1. Using set-builder notation, give formal descriptions of the following sets:
   (a) The set of positive integers that are even.

   > **Solution:** $\{\, x \in \mathbb{Z}^+ \;:\; x\%2 = 0 \,\}$

   (b) $\{\, -2, \; -1, \; 0, \; 1, \; 2 \,\}$

   > **Solution:** $\{\, x \in \mathbb{Z} \;:\; |x| \le 2 \,\}$ or $\{\, x \in \mathbb{Z} \;:\; -2 \le x \le 2 \,\}$

   (c) $\{\, 3, \; 6, \; 9, \; 12, \; \ldots \,\}$

   > **Solution:** $\{\, x \in \mathbb{Z}^+ \;:\; x\%3 = 0 \,\}$

   (d) $\{\, -3, \; -1, \; 1, \; 3, \; 5, \; 7, \; 9 \,\}$

   > **Solution:** $\{\, x \in \mathbb{Z} \;:\; x\%2 = 1 \wedge -3 \le x \le 9 \,\}$

   (e) $\{\, 0, \; 10, \; 20, \; 30, \; \ldots, \; 1000 \,\}$

   > **Solution:** $\{\, x \in \mathbb{Z} \;:\; x\%10 = 0 \wedge 0 \le x \le 1000 \,\}$

   *(f) The power set of X, denoted $P(X)$.

   > **Solution:** $\{\, A \;:\; A \subseteq X \,\}$

2. State the cardinality of the following sets:
   (a) Question 1, part (a)

   > **Solution:** ∞

   (b) Question 1, part (b)

   > **Solution:** 5

   (c) Question 1, part (d)

   > **Solution:** ∞

   (d) Question 1, part (e)

   > **Solution:** 101

   (e) Question 1, part (f)

   > **Solution:** $2^{|X|}$

Consider the following sets:

$A = \{\ 2,\ 4,\ 6,\ 8\ \}$
$B = \{\ x \in \mathbb{Z}\ :\ x\%2 = 0 \wedge 0 < x < 10\ \}$
$C = \{\ x \in \mathbb{Z}\ :\ x\%2 = 0 \wedge 0 < x \leq 10\ \}$

3. Indicate whether each statement about the sets A, B and C is true or false.

(a) $A \subseteq B$

> **Solution:** True. Every element of A is also an element of B.

(b) $A \subset B$

> **Solution:** False. $A = B$. There is no element of B that is not also an element of A.

(c) $A \subseteq C$

> **Solution:** True. Every element of A is also an element of C.

(d) $A \subset C$

> **Solution:** True. Every element of A is also an element of C. Also $10 \in C$ and $10 \notin A$.

(e) $C \subseteq B$

> **Solution:** False. $10 \in C$ and $10 \notin B$.

(f) $A = C$

> **Solution:** False. $10 \in C$ and $10 \notin A$.

(g) $A = B$

> **Solution:** True. $B = \{\ 2,\ 4,\ 6,\ 8\ \}$.

4. Using roster notation, give formal descriptions of the following power sets:

(a) $P(A)$

> **Solution:** $P(A) = \{\ \varnothing,\ \{\ 2\ \},\ \{\ 4\ \},\ \{\ 6\ \},\ \{\ 8\ \},\ \{\ 2,\ 4\ \},\ \{\ 2,\ 6\ \},\ \{\ 2,\ 8\ \},\ \{\ 4,\ 6\ \},\ \{\ 4,\ 8\ \},$
> $\{\ 6,\ 8\ \},\ \{\ 2,\ 4,\ 6\ \},\ \{\ 2,\ 4,\ 8\ \},\ \{\ 2,\ 6,\ 8\ \},\ \{\ 4,\ 6,\ 8\ \},\ \{\ 2,\ 4,\ 6,\ 8\ \}\ \}$

(b) $P(B)$

> **Solution:**