For every relation, also try to find out whether it is a partial/total/well order relation.

Define the relation R on $\mathbb{R}$ by $x\,R\,y$ if $xy > 0$. Is R an equivalence relation? If so, what are the equivalence classes of R?

equivalence relation ~~R~~, S, T

partial order relation ~~R~~, A, T

R ✗ $0 \cdot 0 \not> 0$

S ✓ if $xy > 0$ then $yx > 0$

A ✗

T ✓ if $xy > 0$ and $yz > 0$ then $xz > 0$

$+\,+$ $\quad$ $+\,+$ $\quad$ $+\,+$

$-\,-$ $\quad$ $-\,-$ $\quad$ $-\,-$

4. Let Q be the binary relation on $\mathbb{R} \times \mathcal{P}(\mathbb{N})$ defined by $(r, A)Q(s, B)$ if and only if $r \leqslant s$ and $A \subseteq B$. Is Q a partial order relation? Is Q a total order relation?

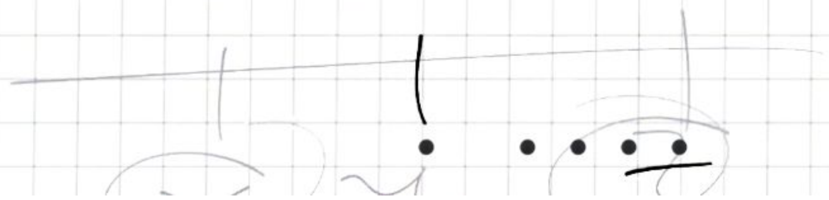
R A T

total order relation = partial order relation +
aRb or bRa for all $a, b \in$ set A

R. ✓ every real number is $\leq$ itself,
every set is $\subseteq$ itself

A ✓ $a \leq b$ and $b \leq a$ iff $a = b$
$A \subseteq B$ and $B \subseteq A$ iff $A = B$

T if $x \leq y$ and $y \leq z \rightarrow x \leq z$
if $A \subseteq B$ and $B \subseteq C \rightarrow A \subseteq C$



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T ✓ if $x \leq y$ and $y \leq z \rightarrow x \leq z$
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partial order relation ✓

$(1, \{1,2\}) \not Q (2, \{1,3\})$ and
$(2, \{1,3\}) \not Q (1, \{1,2\})$

total order relation ✗

w8

Warm Up

a. 10P6

b. 13C5

c. (3x+2y)^5

d. $(3x-2y)^5$

a. $\frac{10!}{4!}$

b. $\frac{13!}{8!\ 5!}$

c.

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

1 5 10 10 5 1

w8

Warm Up

a. 10P6
b. 13C5
c. (3x+2y)^5
d. $(3x-2y)^5$

c. $1(3x)^5(2y)^0 + 5(3x)^4(2y)^1 + 10(3x)^3(2y)^2 +$
$10(3x)^2(2y)^3 + 5(3x)^1(2y)^4 + 1(3x)^1(2y)^5$

d. $+1(3x)^5(2y)^0 - 5(3x)^4(2y)^1 + 10(3x)^3(2y)^2 -$
$10(3x)^2(2y)^3 + 5(3x)^1(2y)^4 - 1(3x)^1(2y)^5$

a. $\frac{10!}{4!}$

b. $\frac{13!}{8!\ 5!}$

How many 7-digit numbers can be made from the digits 1, 2, 3, 4, 5, 6, 7 if there is no repetition and the odd digits must appear in an unbroken sequence. (So, 1357246 and 2753146 satisfy this condition, but 7654231 does not.)

w8

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_ _ _ _ _ _ _

$4! \times 4!$

$= 576$

2.

Determine

$|\{X \in P(\{0,1,2,3,4,5,6,7,8,9\}) : |X| = 4\}|$.

the number of subsets of $\{0, 1, \ldots, 9\}$ that contain 4 elements

$_{10}C_4$

3. How many different ways are there for Mary to choose any combination of 6 fruits from a store that sells papayas, oranges, apples and persimmons?

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papayas | oranges | apples | persimmons

unordered with repetition

_ _ | _ _ | _ _ | _ _ _

$_9C_3$

nts using letter in word "championship"

$$\frac{12!}{2!\,2!\,2!}$$

e 8 different books on a bookshelf if 3 particular books must

4. How many arrangements using letter in word "championship"

$$\frac{12!}{2!\,2!\,2!}$$

4. How many arrangements using letter in word "~~c~~h~~am~~p~~i~~ons~~hi~~p"

$$\frac{12!}{2!\,2!\,2!}$$

5.Number of ways to arrange 8 different books on a bookshelf if 3 particular books must be

a. Together
b. Separated

6.Number of ways dividing 10 people ~~onto~~ into

a. Group of 2,3,5 people
b. Group of 4,3,3 people
c. 5 pairs