1.1.6. Fill in the blanks to rewrite the statement: The cube root of any negative real number is negative.

(a) Given any negative real number $x$, the cube root of ____________.

(b) For any real number $s$, if $s$ is ____________, then ____________.

(c) If a real number $s$ ____________, then ____________.

1.1.11. Fill in the blanks to rewrite the statement: Every positive number has a positive square root.

(a) All positive numbers ____________.

(b) For every positive number $e$, there is ____________ for $e$.

(c) For every positive number $e$, there is a positive number $r$ such that ____________.

1.2.8. Let $A = \{c, d, f, g\}$, $B = \{f, j\}$, and $C = \{d, g\}$.

(b) Is $C \subseteq A$?

(c) Is $C \subseteq C$?

Justify your answers.

1.2.9. Answer the following. Make sure to justify your answers.

(c) Is $\{2\} \in \{1, 2\}$?

(d) Is $\{3\} \in \{1, \{2\}, \{3\}\}$?

(e) Is $1 \in \{1\}$?

1.2.14. Let $R = \{a\}$, $S = \{x, y\}$, and $T = \{p, q, r\}$. Find each of the following sets.

(a) $R \times (S \times T)$

(b) $(R \times S) \times T$

(c) $R \times S \times T$

1.3.2. Let $C = D = \{-3, -2, -1, 1, 2, 3\}$ and define a relation $S$ from $C$ to $D$ as follows: For every $(x, y) \in C \times D$,

$$(x, y) \in S \ \text{ means that } \ \frac{1}{x} - \frac{1}{y} \text{ is an integer.}$$

(a) Is $2\ S\ 2$? Is $-1\ S\ -1$? Is $(3, 3) \in S$? Is $(3, -3) \in S$?

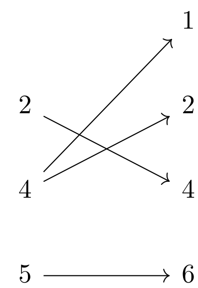
(b) Write $S$ as a set of ordered pairs.

(c) Write the domain and co-domain of $S$.

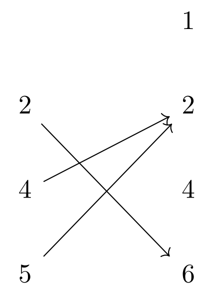
(d) Draw an arrow diagram for $S$.

1.3.15. Let $X = \{2, 4, 5\}$ and $Y = \{1, 2, 4, 6\}$. Which of the following arrow diagrams determine functions from $X$ to $Y$? Justify your answers.

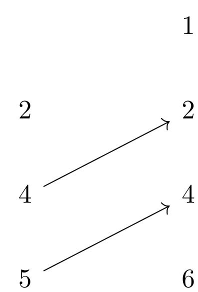
(c)



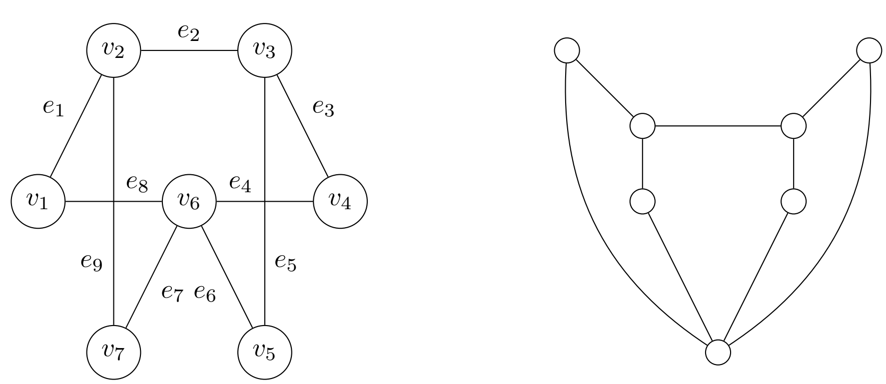

(d)



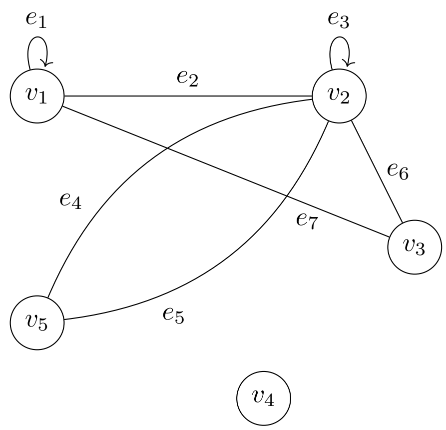

(e)




1.4.7. Show that the two drawings below represent the same graph by labeling the vertices and edges of the right-hand drawing to correspond to those of the left-hand drawing.



1.4.9. Use the graph below to answer the given questions.




(a) Find all edges that are incident on $v_1$.

(b) Find all vertices that are adjacent to $v_3$.

(c) Find all edges that are adjacent to $e_1$.

(d) Find all loops.

(e) Find all parallel edges.

(f) Find all isolated vertices.

(g) Find the degree of $v_3$.

1.4.17. A department wants to schedule final exams so that no student has more than one exam on any given day. The vertices of the graph below show the courses that are being taken by more than one student, with an edge connecting two vertices if there is a student in both courses. Find a way to color the vertices of the graph with only four colors so that no two adjacent vertices have the same color and explain how to use the result to schedule the final exams.