

# Maths Tutorial 7

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## Question 1

Let  $A = \{1, 2, 3\}$  and  $B = \{a, b\}$ . Determine the set  $A \times B$

Answer

All elements of A times by the first element of B then second etc. First step: 1a, 2a Second step: 2a, 2b Third step: 3a, 3b

$A \times B = \{1a, 2a, 2a, 2b, 3a, 3b\}$

## Question 2

Let A be a set. Determine the set  $A \times \emptyset$

Answer

$\emptyset$  is the empty set. Therefore anything times the empty set is also the empty set. Answer:  $\emptyset$ .

## Question 3

Which ordered pairs are in the relation  $R = \{(x, y) | x > y\}$  on the set  $A = \{1, 2, 3, 4\}$ ?

Answer

So a relation on itself ( $A \times A$ ) is every single possible combination in that set. But in this instance we want every single pair where x is more than y. Therefore this is:

$R = \{(2, 1), (3, 1), (3, 2), (4, 1), (4, 2), (4, 3)\}$

## Question 4

List all the binary relations on the set  $\{0, 1\}$ .

Answer

So a binary relation is just any relation that contains every element in the relation. In this instance the binary relation is just:  $\{(0, 1), (1, 0)\}$  As there are only 2 possible ways to change the set of  $\{0, 1\}$  into an order due to 2 items being in the set.

## Question 5

List the set of ordered pairs and draw the graphical representation of the relation R between  $\{1, 2, 3, 4\}$  and  $\{a, b, c\}$  with the matrix:

T	F	F
F	F	T
F	T	F
T	F	F

Answer

So to do this we first need to decide what is T and what is F. We draw this

	a	b	c
1	T	F	F
2	F	F	T
3	F	T	F
4	T	F	F

And this is what the relationship looks like. Now we simply list what is T (True). Relation =  $\{(1, a), (2, c), (4, a)\}$

## Question 6

Let R be the relation on  $\{1, 2, 3, 4\}$  given by  $xRy$  if, and only if,  $x - y = 0$ . Represent R in the following ways:

- As a set of ordered pairs
- In graphical form
- In matrix form

Answer

Okay so this question is a bit awkward. the relation rule is  $x - y = 0$ , so the first one take away the second must equal 0. Because of this, x and y has to be equal because it'll only ever be  $< 0$  or  $> 0$  if it isn't equal. Therefore the set of ordered pairs is:  $R = \{(1, 1), (2, 2), (3, 3), (4, 4)\}$

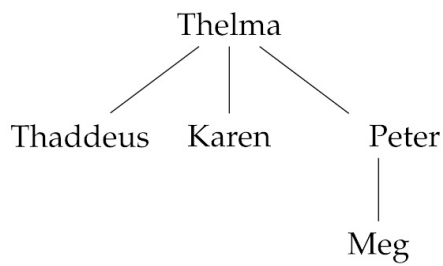
In graphical form this would be a digraph.

As a matrix this would be:

	1	2	3	4
1	T	F	F	F
2	F	T	F	F
3	F	F	T	F
4	F	F	F	T

## Question 7

Consider the following family tree:



Let  $A = \{\text{Thelma, Thaddeus, Karen, Peter, Meg}\}$  be the set of all family members and  $B = \{\text{Thaddeus, Peter}\}$  be the set of male members.

Let  $R$  be the relation between the sets  $A$  and  $B$  consisting of pairs  $(a, b)$ , where  $a$  is a parent of  $b$ . Let  $S$  be the relation between sets  $B$  and  $A$  consisting of pairs  $(a, b)$ , where  $a$  and  $b$  are siblings (brothers or sisters).

- Represent relations  $R$  and  $S$  in the matrix form.
- Use the matrix forms to compute  $R \circ S$  and  $S \circ R$

Answer

$R = \{(\text{Thelma, Thaddeus}), (\text{Thelma, Karen}), (\text{Thelma, Peter}), (\text{Peter, Meg})\}$   $S = \{(\text{Thaddeus, Karen}), (\text{Thaddeus, Peter}), (\text{Karen, Peter})\}$

$R$  in matrix form:

	Thelma	Peter
Thaddeus	T	F
Karen	T	F
Peter	T	F
Meg	F	T