Section 1.1

4. Write the negations for the following statements.

   (a) Jennifer and Teja are not friends.

   (b) A bakers dozen does not have 13 items.

   (c) It is not the case that Abby sends more than 100 text messages every day.

   (d) It is not the case that 121 is a perfect square.

6. Determine the truth values of the propositions

   (a) True because Smartphone B has 288MB of RAM, Smartphone A has 256MB of RAM, and Smartphone C has 128MB of RAM.

   (b) True because Smartphone C has 5MP camera and Smartphone B has a 4MP camera.

   (c) False because Smartphone C still has a 5MP camera even though it has less RAM and ROM than Smartphone B.

   (d) False because Smartphone A cannot have more RAM than Smartphone B.

8. Express each proposition as a sentence

   p: I bought a lottery ticket this week.
   q: I won the million dollar jackpot.

   (a) $\neg p$: I did not buy a lottery ticket this week.

   (b) $p \vee q$: I bought a lottery ticket this week or I won the million dollar jackpot.

   (c) $p \rightarrow q$: I bought a lottery ticket this week, therefore I won the million dollar jackpot.

   (d) $p \wedge q$: I bought a lottery ticket this week and I won the million dollar jackpot.

   (e) $p \leftrightarrow q$: I bought a lottery ticket this week if and only if I won the million dollar jackpot.

   (f) $\neg p \rightarrow \neg q$: I did not buy a lottery ticket this week therefore I did not win the million dollar jackpot.

(g) $\neg p \wedge q$: I did not buy a lottery ticket this week and I did not win the million dollar jackpot.

(h) $\neg p \vee (p \wedge q)$: I did not buy a lottery ticket or I bought a lottery ticket and I won the million dollar jackpot.

12. Express each proposition as a sentence

p: You have the flu.
q: You miss the final examination.
r: You pass the course.

(a) $p \rightarrow q$: If you have then flu, then you miss the final exam.

(b) $\neg q \leftrightarrow r$: Not missing the final exam is necessary to pass the course.

(c) $q \rightarrow \neg r$: If you miss the final exam, then you do not pass the course.

(d) $p \vee q \vee r$: You have the flu or you miss the final or you pass the course.

(e) $(p \rightarrow \neg r) \vee (q \rightarrow \neg r$: You have the flu, therefore you do not pass the course or you miss the final exam therefore you do not pass the course.

(f) $(p \wedge q) \vee (\neg q \wedge r)$: You have the flu and you miss the final exam or you do not miss the final exam and you pass the course.

13. Write the propositions using p and q

p: You drive over 65 miles per hour.
q: You get a speeding ticket.

Proposition	p and q notation
You do not drive over 65 miles per hour.	$\neg p$
You drive over 65 miles per hour, but you do not get a speeding ticket.	$p \wedge \neg q$
You will get a speeding ticket if you drive over 65 miles per hour.	$p \rightarrow q$
If you do not drive over 65 miles per hour, then you will not get a speeding ticket.	$\neg p \rightarrow \neg q$
Driving over 65 miles per hour is sufficient for getting a speeding ticket.	$p \rightarrow q$
You get a speeding ticket, but you do not drive over 65 miles per hour.	$q \wedge \neg p$
Whenever you get a speeding ticket, you are driving over 65 miles per hour.	$q \rightarrow p$

24. Write each statement in if p then q form.

    (a) If you send me an email, then I will remember to send you the address.

    (b) If you were born in the United States, then you are a citizen.

    (c) If you keep your textbook, then it will be a useful reference in your future courses.

    (d) If the Red Wings' goalie plays well, then they will win the Stanley Cup.

    (e) If you have the best credentials, then you get the job.

    (f) If there is a storm, then the beach will erode.

    (g) If you have a valid password, then you can log on into the server.

    (h) If you begin your climb too late, then you will not reach the summit.

32. (a) $p \rightarrow \neg p$

p	$p \rightarrow \neg p$
T	F
F	T

    (b) $p \leftrightarrow \neg p$

p	$p \leftrightarrow \neg p$
T	F
F	F

    (c) $p \oplus (p \vee q)$

p	q	$p \vee q$	$p \oplus (p \vee q)$
T	T	T	F
T	T	T	F
F	T	T	T
F	F	F	F

    (d) $(p \wedge q) \rightarrow (p \vee q)$

p	q	$(p \wedge q)$	$(p \vee q)$	$(p \wedge q) \rightarrow (p \vee q)$
T	T	T	T	T
T	F	F	T	T
F	T	F	T	T
F	F	F	F	T

(e) $(q \to \neg p) \leftrightarrow (p \leftrightarrow q)$

p	q	$\neg p$	$(q \to \neg p$	$(p \leftrightarrow q)$	$(q \to \neg p) \leftrightarrow (p \leftrightarrow q)$
T	T	F	F	T	F
T	F	F	T	F	F
F	T	T	T	F	F
F	F	T	T	T	T

(f) $(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow q)$

p	q	$\neg p$	$\neg q$	$(\neg p \leftrightarrow \neg q)$	$(p \leftrightarrow q)$	$(\neg p \leftrightarrow \neg q) \leftrightarrow (p \leftrightarrow q)$
T	T	F	F	T	T	T
T	F	F	T	F	F	T
F	T	T	F	F	F	T
F	F	T	T	T	T	T

Section 1.2

6. $u \to (b_{32} \wedge g_1 \wedge r_1 \wedge h_{16}) \vee (b_{64} \wedge g_2 \wedge r_2 \wedge h_{32})$

8. Enter these propositions as p, q, r

Proposition	p, q, and r notation
The user has paid the subscription fee, but does not enter a valid password.	$r \wedge \neg p$
Access is granted whenever the user has paid the subscription fee and enters a valid password.	$q \to r \wedge p$
Access is denied if the user has not paid the subscription fee.	$\neg q \to \neg r$
If the user has not entered a valid password but has paid the subscription fee, then access is granted.	$(\neg p \wedge r) \to q$