

The Contrapositive Worksheet 1

Question 1

For an integer n , consider the statement:

n is a multiple of 12 only if n is a multiple of 3.

Which of the following statements is equivalent?

- A If n is not a multiple of 3, then n is not a multiple of 12.
- B If n is not a multiple of 12, then n is not a multiple of 3.
- C Being a multiple of 3 is sufficient for being a multiple of 12.
- D Being a multiple of 12 is necessary for being a multiple of 3.

Question 2

Consider the statement:

Not being in Paris is an inevitable consequence of not being in France.

Which of the following statements is **not** equivalent?

- A Being in Paris is sufficient for being in France.
- B Being in France is sufficient for being in Paris.
- C Not being in France is sufficient for not being in Paris.
- D Not being in Paris is a necessary condition for not being in France.

Question 3

For a real number x , consider the statement:

$x > 2$ is a necessary condition for $x > 7$.

Which of the following statements is equivalent?

- A $x > 2$ is sufficient for $x > 7$.
- B $x > 7$ is necessary for $x > 2$.
- C If $x \leq 2$, then $x \leq 7$.
- D If $x \leq 7$, then $x \leq 2$.

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Question 4

Consider the statement:

If an animal is not a mammal, then it is not a dog.

Which of the following statements is **not** equivalent?

- A Being a dog is sufficient for being a mammal.
- B Being a mammal is necessary for being a dog.
- C Not being a mammal is sufficient for not being a dog.
- D If an animal is not a dog, then it is not a mammal.

Question 5

Consider the statement:

Being equilateral is a sufficient condition for a triangle to be isosceles.

Which of the following statements is equivalent?

- A If a triangle is not isosceles, then it is not equilateral.
- B If a triangle is not equilateral, then it is not isosceles.
- C Being isosceles is sufficient for being equilateral.
- D Being equilateral is necessary for being isosceles.

Question 6

Consider the statement:

A day not being Monday is an inevitable consequence of it not being a weekday.

Which of the following statements is **not** equivalent?

- A A day is Monday only if it is a weekday.
- B Being a weekday is sufficient for being Monday.
- C Not being a weekday is sufficient for not being Monday.
- D Not being Monday is a necessary condition for not being a weekday.

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Question 7

Consider the statement:

Being a rectangle is an inevitable consequence of being a square.

Which of the following statements is equivalent?

- A Being a rectangle is sufficient for being a square.
- B Being a square is necessary for being a rectangle.
- C A shape is not a rectangle only if it is not a square.
- D Not being a square is sufficient for not being a rectangle.

Question 8

A card is drawn from a standard deck. Consider the statement:

The card not being a heart is a necessary condition for it not being red.

Which of the following statements is **not** equivalent?

- A Being a heart is sufficient for being red.
- B Being red is a necessary condition for being a heart.
- C If the card is not red, then it is not a heart.
- D If the card is not a heart, then it is not red.

Question 9

For an integer n , consider the statement:

If n is a multiple of 10, then n is even.

Which of the following statements is equivalent?

- A Not being even is sufficient for not being a multiple of 10.
- B Not being a multiple of 10 is sufficient for not being even.
- C Being even is sufficient for being a multiple of 10.
- D Being a multiple of 10 is necessary for being even.

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Question 10

Consider the statement:

A person is not under 18 only if they are not 15 years old.

Which of the following statements is **not** equivalent?

- A A person is 15 years old only if they are under 18.
- B Being under 18 is sufficient for being 15 years old.
- C If a person is not under 18, then they are not 15 years old.
- D Not being 15 years old is a necessary condition for not being under 18.

Question 11

For a real number x , consider the statement:

$x = 3$ implies $x^2 = 9$.

Which of the following statements is equivalent?

- A $x^2 = 9$ is sufficient for $x = 3$.
- B $x = 3$ is necessary for $x^2 = 9$.
- C If $x^2 \neq 9$, then $x \neq 3$.
- D If $x \neq 3$, then $x^2 \neq 9$.

Question 12

Consider the statement:

An animal not being a bird implies that it is not a penguin.

Which of the following statements is **not** equivalent?

- A Being a penguin is sufficient for being a bird.
- B Being a bird is a necessary condition for being a penguin.
- C If an animal is not a bird, then it is not a penguin.
- D If an animal is not a penguin, then it is not a bird.

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Question 13

For a real number x , consider the statement:

$x < 1$ is a necessary condition for $x < -4$.

Which of the following statements is equivalent?

- A $x \geq 1$ is sufficient for $x \geq -4$.
- B $x \geq -4$ is sufficient for $x \geq 1$.
- C $x < 1$ is sufficient for $x < -4$.
- D $x < -4$ is necessary for $x < 1$.

Question 14

Consider the statement:

A vehicle not having two wheels is a sufficient condition for it not being a bicycle.

Which of the following statements is **not** equivalent?

- A A vehicle is a bicycle only if it has two wheels.
- B Having two wheels is sufficient for being a bicycle.
- C If a vehicle does not have two wheels, then it is not a bicycle.
- D Not being a bicycle is an inevitable consequence of not having two wheels.

Question 15

For an integer $n > 2$, consider the statement:

n is prime only if n is odd.

Which of the following statements is equivalent?

- A Being odd is sufficient for being prime.
- B Being prime is necessary for being odd.
- C If n is not odd, then n is not prime.
- D If n is not prime, then n is not odd.

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Question 16

In this question, a trapezium is a quadrilateral with at least one pair of parallel sides. Consider the statement:

If a quadrilateral is not a trapezium, then it is not a parallelogram.

Which of the following statements is **not** equivalent?

- A Being a parallelogram is sufficient for being a trapezium.
- B Being a trapezium is a necessary condition for being a parallelogram.
- C Not being a trapezium is sufficient for not being a parallelogram.
- D If a quadrilateral is not a parallelogram, then it is not a trapezium.

Question 17

For an integer n , consider the statement:

Being a multiple of 4 is an inevitable consequence of being a multiple of 8.

Which of the following statements is equivalent?

- A n is not a multiple of 4 only if n is not a multiple of 8.
- B Not being a multiple of 8 is sufficient for not being a multiple of 4.
- C Being a multiple of 4 is sufficient for being a multiple of 8.
- D Being a multiple of 8 is necessary for being a multiple of 4.

Question 18

Consider the statement:

The month not being January is a necessary condition for it not having 31 days.

Which of the following statements is **not** equivalent?

- A A month is January only if it has 31 days.
- B Having 31 days is sufficient for being January.
- C If a month does not have 31 days, then it is not January.
- D Not being January is a necessary condition for not having 31 days.

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Question 19

Consider the statement:

Being a square is a sufficient condition for a quadrilateral to have diagonals of equal length.

Which of the following statements is equivalent?

- A Having diagonals of equal length is sufficient for being a square.
- B Being a square is necessary for having diagonals of equal length.
- C If a quadrilateral does not have diagonals of equal length, then it is not a square.
- D If a quadrilateral is not a square, then it does not have diagonals of equal length.

Question 20

Consider the statement:

Only students who have reached Question 20 are permitted to complain that the worksheet is too long.

Which of the following statements is **not** equivalent?

- A Having reached Question 20 is sufficient for being permitted to complain that the worksheet is too long.
- B Having reached Question 20 is a necessary condition for being permitted to complain that the worksheet is too long.
- C Not being permitted to complain that the worksheet is too long is an inevitable consequence of not having reached Question 20.
- D Not having reached Question 20 is sufficient for not being permitted to complain that the worksheet is too long.