RELATIONS

- ▸ Relationships between sets

  - ▸ Equality, subset, superset

  - ▸ Disjoint, overlapping

- ▸ Relationship between elements of a set

  - ▸ Natural numbers $\mathbb{N}$

  - ▸ Set of triangles on a plane

  - ▸ Set of lines on a plane

- ▸ Relationship between elements of one set and elements of another set

  - ▸ Set of points on a plane and set of lines on a plane
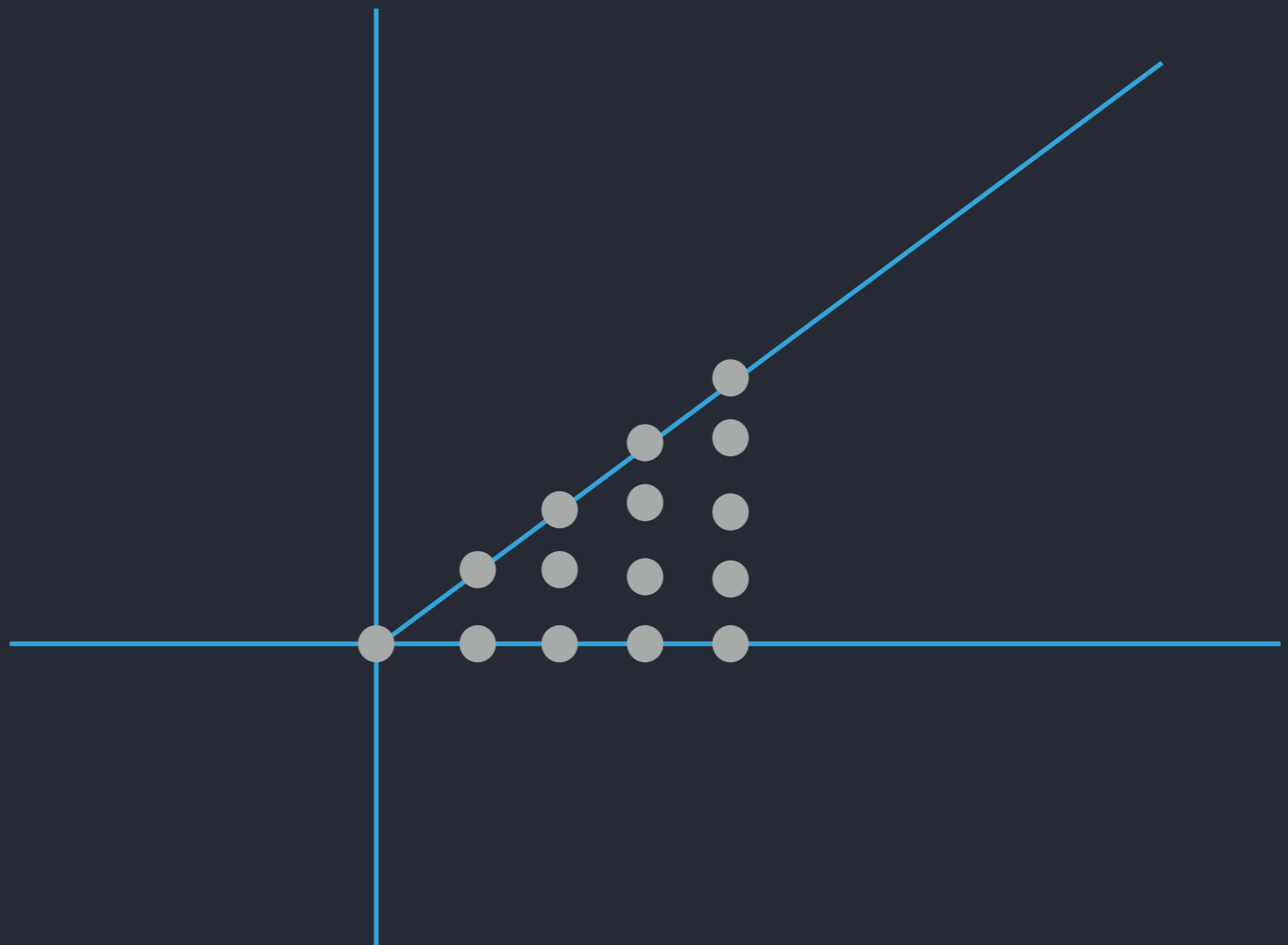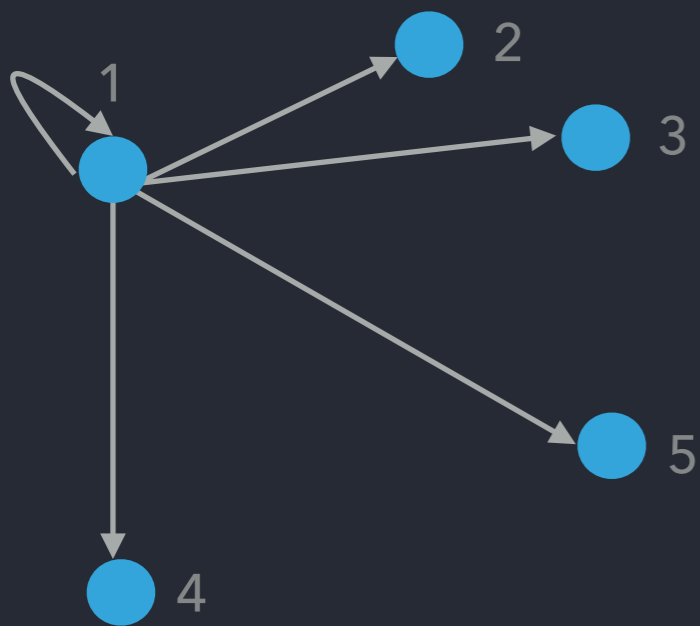
RELATIONS

▸ Let M denote the set of all Palakkad Math Circle students

▸ Relation 1: Student x is related to y if x and y are in same school

▸ Relation 2: Student x is related to y if x and y are in the same class

▸ Relation 3: Student x is related to y if x knows y

▸ How will you represent the set of all pairs x, y such that x is related to y?

▸ $R = \{(x, y) : x, y \in M, x$ and y are in same school$\}$ Note: $R \subseteq M \times M$

▸ A binary relation R on a non-empty set A is a subset of $A \times A$

▸ Notation: $a \ R \ b$ denotes $(a, b) \in R$

RELATIONS

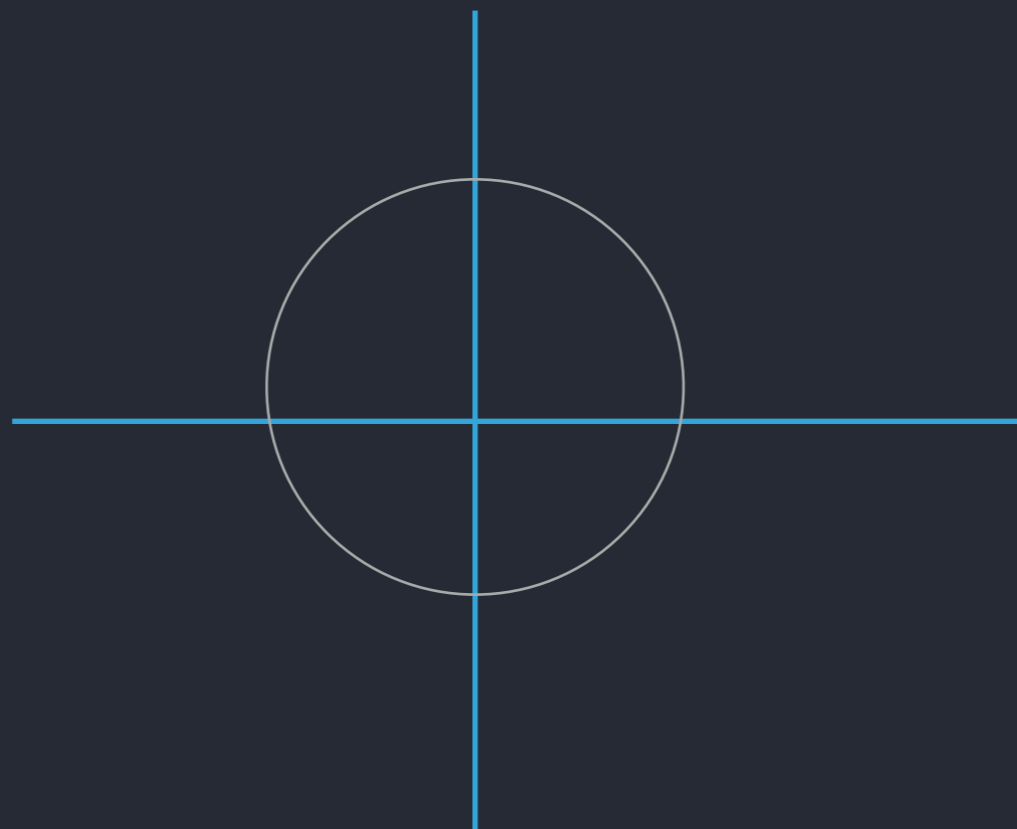▸ $R = \{(a, b) \in \mathbb{Z} \times \mathbb{Z} : a \leq b\}$
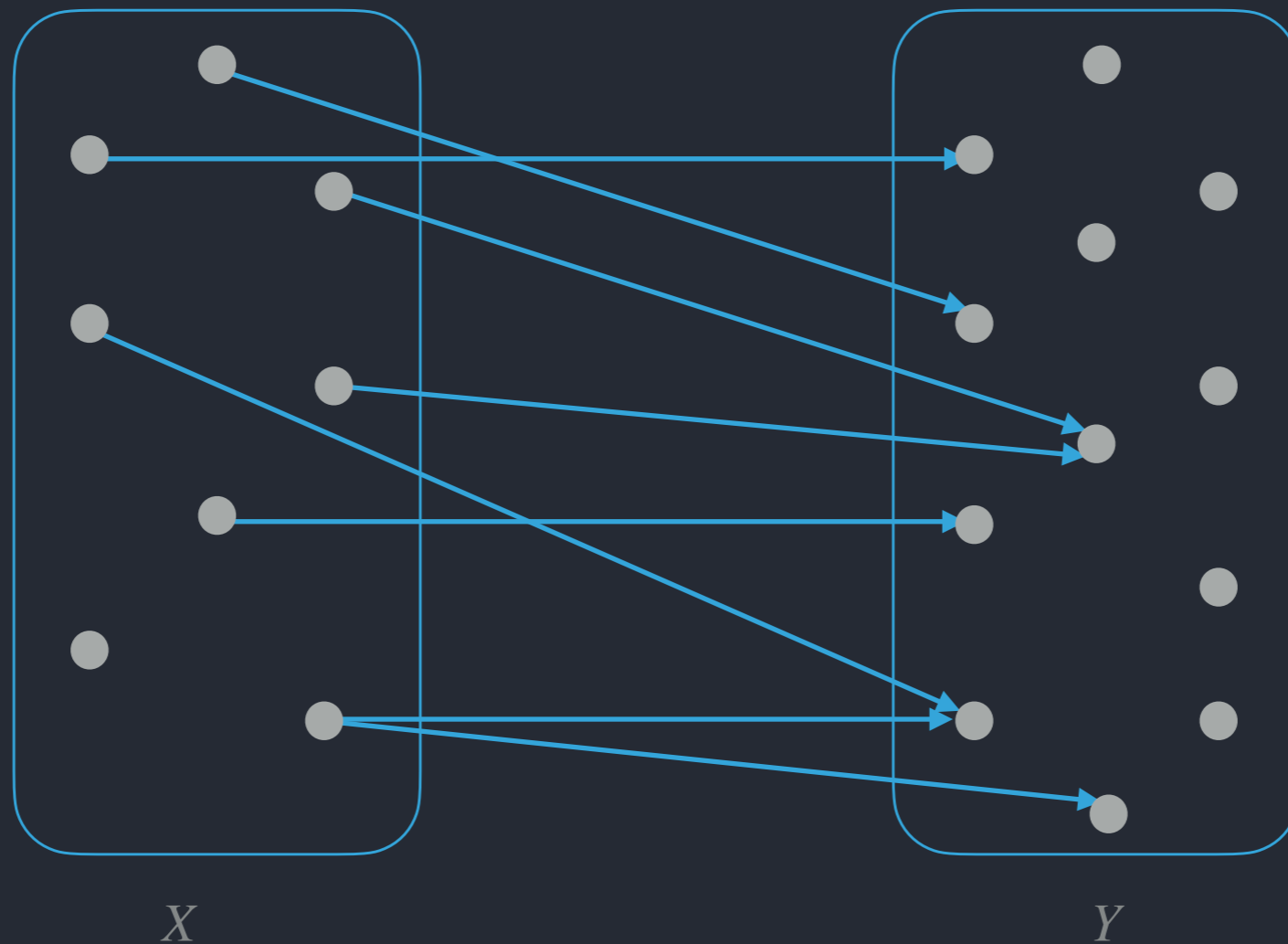
  ▸ Is 1 related to 2?

  ▸ Is 2 related to 1?

RELATIONS

▸ $R = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x^2 + y^2 = 1\}$

  ▸ The unit circle centred at the origin in $\mathbb{R}^2$

  ▸ Is 1 related to 1?

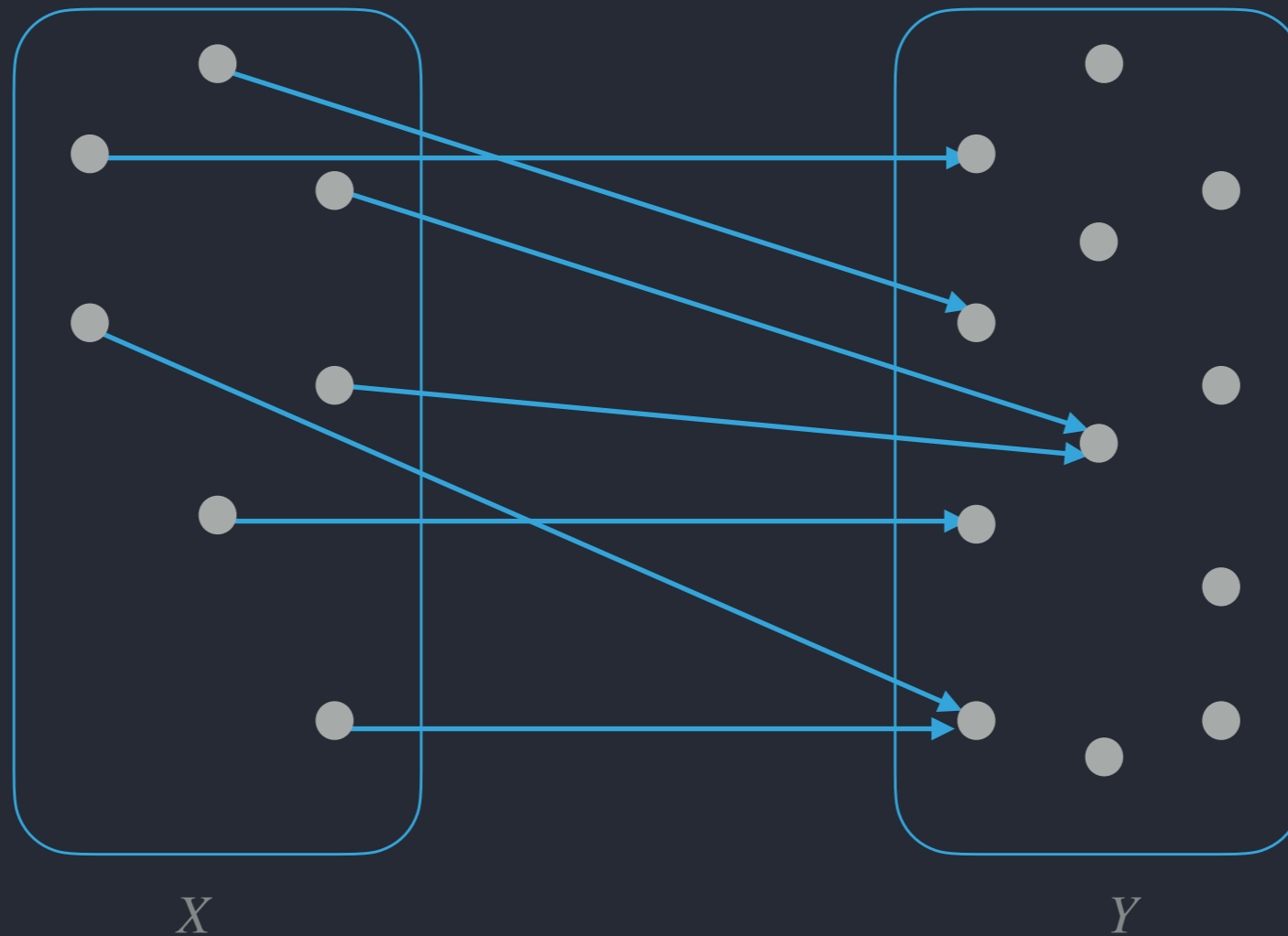 ▸ Find all real numbers y such that 0 is related to y

RELATIONS

▸ A relation between nonempty sets X and Y is a subset $R \subseteq X \times Y$

X Y

FUNCTIONS

X Y

▸ A relation R from a set X to a set Y is called a function if for each

   element $x \in X$ there exists a unique $y \in Y$ such that $(x, y) \in R$

▸ We define $f : X \rightarrow Y$ by setting $f(x) = y$ if $(x, y) \in R$

FUNCTIONS

▸ Which of the following relations are functions?

  ▸ $R = \{(a, b) \in \mathbb{Z} \times \mathbb{Z} : a \leq b\}$

  ▸ $R = \{(x, y) \in \mathbb{R} \times \mathbb{R} : x^2 + y^2 = 1\}$

  ▸ $R = \{(x, x) : x \in X\}$ where X is a nonempty set

  ▸ $R = \{(x, y) : x, y \in M, x$ and y are in same school$\}$