I.   Conditional Statements

1. For the statement, "If the Wheeler basketball team scores 10 points more than their opponent, then they will win the game."

    A. Identify the hypothesis and conclusion

        Hypothesis: The Wheeler basketball team scores 10 points more than their opponent.
        Conclusion: They will win the game.

    B. Create the converse, inverse, and contrapositive of the conditional statement

        Converse: If the Wheeler basketball team wins the game, then they will score 10 more points than their opponent

        Inverse: If the Wheeler basketball team does not score 10 points more than their opponent, then they will not win the game.

        Contrapositive: If the Wheeler basketball team does not win the game, then they will not score 10 more points than their opponent.

    C. Determine the truth value of each statement

        Converse – False

        Inverse – False

        Contrapositive - True

    D. For any false statements, provide a counterexample

        Counterexample of converse: The Wheeler basketball team could win the game, but only win by 5 points.

        Counterexample of Inverse: The Wheeler basketball team could only score 2 more points than their opponent, but still win the game.

2. Create a conditional statement for each statement below.

    A. A swimmer who comes in first place will win gold.
        If a swimmer comes in first place, then they will win gold.

    B. Today is Monday if yesterday was Sunday.

        If yesterday was Sunday, then today is Monday.

    C. A car traveling 50 mph will go 150 miles in 3 hours.
        If a car travels 50 mph, then it will go 150 miles in 3 hours.

    D. A student in Geometry this semester took Algebra I last year.

        If a student is in Geometry this semester, then they took Algebra 1 last year.

3. Create a biconditional statement for each of the statements below.
   A. Two congruent segments have the same measure.
   Two segments are congruent if and only if they have the same measure.

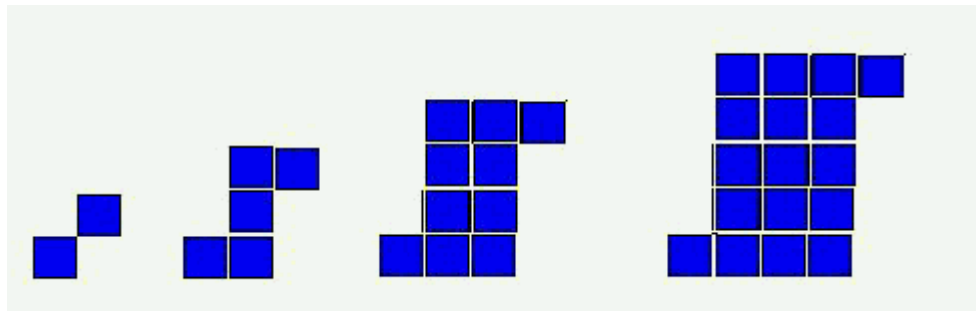   B. Four points are coplanar if they lie on the same plane.
   Four points are coplanar if and only if they lie on the same plane.

   C. A pentagon has five sides.
   A polygon is a pentagon if and only if it has five sides.
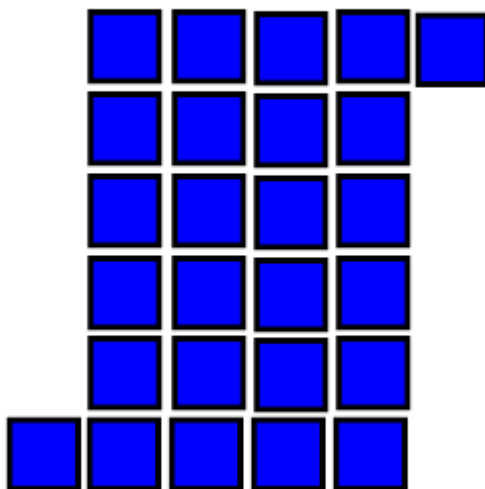
II. Patterns

For the patterns below, make a conjecture as to the pattern. Then, use the conjecture to find the next 2 terms.

1.
Bottom row adds one, height of columns adds one

2. 10, -15, 22.5, -33.75, …
Multiplies by -1.5
Next two: 50.625, -75.9375

3. $\frac{2}{3}, \frac{5}{6}, 1, \frac{7}{6}, \frac{4}{3}, ...$

Adds $\frac{1}{6}$

next two: $\frac{3}{2}, \frac{5}{3}$

III. Law of Detachment

For the proofs below, decide if there is sufficient information to prove the conjecture by the law of detachment. Explain why or why not.

A. *Given*: If Claudia mows the lawn, then she can go to the football game.

Claudia went to the football game.

Conjecture: Claudia mowed the lawn.

Invalid – the Law of Detachment depends upon the initial conditional statement being true. However, this given statement is not necessarily true because Claudia may not be able to go to the game for some other reason. Therefore, the conjecture is not a valid one.

B. *Given*: If Michael Phelps wins this relay race, then he will have 23 gold medals.

Michael Phelps won the relay race.

Conjecture: Michael Phelps has 23 gold medals.

Valid – the given conditional is true, and the initial hypothesis occurred. Therefore, by the Law of Detachment, the conclusion must also occur, and as a result the conjecture is valid.

IV. Law of Syllogism

For the proofs below, decide if there is sufficient information to prove the conjecture by the law of syllogism. Explain why or why not.

A. *Given*: If Hope Solo blocks the 4th penalty kick, then the US soccer team will go ahead in penalty kicks. If the US goes ahead in penalty kicks, then the US will win the game.

Conjecture: If Hope Solo blocks the 4th penalty kick, then the US will win the game.

Valid – If each of the given conditional statements are true, then they will logically lead to the conjecture.

B. *Given*: If a number is divisible by 6, then the number is even. If a number is divisible by 6, then it is divisible by 3.

Conjecture: If a number is even, then it is divisible by 3.

Invalid – the conjecture depends on both of the hypotheses of the given conditional statements, which is not what the Law of Syllogism requires.

V. **Algebraic Properties**
Identify the algebraic property demonstrated by each statement below.
A. If 3x > 8 then 8 < 3x
Symmetric Property

B. If 4 = 3a and 3a = 2b + 5, then 4 = 2b + 5
Transitive Property

C. If 4x + 7 = 12, then 4x + 7 − 7 = 12 − 7
Subtraction Property of Equality

D. If $6^{x-4} = 6^{8+2x}$, then x − 4 = 8 + 2x
Exponential Property of Equality

E. If (5 + 2x) + 3x = 6, then 5 + (2x + 3x) = 6
Associative Property of Addition

VI. **Algebraic Proofs**
Identify the algebraic property or property of real numbers used for each step of solving the equation below

14 = 6(x − 3) − 2x	Given
A. 14 = 6x − 18 − 2x	A. Distributive Property
B. 14 = 6x − 2x − 18	B. Commutative Property of Addition
C. 14 = 4x − 18	C. Combine Like Terms
D. + 18 +18	D. Addition Property of Equality
E. 32 = 4x + 0	E. Inverse Property of Addition
F. 32 = 4x	F. Identity Property of Addition
G. ÷4 ÷4	G. Division Property of Equality
H. 8 = 1x	H. Inverse Property of Multiplication
I. 8 = x	I. Identity Property of Multiplication
J. x = 8	J. Symmetric Property

VII. **Inductive vs. Deductive Reasoning**
Be able to distinguish between inductive and deductive reasoning.
Inductive – pattern
Deductive - fact