = 0.25
- 🔁 Non-terminating, repeating: e.g. 1/3 = 0.333…

❌ **Irrational Numbers:**

- 🔀 Non-terminating & non-repeating: e.g. √2 = 1.414213…

5️⃣ How to Plot √13 on a Number Line? 📏📐

Step-by-step:

1. 🗒️ Write √13 as √(9 + 4) = √(3² + 2²)
2. 📏 Draw OA = 3 units
3. ⬆ Draw AB = 2 units perpendicular to OA
4. ✏️ Join OB → this becomes √13
5. 🧭 Use compass from O with radius OB to mark the point √13

🧠 You can use this same method for √2, √5, etc.

6️⃣ Convert Repeating Decimals to Fractions 🔄

Example 1:

🟡 x = 0.123123…
🔢 1000x = 123.123…
➖ Subtract: 1000x − x = 999x = 123
✅ x = 123/999 = 41/333

Example 2:

🟡 x = 0.888…
🔢 10x = 8.888…
➖ Subtract: 10x − x = 8
✅ x = 8/9

7️⃣ Operations on Real Numbers ⚙️

Operation	Result
✅ **Rational + Rational**	**Rational**
❌ **Rational + Irrational**	**Irrational**
🔄 **Irrational + Irrational**	**Sometimes rational, sometimes irrational**
✖ **Rational × Irrational**	**Irrational (usually)**
✖ **Irrational × Irrational**	**Can be rational or irrational**

🧠 Example:
√2 × √2 = 2 ✅ (Rational)
√2 × √3 = √6 ❌ (Irrational)

8️⃣ Rationalising the Denominator 🧽

Used to remove square roots from the bottom (denominator) of a fraction.

✍️ Example 1:

$$\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$$

✍️ Example 2:

$$\frac{1}{\sqrt{3} + 2} = \frac{\sqrt{3} - 2}{(\sqrt{3} + 2)(\sqrt{3} - 2)} = \sqrt{3} - 2$$

🧠 Tip: Use conjugate to simplify expressions like 1/(a + √b)

9️⃣ Laws of Exponents (Power Rules) 💥

Let a > 0 and m, n be real numbers:

- ✖️ $a^m \times a^n = a^{m+n}$
- ➗ $\frac{a^m}{a^n} = a^{m-n}$
- 🔁 $(a^m)^n = a^{mn}$
- 🟰 $a^0 = 1$
- 🔄 $a^{-n} = \frac{1}{a^n}$
- 🧮 $\sqrt{a} = a^{1/2}$, $\sqrt[3]{a} = a^{1/3}$