**NOTES 2.2: Biconditionals & Reasoning**

**Objective:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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Biconditional Statement:

**Write the conditional statement and converse within the biconditional.**

Example 1: An angle is obtuse if and only if its measure is greater than $90°$

 and less than $180°$.

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| --- | --- |
| Conditional |  |
| Converse |  |

Example 2: A solution is neutral iff its pH is $7$.

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| Conditional |  |
| Converse |  |

**For each conditional, write the converse and a biconditional statement.**

Example 3: If $5x-8=37$, then $x=9$.

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| Converse |  |
| Biconditional |  |

Example 4: If two angles have the same measure, then they are congruent.

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| Converse |  |
| Biconditional |  |

For a biconditional statement to be true, both the conditional statement and its converse must be true. If either the conditional or the converse is false, then the biconditional statement is false.

**Determine if the biconditional is true. If false, give a counterexample.**

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| Example 5: A rectangle has side lengths of $12 cm$ and $25 cm$ if and only if its area is $300 cm^{2}$. | True / False |
| Counterexample: |
| Example 6: An angle is a right angle iff its measure is $90°$. | True / False |
| Counterexample: |

**Write each definition as a biconditional.**

Example 7: A pentagon is a five-sided polygon.

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Example 8: A right angle measures $90°$.

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**Inductive Reasoning:**

**Conjecture:**

**Find the next item in each pattern.**

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| Example 9:January, March, May, ...  |
| Example 10: $7$, $14$, $21$, $28$, … |
| Example 11:… |

**Notes 2.2 (Continued)**

**Complete each conjecture.**

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| Example 12:The sum of two positive numbers is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . |
| Example 13:The number of lines formed by $4$ points, no three of which are collinear, is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . |

\*To show that a conjecture is always true, you must prove it.

\*To show that a conjecture is false, you have to find only one example in

 which the conjecture is not true.

**Counterexample:**

 A counterexample can be a drawing, a statement, or a number.

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| **Inductive Reasoning** |
| 1. Look for a pattern. |
| 2. Make a conjecture. |
| 3. Prove the conjecture or find a counterexample. |

**Show that each conjecture is false by finding a counterexample.**

Example 14:For every integer $n$, $n^{3}$ is positive.

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| Counterexample: |

Example 15:Two complementary angles are not congruent.

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| Counterexample: |

Example 16:The monthly high temperature in Abilene is never below $90°F$

 for two months in a row.

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| Monthly High Temperatures ($°F$) in Abilene, Texas |
| Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
| $$88$$ | $$89$$ | $$97$$ | $$99$$ | $$107$$ | $$109$$ | $$110$$ | $$107$$ | $$106$$ | $$103$$ | $$92$$ | $$89$$ |

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| Counterexample: |

**Determine if each conjecture is true. If false, give a counterexample.**

|  |  |
| --- | --- |
| Example 17: The quotient of two negative numbers is a positive  number. | True / False |
| Counterexample: |
| Example 18: Two supplementary angles are not congruent. | True / False |
| Counterexample: |

**Deductive Reasoning:**

**State whether each conclusion uses inductive or deductive reasoning.**

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| Example 19: There is a myth that you can balance an egg on its end only on the spring equinox. A person was able to  balance an egg on July 8, September 21, and December 19. Therefore, this  myth is false.  |   |
| Example 20: There is a myth that the Great Wall of China is the only man-made object  visible from the Moon. The Great  Wall is barely visible in photographs  taken from 180 miles above Earth. The Moon is about 237,000 miles  from Earth. Therefore, the myth  cannot be true.  |  |
| Example 21: Opposite rays are two rays that have a common endpoint and form a line. $\vec{YX}$ and $\vec{YZ}$ are opposite rays.$$Y$$$$Z$$$$X$$ |  |