1. **(13 points)** Library/ASU-topics/setDiscrete/katie20.pg

Suppose that

$R_1 = \{(2,2),(2,3),(2,4),(3,2),(3,3),(3,4)\}$,
$R_2 = \{(1,1),(1,2),(2,1),(2,2),(3,3),(4,4)\}$,
$R_3 = \{(2,4),(4,2)\}$,
$R_4 = \{(1,2),(2,3),(3,4)\}$,
$R_5 = \{(1,1),(2,2),(3,3),(4,4)\}$,
$R_6 = \{(1,3),(1,4),(2,3),(2,4),(3,1),(3,4)\}$,

Determine which of these statements are correct.
Check ALL correct answers below.

- A. R_3 is reflexive
- B. R_5 is transitive
- C. R_3 is transitive
- D. R_3 is symmetric
- E. R_4 is symmetric
- F. R_6 is symmetric
- G. R_1 is reflexive
- H. R_4 is antisymmetric
- I. R_2 is not transitive
- J. R_1 is not symmetric
- K. R_2 is reflexive
- L. R_4 is transitive
- M. R_5 is not reflexive

2. **(5 points)** Library/NAU/setFoundations/MAT320_0502.pg

Determine which of these relations are reflexive. The variables x, y, x', y' represent integers.

- A. $x \sim y$ if and only if xy is positive.
- B. $x \sim y$ if and only if $xy \geq 0$.
- C. $x \sim y$ if and only if $x - y$ is positive.
- D. $x \sim y$ if and only if $x + y$ is even.
- E. $x \sim y$ if and only if $x + y$ is odd.

3. **(6 points)** Library/NAU/setFoundations/MAT320_0501.pg

Determine which of these relations are transitive. The variables x, y, x', y' represent integers.

- A. $x \sim y$ if and only if $x + y$ is positive.
- B. $x \sim y$ if and only if xy is positive.
- C. $(x,y) \sim (x\prime, y\prime)$ if and only if $x - y = x\prime - y\prime$.
- D. $x \sim y$ if and only if $xy \geq 0$.
- E. $x \sim y$ if and only if $x - y$ is positive.
- F. $x \sim y$ if and only if xy is negative.

4. **(5 points)** Library/NAU/setFoundations/MAT320_0503.pg

Determine which of these relations are symmetric. The variables x, y, x', y' represent integers.

- A. $x \sim y$ if and only if $xy \geq 0$.
- B. $x \sim y$ if and only if $x - y$ is a multiple of 10.
- C. $x \sim y$ if and only if $x + 2y$ is positive.
- D. $x \sim y$ if and only if $x - y$ is positive.
- E. $x \sim y$ if and only if xy is negative.

5. **(20 points)** Library/ASU-topics/setDiscrete/katie21.pg

Given the following relations on the set of all people. Check ALL correct answers from the following lists:

(a) a is older than b

- A. irreflexive
- B. antisymmetric
- C. transitive
- D. symmetric
- E. reflexive

(b) a and b have a common grandparent

- A. transitive
- B. antisymmetric
- C. reflexive
- D. irreflexive
- E. symmetric

(c) a has the same first name as b

- A. reflexive
- B. transitive
- C. irreflexive
- D. symmetric
- E. antisymmetric

(d) a and b were born on the same day

- A. reflexive
- B. antisymmetric
- C. symmetric
- D. irreflexive
- E. transitive

6. **(20 points)** Library/ASU-topics/setDiscrete/katie22.pg
Given the following relations on the set of all integers where $(x,y) \in R$ if and only if the following is satisfied. (Check ALL correct answers from the following lists):

(a) $x + y = 0$

- A. reflexive

- B. irreflexive
- C. transitive
- D. symmetric
- E. antisymmetric

(b) $x - y$ is an integer

- A. transitive
- B. antisymmetric
- C. symmetric
- D. reflexive
- E. irreflexive

(c) $x = 2y$

- A. antisymmetric
- B. reflexive
- C. transitive
- D. irreflexive
- E. symmetric

(d) $xy > 1$

- A. reflexive
- B. symmetric
- C. transitive
- D. irreflexive
- E. antisymmetric

---

7. **(5 points)** `Library/MC/Proofs/Relations/Transitive01.pg`

Order 5 of the following sentences so that they form a logical proof of the statement:

Suppose R is a relation on $A = \mathbb{N}$ defined by $(x,y) \in R \Leftrightarrow y < x$.
Prove that R is transitive.

- Let $x,y,z \in \mathbb{N} \ni (x,y) \in R, (y,z) \in R$ and $(x,z) \in R$
- Assume $\exists x,z \in \mathbb{N} \ni (x,z) \in A$
- $y < x$ and $z < y$
- $z < y < x \Rightarrow z < x$
- Let $x,y,z \in \mathbb{N} \ni (x,y) \in R$ and $(y,z) \in R$
- $(x,z) \in R$
- Meditation leads to the next step.
- R is transitive
- $x < y$ and $y < z$

---

8. **(6 points)** `Library/ASU-topics/setDiscrete/katie23.pg`

Suppose R and S are relations on a set A. Select *True* or *False* for each statement below.

1. If R and S are reflexive relations, then $R \circ S$ is reflexive. ?

2. If R and S are reflexive relations, then $R \cap S$ is reflexive. ?

3. If R and S are reflexive relations, then $R \cup S$ is reflexive. ?