









+

$$a + b = b + a$$

$$a + (b + c) = (a + b) + c$$

$$\exists 0, a + 0 = 0 + a = a \quad \forall a$$

$$\forall a \exists (-a) \text{ s.t. } a + (-a) = 0$$

$$\parallel$$

$$(-a) + a$$

(commutative group)

$$a(b + c) = ab + ac$$

•

$$ab = ba$$

$$a(bc) = (ab)c$$

$$\exists 1 \quad 1a = a1 = a \quad \forall a$$

$$\forall a \neq 0 \exists a^{-1} \text{ s.t. } aa^{-1} = a^{-1}a = 1$$

ring

division ring

Axioms of proj. plane

+ Desargues \Rightarrow division ring

+ Pappus \Rightarrow field

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