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Problem 1: Let $X = \{a, b, c\}$, $Y = \{a, d, e, f\}$, and $Z = \{f, g\}$. List all elements of the following sets:

$$X \cup Y \cup Z \;=$$

$$X \cap Y \;=$$

$$(Y - X) - Z \;=$$

$$X \times X \;=$$

$$\mathbf{P}(Z) \;=$$

Note: $\mathbf{P}(Z)$ denotes the power set of Z.

Problem 2: Let $f, g : R \to R$ be the functions given by $f(x) = 2x - 3$, and $g(x) = x^3 + 1$. Give the formulas for the following functions:

$$f \circ g(x) \quad =$$

$$g \circ f(x) \quad =$$

$$g \circ g(x) \quad =$$

$$f^{-1}(x) \quad =$$

$$g^{-1}(x) \quad =$$

Note: $f \circ g$ is the composition of g and f, that is $f \circ g(x) = f(g(x))$, and f^{-1} is the inverse of f.

Problem 3: Let X be a set of 10 distinct items. Give formulas for the following quantities (you do not have to compute the value.)

(a) What is the total number of subsets of X?

(b) In how many ways we can choose 6 items from X if the items in the choices are ordered and repetition is not allowed?

(c) In how many ways we can choose 6 items from X if the items in the choices are ordered and repetition is allowed?

(d) In how many ways we can choose 6 items from X if the items in the choices are not ordered and repetition is not allowed?

(e) In how many ways we can order X?