

Geometry · Logic and Two-Column Proofs · Worksheet

Common Core G-CO.C.9 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These 23 problems practice logic and proof for G-CO.C.9. Students identify hypotheses and conclusions, write converses, inverses and contrapositives, find counterexamples and tell inductive from deductive reasoning.

Later problems supply reasons or statements for two-column proofs, including vertical angles and midpoints, then ask for a paragraph proof and algebra with justification.

GeometryCommon Core: G-CO.C.9

Problem 1: Hypothesis and conclusion

Identify the hypothesis and the conclusion: "If it rains on Saturday, then the Little League game is canceled."

Problem 2: Writing if-then form

Rewrite as an if-then statement and underline the hypothesis in your answer: "A number is divisible by 6 if it is divisible by both 2 and 3."

Problem 3: Rewriting a statement

Rewrite in if-then form: "All squares have four congruent sides."

Problem 4: Writing a converse

Write the converse of "If a figure is a square, then it is a rectangle." Decide whether the converse is true or false. If false, give a counterexample.

Problem 5: Inverse and contrapositive

Write the inverse and the contrapositive of "If an angle measures 90° , then it is a right angle."

Problem 6: Truth values of related statements

Consider “If a number is a multiple of 4, then it is even.” Write the converse, inverse and contrapositive, and decide whether each of the four statements is true or false. Give a counterexample for each false one.

Problem 7: Counterexample with primes

Find a counterexample to: “If a number is prime, then it is odd.”

Problem 8: Counterexample with squares

Find a counterexample to: “If $x^2 = 49$, then $x = 7$.”

Problem 9: Counterexample with angles

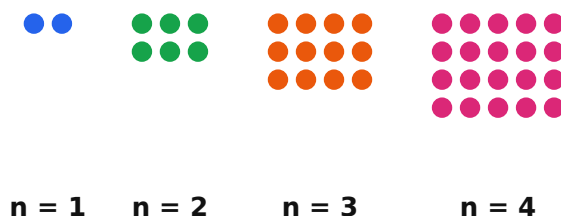
Maya claims: “If two angles are supplementary, then they form a linear pair.” Use the figure to show that her claim is false.



Two angles that are not next to each other.

Problem 10: Inductive pattern of dots

The figure shows the first four dot patterns. Use inductive reasoning to find the number of dots in Pattern 5 and Pattern 6, and write a rule for Pattern n .



Pattern n has n rows of $n + 1$ dots.

Problem 11: Inductive or deductive?

Decide whether each argument uses inductive or deductive reasoning.

- The first five Saturdays of the season were sunny, so Maya concludes the next Saturday will be sunny.
- Every even number is divisible by 2. The number 148 is even, so 148 is divisible by 2.
- Diego measures the angles of three triangles, finds each sum is 180° , and concludes every triangle has an angle sum of 180° .
- Every triangle has an angle sum of 180° . Polygon XYZ is a triangle, so its angle sum is 180° .

Problem 12: Making a conjecture

Look at these sums: $3+5=8$, $7+9=16$, $11+5=16$, $1+13=14$. Write a conjecture about the sum of two odd numbers.

Problem 13: Disproving a conjecture

Ethan conjectures: "The sum of two numbers is always greater than either number." Find a counterexample.

Problem 14: Naming properties of equality

Name the property that justifies each statement.

- If $AB=CD$, then $CD=AB$.
- If $m\angle 1=m\angle 2$ and $m\angle 2=m\angle 3$, then $m\angle 1=m\angle 3$.
- $PQ=PQ$.
- If $3x=15$, then $x=5$.

Problem 15: Supplying reasons

Copy and complete the reasons.

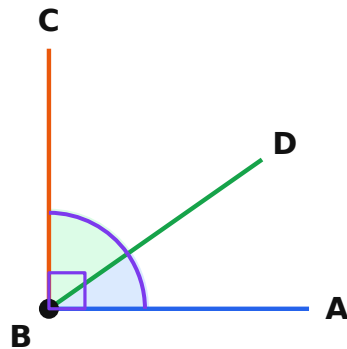
Given: $3x+7=22$. Prove: $x=5$.

Statements	Reasons
1. $3x+7=22$	1. ____
2. $3x=15$	2. ____
3. $x=5$	3. ____

Problem 16: Supplying statements

Angles 1 and 2 together form a right angle, so they are complementary. Copy and complete the statements.

Given: $\angle 1$ and $\angle 2$ are complementary; $m\angle 1 = 35^\circ$. Prove: $m\angle 2 = 55^\circ$.



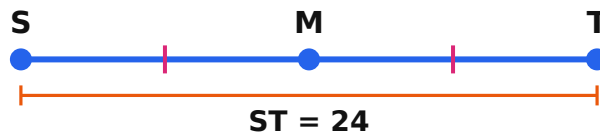
Angles 1 and 2 form a right angle.

Statements	Reasons
1. ____	1. Given
2. ____	2. Definition of complementary angles
3. ____	3. Substitution Property of Equality
4. ____	4. Subtraction Property of Equality

Problem 17: Midpoint proof

Copy and complete the reasons.

Given: M is the midpoint of $\overline{ST}$; $ST = 24$. Prove: $SM = 12$.

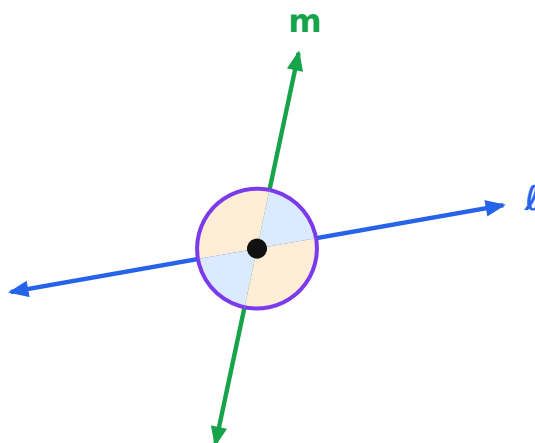


M is the midpoint of ST.

Statements	Reasons
1. M is the midpoint of $\overline{ST}$; $ST = 24$	1. Given
2. $SM = MT$	2. ____
3. $SM + MT = ST$	3. ____
4. $SM + SM = 24$	4. ____
5. $2(SM) = 24$	5. ____
6. $SM = 12$	6. ____

Problem 18: Vertical angles proof

Lines ℓ and m intersect to form angles 1, 2, 3 and 4. Copy and complete the reasons to prove that $\angle 2 \cong \angle 4$.



Angles 2 and 4 are opposite each other.

Statements	Reasons
1. Lines ℓ and m intersect	1. Given
2. $\angle 2$ and $\angle 3$ are a linear pair; $\angle 3$ and $\angle 4$ are a linear pair	2. ____
3. $\angle 2$ and $\angle 3$ are supplementary; $\angle 3$ and $\angle 4$ are supplementary	3. ____
4. $m\angle 2 + m\angle 3 = 180^\circ$; $m\angle 3 + m\angle 4 = 180^\circ$	4. Definition of supplementary angles
5. $m\angle 2 + m\angle 3 = m\angle 3 + m\angle 4$	5. ____
6. $m\angle 2 = m\angle 4$	6. ____
7. $\angle 2 \cong \angle 4$	7. ____

Problem 19: Paragraph proof

Write a paragraph proof. Given: $\angle A$ and $\angle B$ are complementary; $\angle C$ and $\angle B$ are complementary. Prove: $\angle A \cong \angle C$.

Problem 20: Contrapositive in context

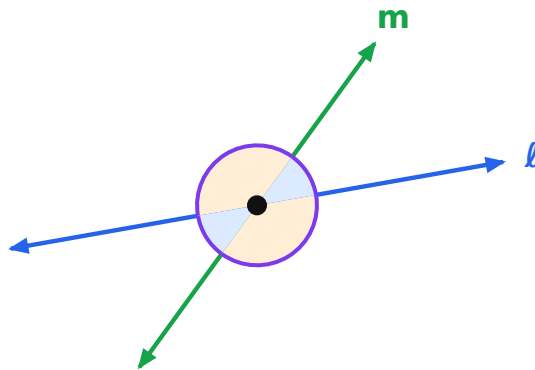
A school rule says: "If a student is on the honor roll, then the student has a GPA of at least 3.5." Priya's GPA is 3.2. What can you conclude about Priya, and which related statement did you use?

Problem 21: Chaining conditionals

Two rules are true: "If it snows more than 6 inches, then school is closed" and "If school is closed, then the bake sale moves to Sunday." Write one conditional that links them. Aisha hears that 8 inches of snow fell. What follows?

Problem 22: Solve and justify

Lines ℓ and m intersect. $m\angle 1 = (3x + 14)^\circ$ and $m\angle 3 = (5x - 6)^\circ$. Find x and $m\angle 2$, and give a reason for each step.



Angles 1 and 3 are vertical.

Problem 23: Writing a biconditional

Consider "If an angle is a right angle, then its measure is 90° ." Write the converse, decide whether it is true, and then write a biconditional statement.