Q1) Every mother loves her children.

For representing the above statement in predicate logic; let us rewrite the statement as:-

"For every lady in this world, if the lady is a mother then she loves her children."

Let a lady be represented as x.

Universe of Discourse → All ladies in this world.

Let $L(x)$ → x loves her children.

$M(x)$ → x is a mother.

Then, the predicate may be written as

$$\forall x \ (M(x) \rightarrow L(x))$$

Ans.

Q2) The given predicate can be written in the symbolic form as:

$$\forall x \exists y \ P(x,y) \text{ where } P(x,y) : y < x$$

Now, $\sim [\forall x \exists y \ P(x,y)]$

$\equiv \exists x \ [\sim \exists y \ P(x,y)]$

$\equiv \exists x \ \forall y \ [\sim P(x,y)]$

Hence the negation of the given statement can be written as:

"There is a number x such that for every number y, $y \geq x$."

Ans.

Q3

(i) (∀x)[S(x)->M(x)]

U.d is the set of all people.
S(x): x is a student.
M(x): x have taken a course in Mathematics.

(ii) (∃x)(I(x)∧~[H(x)])

U.d is the set of all
students.

I(x): x is intelligent.
H(x): x is hardworking.

Q4
(i) False
(ii) True

Q5

a. Sarah Smith has visited www.att.com.

b. At least one student has visited www.imdb.com.

c. Jose Orez has visited at least one website.

d. There is a website that both Ashok Puri and Cindy yoon has visited.

e. There is a student besides David Belcher who has visited all the websites that David Belcher has visited.

f. There are two different students who have visited exactly the same websites.

Q6

(i) If x is a teacher, then there exists a y such that if y is a student, then y likes x.

(ii) If x is a teacher, then there exists some y who is a student and likes x.

(iii) There exists a student who likes all teachers.

(iv) Everyone is a teacher and there exists a y such that if y is a student then y likes x. Assuming one cannot be both, student and teacher at the same time, this just means everyone is a teacher.

Ans is (ii).

Q7

[Grab your reader's attention with a great quote from the document or use this space to emphasize a key point. To place this text box anywhere on the page, just drag it.]

(i) Let $M(x)$: x is a man.

$G(x)$: x is generous.

Hence, the given statement can be written as :-

$$\exists x \, (M(x) \wedge G(x))$$ Ans.

(ii) Let $P(x,y)$: $x^2 + y^2 \geq 100$

Hence, the statement can be written as:-

$$\forall x \exists y \, P(x,y)$$ Ans.

Q8.

i. The teacher is absent, and all the students completed their homework.
ii. Some of the students did not complete their homework or the teacher is absent.
iii. All the students completed their homework, and the teacher is present.