Question 3: Exercise 4.1.3, sections b, c

b) f is not a function when x is 2 and -2; $\frac{1}{0}$
c) f is a function, its range is all positive real numbers

Exercise 4.1.5, section, b, d, h, i, l

b) $\{4, 9, 16, 25\}$
d) $\{0, 1, 2, 3, 4, 5\}$
h) $\{(1,1), (1,2), (1,3), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3)\}$
i) $\{(1,2), (1,3), (1,4), (2,2), (2,3), (2,4), (3,2), (3,3), (3,4)\}$
l) $\emptyset, \{2\}, \{2,3\}, \{3\}$
subtracting from the power set $\emptyset, \{1\}, \{1,2\}, \{1,3\}, \{2\}, \{2,1\}, \{2,3\}, \{3\}$

Question 4:

Exercise 4.2.2, sections, c,g,k

c) It is one to one, but not onto $(x \neq -2)$
g) It is one to one, but not onto because y can never be odd because y can never be odd
k) It is not one to one because when x = 2, y = 2 and x = 1, y = 4 map to the same value, it is not onto because y can never be one.

Exercise 4.2.4, sections b, c, d, g

b) It is neither one to one nor onto. It is not one to one because f(100) and f(000) map to the same target. It is not onto because y = 000 is never mapped to.

c) It is one to one and onto.

d) It is one to one, but not onto because y = 0001 is not mapped to anything.

g) It is not one to one because f({1,2}) and f({2}) maps to the same y; it is not onto because nothing maps to {1,2}.

II. Give an example of a function from the set of integers to the set of postitive integers that is:

a) one to one, but not onto: $f(x) = x^2 + 2$
b) onto, not one to one: $f(x) = |x| + 1$
c) one to one and onto:
$f(x) = -2x, x < 0$
$f(x) = 2x + 1, x \geq 0$
d) neither one to one nor onto: $f(x) = x^2$

Question 5:

Exercise 4.3.2, sections c,d,g,i

c) It has a well deifined inverse, the inverse is $f^{-(1)}(x) = x - \frac{3}{2}$
d) It is not a well defined inverse because both {1,2} and {3,4} maps to 2
g) It has a well defined inverse, the inverse is just $f^{-(1)} = f$ output is obtained by taking the input string and reversing the bits
i) It has a well defined inverse, the inverse is $f^{-(1)}(x, y) = (x - 5, y + 2)$

Exercise 4.4.8, sections c,d

c) $2(x^2 + 1) + 3$
d) $(2x + 3)^2 + 1$

Exercise 4.4.2, sections b-d

b) $\left(\left\lceil \frac{x}{5} \right\rceil\right)^2 \to \left(\left\lceil \frac{52}{5} \right\rceil\right)^2 \to (11)^2 \to 121$
c) $4^2 = 16 \to \left\lceil \frac{16}{5} \right\rceil = 4 \to 2^4 = 16$
d) $\left(\left\lceil \frac{x^2}{5} \right\rceil\right)^2$

Exercise 4.4.6, sections c-e

c) $h(f(010)) \to h(110) \to 111$
d) $\{000, 001, 010, 011, 100, 101, 110, 111\} \to \{100, 101, 110, 111\} \to \{101, 111\}$
e) $\{000, 001, 010, 011, 100, 101, 110, 111\} \to \{100, 101, 110, 111\} \to \{001, 101, 011, 111\}$