Converse and Equivalence Worksheet 1

Question 1

For statements P and Q, consider the statement:

P if and only if Q.

Which of the following statements is equivalent?

A If P, then Q, and if Q, then P.

B If P, then Q, but the converse need not be true.

C If not P, then not Q, but the converse need not be true.

D Either P is true or Q is true.

Question 2

Consider the statement:

A door opens exactly when the silver key is inserted.

Which of the following statements is equivalent?

A If the door opens, then the silver key is inserted, and if the silver key is inserted, then the door opens.

B If the door opens, then the silver key is inserted, but inserting the silver key might not open the door.

C If the silver key is inserted, then the door opens, but the door might also open in another way.

D The door opens only if the silver key is inserted.

Question 3

Consider the statement:

If a shape is a square, then it is a rectangle.

Which of the following statements is equivalent?

A If a shape is a rectangle, then it is a square.

B A shape is a square if and only if it is a rectangle.

C A shape is a square only if it is a rectangle.

D A shape is not a square or it is not a rectangle.

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Question 4

For an integer n, consider the condition:

n is a multiple of 12.

Which of the following conditions is equivalent?

A n is a multiple of 3 and a multiple of 4.

B n is a multiple of 3 or a multiple of 4.

C n is a multiple of 6 and a multiple of 8.

D n is a multiple of 2 and a multiple of 6.

Question 5

For an integer n, consider the condition:

n^2 is a multiple of 4.

Which of the following conditions is equivalent?

A n is a multiple of 4.

B n is even.

C n is a multiple of 8.

D n is odd or a multiple of 4.

Question 6

For real numbers x and y, consider the condition:

$xy > 0$.

Which of the following conditions is equivalent?

A $x < 0$ or $y > 0$

B $x > 0$ and $y > 0$

C $x < 0$ and $y > 0$

D $x \neq 0$ and $y \neq 0$, and $x > 0$ if and only if $y > 0$.

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Question 7

For a real number x, consider the condition:

$|x-2| \leq 3$.

Which of the following conditions is equivalent?

A $-1 \leq x \leq 5$

B $-1 < x < 5$

C $x \leq -1$ or $x \geq 5$

D $-5 \leq x \leq 1$

Question 8

For a real number x, consider the inequality:

$x^2 + 2x + 9 > 0$.

Which of the following conditions is equivalent?

A x is any real number.

B $x \neq -1$

C $x > -1$

D $x < -1$ or $x > 1$

Question 9

For a real number x, consider the inequality:

$\dfrac{x-4}{x+1} > 0$.

Which of the following conditions is equivalent?

A $x < -1$ or $x > 4$

B $-1 < x < 4$

C $x \leq -1$ or $x \geq 4$

D $x < -1$ or $x \geq 4$

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Question 10

For a real number x, consider the equation:

$x^2 = 5x$.

Which of the following conditions is equivalent?

A $x = 0$ or $x = 5$

B $x = 5$

C $x = 0$ and $x = 5$

D $x \neq 0$ and $x = 5$

Question 11

For a real number x, consider the equation:

$\dfrac{x-3}{x+2} = 0$.

Which of the following conditions is equivalent?

A $x = 3$

B $x = -2$

C $x = 3$ or $x = -2$

D $x \neq -2$

Question 12

For a real number x, consider the equation:

$\dfrac{x^2-1}{x-1} = 0$.

Which of the following conditions is equivalent?

A $x = 1$ or $x = -1$

B $x = 1$

C $x = -1$

D $x^2 - 1 = 0$

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Question 13

For a real number x, consider the equation:

$x^2 = |x|$.

Which of the following conditions is equivalent?

A $x = -1$, $x = 0$, or $x = 1$

B $x = 0$ or $x = 1$

C $x = -1$ or $x = 1$

D $-1 \leq x \leq 1$

Question 14

For a real number x, consider the equation:

$\sqrt{x+6} = x$.

Which of the following conditions is equivalent?

A $x = 3$

B $x = -2$ or $x = 3$

C $x^2 - x - 6 = 0$

D $x \geq -6$ and $x^2 - x - 6 = 0$

Question 15

For a real number x, consider the inequality:

$(x-1)x(x+2) > 0$.

Which of the following inequalities has exactly the same solution set?

A $\dfrac{2}{x} < x + 1$

B $\dfrac{2}{x} \leq x + 1$

C $\dfrac{2}{x} > x + 1$

D $\dfrac{2}{x} < x - 1$

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Question 16

The complement S^c is the set of all elements in the universal set that are not in S. Let A and B be subsets of the same universal set.

Consider the set

$$(A^c \cup B)^c.$$

Which of the following is an equivalent description of this set?

A The set of elements that are in A and not in B.

B The set of elements that are not in A and not in B.

C The set of elements that are in A or in B.

D The set of elements that are not in A or are in B.

Question 17

Consider a quadrilateral in the usual Euclidean sense. Suppose that all four of its sides have equal length.

Which of the following statements is equivalent?

A The quadrilateral is a square.

B The quadrilateral is a rectangle.

C The quadrilateral is a rhombus.

D The quadrilateral is a parallelogram.

Question 18

A triangle has side lengths a, b and c, where c is the longest side.

Which of the following conditions is equivalent to the triangle having an obtuse angle?

A $a^2 + b^2 = c^2$

B $a^2 + b^2 > c^2$

C $a^2 + b^2 < c^2$

D $a^2 + b^2 = c^2$ and $a = b$

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Question 19

Parallelograms $ABCD$ and $EFGH$ have corresponding vertices listed in the same order.

Which of the following conditions is equivalent to the statement: the two parallelograms are congruent?

A $AB = EF$, $BC = FG$ and $\angle ABC = \angle EFG$

B $AB = EF$ and $\angle ABC = \angle EFG$

C The parallelograms have the same perimeter and the same area.

D The diagonals AC and EG have equal length.

Question 20

Consider the statement:

It is not true that every student both understands Question 20 and takes it seriously.

Which of the following statements is equivalent?

A There exists a student who either does not understand Question 20 or does not take it seriously.

B Every student either does not understand Question 20 or does not take it seriously.

C There exists a student who neither understands Question 20 nor takes it seriously.

D There exists a student who does not understand Question 20, and there exists a student who does not take it seriously.