Example questions

For each of the three relations defined below:
- Draw a graph (circles and arrows) corresponding to the relation
- Say whether the relation is:
  + reflexive, irreflexive, neither
  + symmetric, anti-symmetric, neither
  + transitive, not-transitive

Relation 1, \( r_1 \), on the set of people \( \{ \text{Leon, Jill, Maria, Tim, Kate} \} \)
\[ r_1 = \{(\text{Leon, Kate}), (\text{Kate, Leon}), (\text{Kate, Kate}), (\text{Maria, Jill}), (\text{Jill, Maria}), (\text{Maria, Maria}), (\text{Tim, Leon}), (\text{Leon, Tim})\} \]

Relation 2, \( r_2 \), on the set of food \( \{ \text{pizza, fries, hotdog, burger, soda} \} \)
\[ r_2 = \{(\text{soda, soda}), (\text{soda, hotdog}), (\text{soda, pizza}), (\text{burger, fries}), (\text{fries, burger}), (\text{fries, fries}), (\text{pizza, fries}), (\text{pizza, burger}) \} \]

Not reflexive, not symmetric, not transitive

Relation 3, \( r_3 \), on the set of numbers \( \{1,2,3,4,5,6,7,8\} \)
\[ r_3 = \{(1, 1), (1,4), (1,8), (3, 3), (4, 4), (4,8), (5, 5), (5,8), (8, 8)\} \]

Write out the set of ordered pairs in the following relations on the integers \( \mathbb{Z} \):
- \((x,y)\) is in the relation if and only if \( y > 3x \)
  \{..., (-1,-2), (-1,-1), (-1,0), ...
  (0,1), (0,2), (0,3), ...
  (1,4), (1,5), (1,6), ...
  ...
  \}
- \((x,y)\) is in the relation if and only if \( 3x-y = 4 \)
  \((x,y)\) is in the relation if and only if \( \frac{x}{y} = 5 \)
  \{..., (-10,-2), (-5,-1), (5,1), (10,2), ...
  \}
- \((x,y)\) is in the relation if and only if \( x-3 = 2y \)
Consider the following relations on the set of all people and say whether the resulting relations are: reflexive, irreflexive, or neither; symmetric, anti-symmetric, or neither; transitive or not

- Has as many siblings as
- Is shorter than
- Has bought food at the same restaurant as
- Took the same Spring 2014 classes as

**Reflexive, symmetric, transitive**