

EXERCISE 31.5

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1. Write each of the following statements in the form “if p, then q.”

- (i) You can access the website only if you pay a subscription fee.
- (ii) There is traffic jam whenever it rains.
- (iii) It is necessary to have a passport to log on to the server.
- (iv) It is necessary to be rich in order to be happy.
- (v) The game is canceled only if it is raining.
- (vi) It rains only if it is cold.
- (vii) Whenever it rains, it is cold.
- (viii) It never rains when it is cold.

Solution:

- (i) If you access the website, then you pay a subscription fee.
- (ii) If it rains, then there is a traffic jam.
- (iii) If you log on the server, then you must have a passport.
- (iv) If he is happy, then he is rich.
- (v) If it is raining, then the game is canceled.
- (vi) If it rains, then it is cold.
- (vii) If it rains, then it is cold.
- (viii) If it is cold, then it never rains.

2. State the converse and contrapositive of each of the following statements:

- (i) If it is hot outside, then you feel thirsty.
- (ii) I go to a beach whenever it is a sunny day.
- (iii) A positive integer is prime only if it has no divisions other than 1 and itself.
- (iv) If you live in Delhi, then you have winter clothes.
- (v) If a quadrilateral is a parallelogram, then its diagonals bisect each other.

Solution:

- (i) If it is hot outside, then you feel thirsty.
Converse: If you feel thirsty, then it is hot outside.

Contrapositive: If you do not feel thirsty, then it is not hot outside.

(ii) I go to a beach whenever it is a sunny day.

Converse: If I go to a beach, then it is a sunny day.

Contrapositive: If I do not go to a beach, then it is not a sunny day.

(iii) A positive integer is prime only if it has no divisions other than 1 and itself.

Converse: If an integer has no divisor other than 1 and itself, then it is prime.

Contrapositive: If an integer has some divisor other than 1 and itself, then it is not prime.

(iv) If you live in Delhi, then you have winter clothes.

Converse: If you have winter clothes, then you live in Delhi.

Contrapositive: If you do not have winter clothes, then you do not live in Delhi.

(v) If a quadrilateral is a parallelogram, then its diagonals bisect each other.

Converse: If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.

Contrapositive: If the diagonals of a quadrilateral do not bisect each other, then the quadrilateral is not a parallelogram.

3. Rewrite each of the following statements in the form “p if and only is q.”

(i) **p: If you watch television, then your mind is free, and if your mind is free, then you watch television.**

(ii) **q: If a quadrilateral is equiangular, then it is a rectangle, and if a quadrilateral is a rectangle, then it is equiangular.**

(iii) **r: For you to get an A grade, it is necessary and sufficient that you do all the homework you regularly.**

(iv) **s: If a tumbler is half empty, then it is half full, and if a tumbler is half full, then it is half empty.**

Solution:

(i) You watch television if and only if your mind is free.

(ii) A quadrilateral is a rectangle if and only if it is equiangular.

(iii) You get an A grade if and only if you do all the homework regularly.

(iv) A tumbler is half empty if and only if it is half full.

4. Determine the Contrapositive of each of the following statements:

- (i) If Mohan is a poet, then he is poor.
- (ii) Only if Max studies will he pass the test.
- (iii) If she works, she will earn money.
- (iv) If it snows, then they do not drive the car.
- (v) It never rains when it is cold.
- (vi) If Ravish skis, then it snowed.
- (vii) If x is less than zero, then x is not positive.
- (viii) If he has courage he will win.
- (ix) It is necessary to be strong in order to be a sailor.
- (x) Only if he does not tire will he win.
- (xi) If x is an integer and x^2 is odd, then x is odd.

Solution:

(i) If Mohan is a poet, then he is poor.

Contrapositive: If Mohan is not poor, then he is not a poet.

(ii) Only if Max studies will he pass the test.

Contrapositive: If Max does not study, then he will not pass the test.

(iii) If she works, she will earn money.

Contrapositive: If she does not earn money, then she does not work.

(iv) If it snows, then they do not drive the car.

Contrapositive: If then they do not drive the car, then there is no snow.

(v) It never rains when it is cold.

Contrapositive: If it rains, then it is not cold.

(vi) If Ravish skis, then it snowed.

Contrapositive: If it did not snow, then Ravish will not ski.

(vii) If x is less than zero, then x is not positive.

Contrapositive: If x is positive, then x is not less than zero.

(viii) If he has courage he will win.

Contrapositive: If he does not win, then he does not have courage.

(ix) It is necessary to be strong in order to be a sailor.

Contrapositive: If he is not strong, then he is not a sailor

(x) Only if he does not tire will he win.

Contrapositive: If he tries, then he will not win.

(xi) If x is an integer and x^2 is odd, then x is odd.

Contrapositive: If x is even, then x^2 is even.

