Worksheet: Set-theoretic notations and terminology

1. Write the following sets using "set builder" notation:

   (a) The set of *real* solutions to $x^2 - 2x < 3$.

   (b) The set of *integer solutions* to $x^2 - 2x < 3$.

   (c) The set of odd integers.

   (d) The set of odd natural numbers.

   (e) The set $\{1, 4, 7, 10, \dots\}$.

   (f) The set of integers that can be written as sums of two integer squares. (The first few such integers are $0 = 0^2 + 0^2$, $1 = 0^2 + 1^2 = 1$, $2 = 1^2 + 1^2$, $4 = 0^2 + 2^2$.)

2. Given $A = \{1, 2, 3, 4\}$, $B = \{0, 1\}$, find the following sets. *Be sure to use correct set-theoretic notation.*

   (a) $A - B$

   (b) $B - A$

   (c) $A \times B$

   (d) $P(B)$

   (e) $B \times \mathbb{N}$

3. In the following, E, O denote, respectively, the sets of even integers and odd integers. In each case, write the given set in simpler form.

   (a) $\{p/q : p, q \in E, q \in \mathbb{Z}, q \neq 0\}$

   (b) $\{1/q : q \in \mathbb{Q}, q \neq 0\}$

   (c) $(\mathbb{N} \times \mathbb{Z}) \cap (\mathbb{Z} \times \mathbb{N})$

   (d) $(\mathbb{Z} - E) \cup (\mathbb{Z} - O)$

4. Let $A = \{1, 2\}$ and $B = \{\{1\}, 2\}$. Determine which of the following relations are true:

   (a) $\{1\} \in A$

   (b) $\{1\} \subseteq A$

   (c) $\{1\} \in P(A)$

   (d) $\{1\} \subseteq P(A)$

   (e) $\{1\} \in B$

   (f) $\{1\} \subseteq B$

   (g) $\{1\} \in P(B)$

   (h) $\{1\} \subseteq P(B)$