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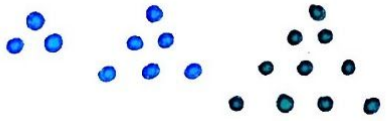
Analytic Geometry: Notes

Inductive Reasoning:

Inductive Reasoning: Making an educated guess when observing patterns

Examples: Find the next figure/number in the pattern.



32, 16, 8, 4, 2

Conjecture: an educated guess

counterexample: one specific case to prove a conjecture false

Example:  This angle is acute

conjecture: all angles are acute

counterexample: some angles are obtuse

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Conditional Statements:

conditional statement: a logical statement that has a hypothesis and a conclusion
↳ written in "if-then" form

If a dog is a Great Dane,
then it is large. (True)

converse: when the original hypothesis and conclusion are switched

If a dog is large,
then it is a Great Dane. (False)

inverse: the negative form of the original conditional statement

If the dog is not a Great Dane,
then it is not large. (False)

contrapositive: when the original hypothesis and conclusion are switched and made negative

If the dog is not large,
then it is not a Great Dane. (False)

Biconditional statement: statement that combines a conditional and its converse only if they both are true
↳ written "if and only if"

Angles are 90° if and only if they are right angles.

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Symbolic Notation:

p : if

q : then

→ : results in

↔ : biconditional

~ : not

∴ : therefore

∧ or ∩ : and

∨ or ∪ : or

Conditional statement: $p \rightarrow q$

Converse: $q \rightarrow p$

Inverse: $\sim p \rightarrow \sim q$

Contrapositive: $\sim q \rightarrow \sim p$

Biconditional: $p \leftrightarrow q$

* You will receive a problem that gives letters to represent the if and then.
  - ↳ You will read statements and use this notation to answer them
  - ↳ Statements given CAN be more than one type of notation
  - ↳ You can get letters and be told to write out statements for them

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Equality Properties:

Reflexive Property of Equality:

Real Numbers: $a = a$, $4 = 4$

Segment Measure: $AB = AB$, $5' = 5'$

Angle Measure: $m\angle A = m\angle A$, $60^\circ = 60^\circ$

Symmetric Property of Equality:

Real Numbers: If $a = b$, then $b = a$; If $x = 5$, then $5 = x$

Segment Measure: If $AB = CD$, then $CD = AB$

Angle Measure: If $m\angle A = m\angle B$, then $m\angle B = m\angle A$

Transitive Property of Equality:

→ used commonly in Algebra

Real Numbers: If $a = b$ and $b = c$, then $a = c$

Segment Measure: If $AB = CD$ and $CD = EF$, then $AB = EF$

Angle Measure: If $m\angle A = m\angle B$ and $m\angle B = m\angle C$, then $m\angle A = m\angle C$

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Lines and Angles:

Parallel Lines: 2 lines that do not intersect and are coplanar

Skew Lines: 2 noncoplanar lines that do not intersect

Parallel Planes: 2 planes that don't intersect

Transversal: A line that crosses two or more other coplanar lines

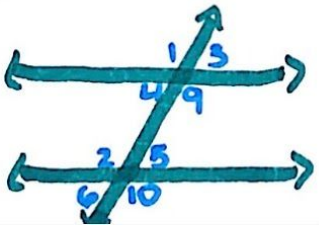
Corresponding Angles:
Angles that have corresponding positions (same angle measure)
∠1 and ∠2

Alternate Interior Angles:
Angles that lie inside the 2 lines and on opposite sides of the transversal (add up to [redacted] each other)
∠9 and ∠2

Alternate Exterior Angles:
Angles that lie outside the 2 lines on opposites sides of the transversal (same angle measure)
∠3 and ∠6

Consecutive Interior Angles:
Angles that lie inside the 2 lines and on the same side of the transversal (add up to 180°)
∠4 and ∠2

Ex:



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Angle Postulates:

Corresponding Angle Postulate: If two parallel lines are cut by a transversal, then the corresponding angles are congruent.

If 

then $\angle 1 \cong \angle 2$

Alternate Interior Angle Theorem: If two parallel lines are cut by a transversal, then the alternate interior angles are congruent

If 

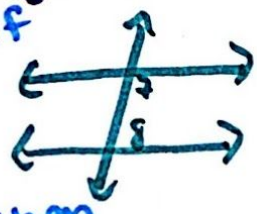
then $\angle 3 \cong \angle 4$

Alternate Exterior Angle Theorem: If two parallel lines are cut by a transversal, then the alternate exterior angles are congruent

If 

then $\angle 5 \cong \angle 6$

Consecutive Interior Angle Theorem: If two parallel lines are cut by a transversal, then the consecutive interior are supplementary

If 

then $\angle 7 + \angle 8 = 180°$

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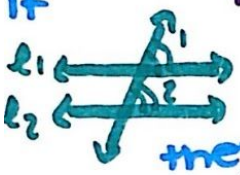
Converse of the Angle Postulates | Theorems:

Converse of the Corresponding Angle Postulate: If two lines are cut by a transversal, so the corresponding angles are congruent, then the lines are parallel

If



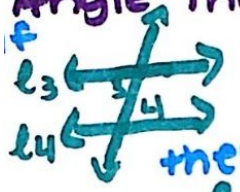
$\angle 1 \cong \angle 2$

then

$l_1 \parallel l_2$

Converse of the Alternate Interior Angle Theorem: If two lines are cut by a transversal, so the alternate interior angles are congruent, then the lines are parallel

If



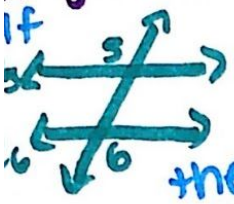
$\angle 3 \cong \angle 4$

then

$l_3 \parallel l_4$

Converse of the Alternate Exterior Angle Theorem: If two lines are cut by a transversal, so the alternate exterior angles are congruent, then the lines are parallel

If



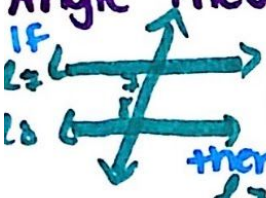
$\angle 5 \cong \angle 6$

then

$l_5 \parallel l_6$

Converse of the Consecutive Interior Angle Theorem: If two lines are cut by a transversal so the consecutive interior angles are supplementary, then the lines are parallel

If



$\angle 7 + \angle 8 = 180°$

then

$l_7 \parallel l_8$

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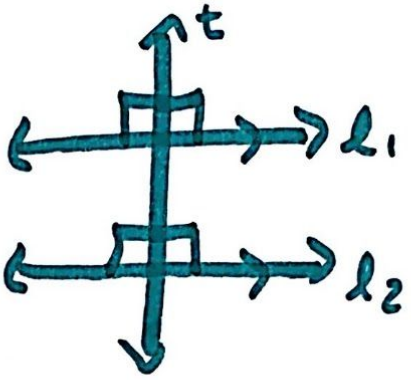
Perpendicular Line Theorems:

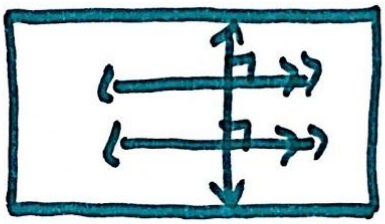
Perpendicular Transversal Theorem:

If a transversal is perpendicular to one of the 2 parallel lines, then it is perpendicular to the other.



Lines Perpendicular to a Transversal Theorem:

In a plane, if two lines are perpendicular to the same line, then they are parallel to each other.



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Slopes of Parallel and Perpendicular Lines:

Slope Equation: $\frac{y_2 - y_1}{x_2 - x_1}$ $\left(\frac{\text{rise}}{\text{run}}\right)$

Negative Slope

Positive Slope

Zero Slope

undefined slope

Slope of Parallel lines: same as regular (original) slope

slope: -3 $\parallel$ slope: -3

Slope of Perpendicular lines: ➡ negative reciprocal of regular (original) slope

slope: -3 $\perp$ slope: $\frac{1}{3}$