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CS-225: Discrete Structures in CS
Homework 3, Part 1

Exercise Set 6.1: Problem 7

a: False

$a = 5$

$6 \cdot 5 + 4 = 30$

$18b - 2 = 30$

$18b = 32$

$b = 32/18 = \boxed{16/9}$

b: True

$18b - 2 = 6a + 4 = 18(a+1) - 2$

$\frac{18b}{18} = \frac{6a+6}{18} = \frac{18a+18}{3} - 2$

$b = a + 1/3 = 6a + 6 - 2 = \boxed{6a+4}$

c: True

$18b - 2 = 18c + 16 = 18(b-1) + 16$

$18b - 2 - 16 = 18c = 18b - 18 + 16$

$18c = 18b - 18 = \boxed{18b - 2}$

$c = b - 1$

Exercise Set 6.1: Problem 12

$\{x \in R \mid \quad\}$

a: $-3 \leq x < 2$

b: $-1 < x \leq 0$

c: $x < -3$ or $x > 0$

d: $-3 \leq x \leq 0$ or $6 < x \leq 8$

e: $\emptyset$

f: $x \leq -1$ or $x > 0$

g: 2, 3, 4, 6, 8, 9

h: $x \leq -1$ or $x > 0$

i: $x < -3$ or $x > 0$

j: $x < -3$ or $x \geq 2$

Exercise Set 6.1: Problem23

a: $\bigcup_{i=0}^{4} V_i = \{x \in R \mid -1 \leq x \leq 1\}$

b: $\bigcap_{i=0}^{4} V_i = \{x \in R \mid -\frac{1}{4} \leq x \leq \frac{1}{4}\}$

c: Are $V_1, V_2, V_3 \ldots$ mutually disjoint? Explain

No

$V_i = \{x \in R \mid -\frac{1}{i} \leq x \leq \frac{1}{i}\} = [-\frac{1}{i}, \frac{1}{i}]$

$V_1 = \{x \in R \mid -\frac{1}{1} \leq x \leq \frac{1}{1}\} = |-1 \leq x \leq 1$

$V_2 = \{x \in R \mid -\frac{1}{2} \leq x \leq \frac{1}{2}\}$

$V_3 = \{x \in R \mid -\frac{1}{3} \leq x \leq \frac{1}{3}\}$

$V_4 = \{x \in R \mid -\frac{1}{4} \leq x \leq \frac{1}{4}\}$

Exercise Set 6.1: Problem 27

b: Yes

c: No, 4 in two sets

Exercise Set 6.1: Problem 33

a: $P(\emptyset) = \{\emptyset\}$

c: $P(P(P(\emptyset))) = P(P(\{\emptyset\}))$

$= P(\{\emptyset, \{\emptyset\}\})$

$= \{\emptyset, \{\emptyset\}, \{\emptyset, \{\emptyset\}\}, \{\{\emptyset\}\}\}$

Exercise Set 6.1: Problem 35

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

c: $A \times (B \cap C)$
$= A \times (\{1,2\} \cap \{2,3\})$
$= A \times (\{2\})$
$= \{a, b\} \times \{2\}$
$= \{(a,2), (b,2)\}$

d: $(A \times B) \cap (A \times C)$
$(\{a,b\} \times \{1,2\}) \cap (\{a,b\} \times \{2,3\})$
$(\{(a,1), (a,2), (b,1), (b,2)\} \cap (\{(a,2), (a,3), (b,2), (b,3)\})$

$= \{(a,2), (b,2)\}$