

HW1 MATH 2510 Spring 2019

- 1) a) No, $2 \notin X$
Yes, $2 \in Y$
Yes, $2 \in Z$

- b) No, $X \not\subseteq Y$ (because, e.g., $1 \in X$ but $1 \notin Y$)
No, $X \not\subseteq Z$ (because $4 \in X$ but $4 \notin Z$)
No, $Y \not\subseteq Z$ (because $4 \in Y$ but $4 \notin Z$)
No, $Z \not\subseteq X$ (b/c, e.g., $2 \in Z$ but $2 \notin X$)
No, $Z \not\subseteq Y$ (b/c, e.g., $3 \in Z$ but $3 \notin Y$)

- e) $X \cup Y = \{1, 2, 3, 4, 5\}$
 $X \cup Z = \{1, 2, 3, 4, 5, 7\}$
 $Y \cup Z = \{1, 2, 3, 4, 5, 7\}$
 $X \cup Y \cup Z = \{1, 2, 3, 4, 5, 7\}$

- d) $X \cap Y = \{4\}$
 $X \cap Z = \{1, 3\}$
 $Y \cap Z = \{2, 5\}$
 $X \cap Y \cap Z = \emptyset$ (empty)

- e) $X \times Y = \{(1, 2), (1, 4), (1, 5), (3, 2), (3, 4), (3, 5), (4, 2), (4, 4), (4, 5)\}$

2) Yes, R is a function because no first coordinate appears twice.

3) empty set — the set containing no elements

4) No — because "A V \neg " makes no sense.

5) Yes — all connectives are surrounded by appropriate statements in appropriate way.

6) P — true, Q — false, R — false

a) $P \rightarrow (Q \vee R)$

$T \rightarrow (F \vee F)$

$\underbrace{\quad}_{F}$

$T \rightarrow F$ is false

b) $R \rightarrow (Q \wedge P)$

$F \rightarrow (F \wedge T)$

$\underbrace{\quad}_{F}$

$F \rightarrow F$ is true

c) $\neg P \leftrightarrow Q$

$(\neg T) \leftrightarrow F$

$F \leftrightarrow F$

true

d) $(P \vee R) \leftrightarrow (Q \vee R)$

$(T \vee F) \leftrightarrow (F \vee F)$

$T \leftrightarrow F$

false

e) $P \wedge (Q \wedge (R \vee P))$

$T \wedge (F \wedge (T \vee F))$

$\underbrace{\quad}_{T}$

$\underbrace{\quad}_{F}$

$T \wedge F \rightarrow$ false

$$P \rightarrow (Q \vee R)$$

7) a)

P	Q	R	$Q \vee R$	$P \rightarrow (Q \vee R)$
T	T	T	T	T
T	T	F	T	T
T	F	T	T	T
T	F	F	F	F
F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
F	F	F	F	T

c) $\neg P \leftrightarrow Q$

P	Q	$\neg P$	$\neg P \leftrightarrow Q$
T	T	F	F
T	F	F	T
F	T	T	T
F	F	T	F

e) $P \wedge (Q \wedge (R \vee P))$

P	Q	R	$R \vee P$	$Q \wedge (R \vee P)$	$P \wedge (Q \wedge (R \vee P))$
F	T	T	T	T	T
T	T	F	T	T	T
T	F	T	T	F	F
T	F	F	T	F	F
F	T	T	T	T	F
F	T	F	F	F	F
F	F	T	T	F	F
F	F	F	F	F	F