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Abstract

See JC 690 392 above.

# INSTRUCTIONAL OBJECTIVES FOR A JUNIOR COLLEGE COURSE IN GEOMETRY



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GEOMETRY OBJECTIVES: SET # 1

## THE UNITS OF INSTRUCTION

The first unit of instruction deals mainly with the definition of mathematical terms and the description of geometrical forms which will be used by the student and teacher throughout the semester. It also includes methods of reasoning which the student must use in the solution and proofs of problems.

On the level of knowledge, the student must be able to:

1) define sets, subsets, and the operations on sets and write the mathematical symbols which stand for sets, subsets, and the operations in sets
2) define points, lines, solids and planes and state the types and relationships between points, lines, solids and planes
3) define angles, the types of angles, triangles, and types of triangles
4) define the inductive and deductive method of reasoning and exhibit the differences between each.
5) define axioms, postulates, and theorems and state the content of each axiom, postulate, and theorem in this unit
6) define reasoning by generalization, inference and analogy and state effect of the use of emotional words in reasoning.

On this level the student will be given a list of fill-in type questions, multiple-choice questions, true-false questions, questions asking for the definition, or any combination of the four types. The type of questions will be as follows:

Fill in the correct answer:

An _____ angle is larger than its supplement.

Angles with the same measure are _____.

Choose the correct answer:

The sum of the measures of the angles about a point is equal to how many straight angles?

1) 1 3) 3

2) 2 4) 4

What is an angle with a measure less than $90^{\circ}$ called?

1) right 3) acute

2) obtuse 4) interior

True or False:

All isosceles triangles are equilateral.

Valid conclusions can result from false basic assumptions.

Define in the language of mathematics (or in mathematical symbols):

Perpendicular lines

The union of two sets

On the level of comprehension, the student must be able to

1) translate the meaning of set symbols to a Venn diagram and a Venn diagram to set symbols.

2) draw geometric forms from their definitions and state the geometric definition of a given geometric form.

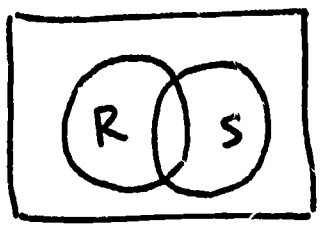
3) state the type of reasoning process involved in the proof of a given statement.

The student will be given a list of set symbols and Venn diagrams and will be asked to draw and write their equivalents in Venn diagrams and set symbols. For example,

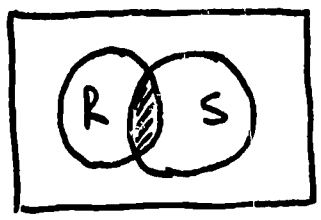
Copy the Venn diagram and use shading to illustrate the following sets:

1. $R \cap S$

2. $R'$




Write the set for which the following Venn diagram is shaded.




The student will also be given a list of words for which the definition is assumed to be known by the student. He will then be asked to draw the corresponding geometric forms. Or, the reverse will be asked of him.

Draw the following geometric forms:

1) acute angle

2) two lines perpendicular to each other

What are the following geometric forms called?

1) 

$\angle a \cong \angle b$

2) 

In addition, the student will be given a statement and a proof of the statement and will be asked to state what type of reasoning is involved. For example,

What type of reasoning is involved in order to arrive at the given conclusion?

Barking dogs do not bite, my dog barks. Therefore, he does not bite.

On the level of application, the student must be able to apply the methods of inductive and deductive reasoning in order to state conclusions from given

statements. Examples are:

1) Barking dogs do not bite. My dog barks. What is the conclusion?

2) All lions are green. No animals have blue eyes. Conclusion.

a) No lions have blue eyes.

b) Some green animals are lions.

c) Some animals with blue eyes are not lions.

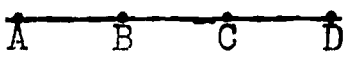
d) Some lions have blue eyes.

For analysis, the student must be able to write out the definitions, axioms, and postulates which justify a conclusion drawn from given statements. For example,

What are the definitions, axioms, and postulates used to justify the given conclusion?

If $5X = 10$, then $X = 2$

If $AB = CD$, then $AC = BD$

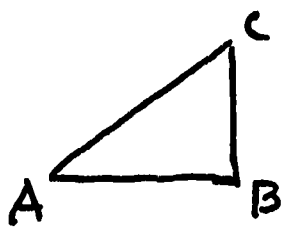



He must also be able to write the reasons for the various steps in a proof.

Given: $\triangle ABC$ with $\overleftrightarrow{AB} \perp \overleftrightarrow{BC}$

$m\angle A + m\angle B + m\angle C = 180°$

Prove: $\angle A$ is the complement of $\angle C$.



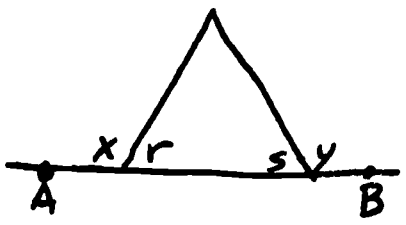

| Proof: Statements | Reasons. |
|---|---|
| 1) $m\angle A + m\angle B + m\angle C = 180°$ | 1) Why? |
| 2) etc. | 2) etc. |

On the level of synthesis, the student must be able to complete proofs from given statements using definitions, axioms, postulates, theorems, and corollaries previously proved. For example,

1) Given: $\overleftrightarrow{AB}$ is a straight line

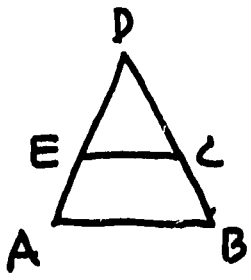
$\angle r \cong \angle s$

Prove: $\angle x \cong \angle y$




2) Given: AD = BD, AE = BC

Prove: ED = CD



The second unit of instruction is Elementary logic. It deals with the methods one may use in proofs.

On the knowledge level, the student must be able to define:

statement, truth value, conjunction, disjunction, negation, hypothesis, conclusion, implication, Fundamental Rule of Inference, modus ponens and tollens, Law of the Excluded Middle, the Rule for Denying the Alternation, converse, and contrapositive.

The types of questions that will be asked are,

A _____ is a sentence which is either true or false, but not both.

The converse of $p \rightarrow q$ is _____.

True or False:

"It is cold and I am freezing" is a statement.

Supplementary angles are equal.

On the level of comprehension, the student must be able to

1) state the simple components of each sentence in a list of sentences.

2) form the negation of a given statement.

Examples are,

It is hot and I am tired.

Gold is not heavy.

On the level of application, the student must be able to form a) the converse, b) the contrapositive, and c) the converse of the contrapositive of a conditional statement. For example, do the above for the statement: Parallel lines will not meet.

On the level of analysis, the student must be able to

1) give the negation of a statement and determine whether it is true or false (e.g., some men like to hunt, others like to fish).
2) write the premise and the conclusion of a given statement (e.g., The train will be late if it snows).
3) write the converse of the statement (e.g., Carrots are vegetables).
4) determine which pair of statements are equivalent (e.g., p: 5 is greater than 3, q: 3 is less than 5).

On the level of synthesis, the student must be able to form statements into conjunctions and disjunctions. An example of the type of statement is, The diamond is hard. Putty is soft.

The third unit of instruction deals with the definition, axioms, postulates, and theorems that are related to congruence. This unit also includes the study of geometrical figures with the same shape.

On the level of knowledge, the student must be able to

1) define congruence, linear congruence, angle congruence, one-to-one correspondence, and identity congruence

2) define vertex angles, base angles, the altitude of a triangle, angle bisector, exterior angle, and interior angle.

On this level the student will be given a list of fill-in type questions, multiple choice questions, true-false questions, questions asking for the definition, or any combination of the four types. The type of questions will be as follows:

Corresponding sides of congruent triangles are found opposite the _____ angles of the triangles.

An _____ of a triangle is the line segment drawn from a vertex perpendicular to the opposite side.

The angle opposite the base of a triangle is called the

1) vertex angle
2) base angle
3) interior angle
4) exterior angle

When two figures have the same shape and size, they are called

1) congruent
2) equal
3) similar
4) opposite

True or False:

Two triangles are congruent if two angles and the side of one are congruent respectively to two angles and the side of the other.

An equilateral triangle is equiangular.

On the level of comprehension, the student must be able to

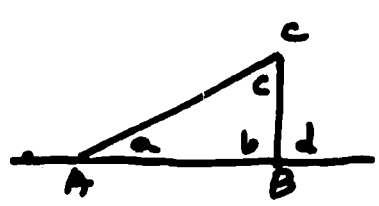
1) draw geometric forms from their definitions

2) state the geometric definition of a geometric form.

For example,

Given an equilateral triangle, draw the triangle which is congruent to it.

Define an exterior angle and label the exterior angle in the diagram below.




On the level of application, the student must be able to apply the axioms and postulates in the proof of theorems. For example, in the following problem, the student must supply the reasons for each step in the proof.

Given: $\triangle$ ABC and $\triangle$ DEF with AC = DF, BC = EF; $\angle$ C and $\angle$ F are right $\angle$s.
Conclusion: $\triangle$ ABC $\cong$ $\triangle$ DEF.
Proof:

| Statements | Reasons |
|---|---|
| 1. AC = DF; BC = EF. | 1. ? |
| 2. $\angle$ C and $\angle$ F are right $\angle$s. | 2. ? |
| 3. $\angle$ C $\cong$ $\angle$ F. | 3. ? |
| 4. $\triangle$ ABC $\cong$ $\triangle$ DEF. | 4. ? |

On the level of analysis, the student must be able to determine the given and the conclusion from a statement. For example, write the given and the conclusion of the following statement:

If the two legs of a right triangle are congruent respectively to the two legs of a second right triangle, the hypotenuses of the two triangles are congruent.

On the level of synthesis, the student must be able to prove statements given the given and conclusion. For example, supply the proof of the statement in the analysis section.

The fourth unit of instruction is Parallel Lines and Parallelograms and deals with the definitions, theorems, and postulates that pertain to parallel lines and parallelograms. Also included is the indirect method of proof.

On the level of knowledge, the student must be able to

1) define parallel lines, skew lines, and transversals

2) define a polygon, the vertices and sides of a polygon, a regular polygon, diagonal of a polygon, a quadrilateral, a parallelogram, a rhombus, a rectangle, a square, and a trapezoid.

On this level the student will be given a list of fill-in type questions, multiple-choice questions, true-false questions, questions asking for the definition, or any combination of the four types. The type of questions will be as follows:

Two lines parallel to the same line are _____ to each other.

The bases of a trapezoid are the _____ sides of the figure.

An equilateral parallelogram is called a

1) rhombus 3) triangle

2) rectangle 4) circle

True or False:

The diagonals of a parallelogram bisect each other.

An isosceles triangle has three acute angles.

On the level of comprehension, the student must be able to

1) draw geometric forms from their definitions

2) state the geometric definition of a given geometric form.

For example,

Draw the following geometric forms: rectangle and rhombus.

For the above geometric forms, state their definition.

On the level of application, the student must be able to apply the method of indirect reasoning in order to state conclusions from given statements. Examples are,

Tom, Jack, Harry, and Jim have just returned from a fishing trip in Jim's car. After Jim has taken his three friends to their homes, he discovers a bone-handled hunting knife which one of his friends has left in the car. He recalls that Tom used a fish-scaling knife to clean his fish and that Harry borrowed his knife to clean his fish. Discuss how Jim could reason whose knife was left in his car.

Two boys were arguing whether or not a small animal in their possession was a rat or a guinea pig. What was proved if the boys agreed that guinea pigs have no tails and the animal in question had a tail?

For analysis, the student must be able to write the definitions, axioms, and postulates which justify a conclusion drawn from a given statement. An example is,

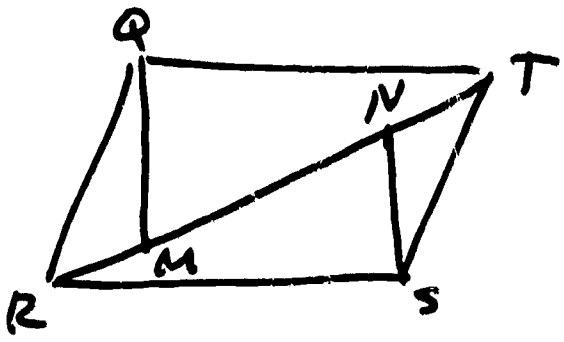
Given: $\triangle ABC$ with $\angle A \cong \angle B$.
Conclusion: $\overline{AC} \cong \overline{BC}$.

Proof:

| Statements | Reasons |
|---|---|
| 1. $\triangle ABC$ with $\angle A \cong \angle B$. | 1. ? |
| 2. Draw $\overline{CD}$ bisecting $\angle C$. | 2. ? |
| 3. $\angle m \cong \angle n$. | 3. ? |
| 4. $\angle x \cong \angle y$. | 4. ? |
| 5. $\overline{CD} \cong \overline{CD}$. | 5. ? |
| 6. $\triangle ADC \cong \triangle BDC$. | 6. ? |
| 7. $\overline{AC} \cong \overline{BC}$. | 7. ? |

On the level of synthesis, the student must be able to complete proofs from given statements using definitions, axioms, postulates, theorems, and corollaries previously proved. For example,

Given: QRST is a ▱ ;
RM ≅ NT.
Prove: QM = SN.



The fifth unit of instruction is Circles and is concerned with the definitions, theorems and postulates associated with circles.

On the level of knowledge, the student must be able to:

1) define circle, center of a circle, radius, chord, and diameter

2) define tangent and secant.

On this level the student will be given a list of fill-in type questions, multiple-choice questions, true-false questions, questions asking for the definition, or any combination of the four types. For example,

A central angle of a circle is formed by two _____.

An inscribed angle of a circle is formed by two _____.

The segment whose end points are points of the circle is called a

1) chord 3) tangent

2) radius 4) secant

True or False: If a parallelogram is inscribed in a circle, it must be a rectangle.

Doubling the minor arc of a circle will double the chord of the arc.

On the level of comprehension, the student must be able to

1) draw geometric forms from their definitions

2) state the geometric definition of a given geometric figure. For example,

Draw the following geometric figure and state it definition:-

circle

tangent

diameter

On the level of analysis, the student must be able to write the reasons for various steps in a proof. As an example,

Given: $\odot$ O with $\overleftrightarrow{AB} \perp \overline{OC}$ at C.
Conclusion: $\overleftrightarrow{AB}$ is tangent to $\odot$ O at C.
Proof:

| Statements | Reasons |
|---|---|
| 1. $\odot$ O with $\overleftrightarrow{AB} \perp \overline{OC}$ at C. | 1. ? |
| 2. Draw $\overline{OD}$ to any point D on $\overleftrightarrow{AB}$ except C. | 2. ? |
| 3. OD is not $\perp \overleftrightarrow{AB}$. | 3. ? |
| 4. OD $>$ OC. | 4. ? |
| 5. D lies outside $\odot$ O. | 5. ? |
| 6. $\overleftrightarrow{AB}$ is tangent to $\odot$ O. | 6. ? |

On the level of synthesis, the student must be able to complete proofs from given statements using definitions, axioms, postulates, theorems, and corollaries previously proved. For example,

Given: $\odot$ O with diameter AB; radius $\overline{OD} \parallel$ chord AC.
Prove: $\overline{OD}$ bisects $\overset{\frown}{CB}$.

The sixth unit of instruction is Inequalities and deals with the definitions, axioms, postualtes. and theorems associated with inequalities.

On the level of knowledge, the student must be able to define an inequality.

On the level of comprehension, the student must be able to write the symbol for the inequality when one measure is greater than and less than another measure.

On the level of application, the student must be able to apply the inequality to the properties of geometric figures as part of a fill-in type question or true-false type question. For example,

The sum of any two sides of a triangle is _____ than the third side.

Angle T is the largest angle in triangle RST. The largest side is _____.

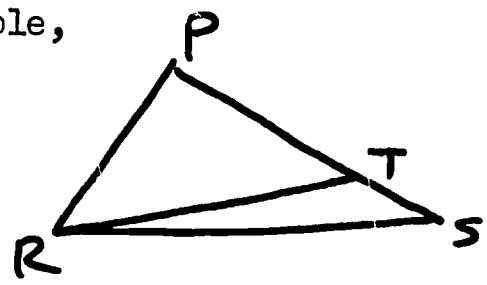
On the level of analysis, the student must be able to write the reasons for the various steps in a proof. As an example,

Given: $\odot O \cong \odot O'$ with chord AB $>$ chord A'B',
Conclusion: $m\widehat{AB} > m\widehat{A'B'}$.
Proof:

| Statements | Reasons |
|---|---|
| 1. $\odot O \cong \odot O'$. | 1. ? |
| 2. Draw radii OA, OB, O'A', O'B'. | 2. ? |
| 3. OA = O'A'; OB = O'B'. | 3. ? |
| 4. Chord AB $>$ chord A'B'. | 4. ? |
| 5. $m\angle O > m\angle O'$. | 5. ? |
| 6. $m\widehat{AB} > m\widehat{A'B'}$. | 6. ? |

On the level of synthesis, the student must be able to complete proofs from given statements using definitions, axioms, postulates, theorems, and corollaries previously proved. For example,

Given: PR = PT.
Prove: $m\angle PRS > m\angle S$.



The seventh unit of instruction is Proportion, Measurement, and Similar Polygons. This unit deals with the definitions and theorems associated with geometric figures that are related to one another by their measure.

On the level of knowledge, the student must be able to define:

1) quotient, terms of a ratio, proportion, extremes, and means

2) similar and ratio of similitude

3) external and internal segments of a secant.

Examples are,

A statement of equality of two ratios is termed a _____.

True or False: A proportion has four unequal terms.

For comprehension, the student must be able to draw geometric figures which are proportional and similar. For example, draw a triangle which is proportional to the one below.

On the level of analysis, the student must be able to write various reasons in the steps of a proof. As an example,

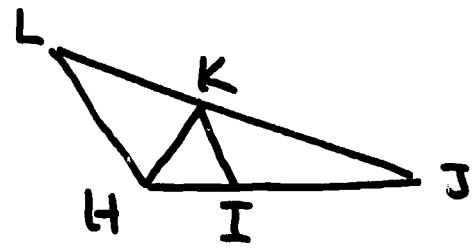
Given: $\overline{AC} \perp \overline{AD}$ and $\overline{DE} \perp \overline{AD}$.
Prove: $AC:DE = AB:BD$.

Proof:

| Statements | Reasons |
|---|---|
| 1. $\overline{AC} \perp \overline{AD}$; $\overline{DE} \perp \overline{AD}$ | 1. ? |
| 2. $\angle CAB$ and $\angle EDB$ are rt. $\angle$s. | 2. ? |
| 3. $\angle ABC \cong \angle DBE$. | 3. ? |
| 4. $\triangle ABC \sim \triangle DBE$. | 4. ? |
| 5. $\therefore AC:DE = AB:BD$ | 5. ? |

On the level of synthesis, the student must be able to complete proofs from given statements using definitions, axioms, postulates, theorems, and corollaries previously proved. For example,

Given: $\overline{HK} = LK$;
$\overrightarrow{IK}$ bisects $\angle HKJ$.
Prove: $LH:HJ = KI:IJ$.



The eighth unit of instruction is Geometric Loci and deals with geometric figures as sets of points satisfying certain boundary conditions.

On the level of knowledge, the student must be able to define

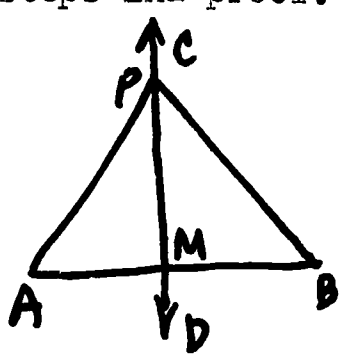
1) space, locus of points, and loci.

2) a parabola, paraboloid of revolution, ellipse, ellipsoid of revolution, hyperbola, and hyperboloid of revolution.

On the level of comprehension, the student must be able to state the steps involved in the determination of a locus.

For application, the student must be able to apply the rules for determining a locus to determine a locus. For example, what is the locus of points equidistant from two parallel lines?

On the level of analysis, the student must be able to write the various reasons for steps ina proof. As an example,




Given: $\overleftrightarrow{CD} \perp \overleftrightarrow{AB}$; AM = MB; P is any point on $\overleftrightarrow{CD}$.
Conclusion: AP = BP.
Proof:

| Statements | Reasons |
|---|---|
| 1. $\overleftrightarrow{CD} \perp \overleftrightarrow{AB}$; AM = MB. | 1. ? |
| 2. $\angle$ AMP and $\angle$ BMP are rt. $\angle$s. | 2. ? |
| 3. Draw $\overleftrightarrow{PA}$ and $\overleftrightarrow{PB}$. | 3. ? |
| 4. PM = PM. | 4. ? |
| 5. $\triangle$ AMP $\cong$ $\triangle$ BMP. | 5. ? |
| 6. $\therefore$ AP = BP. | 6. ? |

The ninth unit of instruction deals with Geometric Constructions. The main object is for the student to be able to define the steps in the solution of a construction problem. He must also be able to draw geometric figures with a straight-edge and compass. Examples of the type of construction are;

Construct the perpendicular bisector of a given line segment.

Construct a line passing through a point parallel to a given line by constructing a pair of congruent alternate interior angles.

The tenth unit of instruction is Areas of Polygons. This unit deals with the definitions, theorems, and formulas associated with the determination of areas of polygons.

On the knowledge level, the student must be able to define

1) regions, component triangular regions, and polygonal regions

2) circumference and pi

Examples of the type of questions:

The ratio of the circumference to the diameter of a circle is _____.

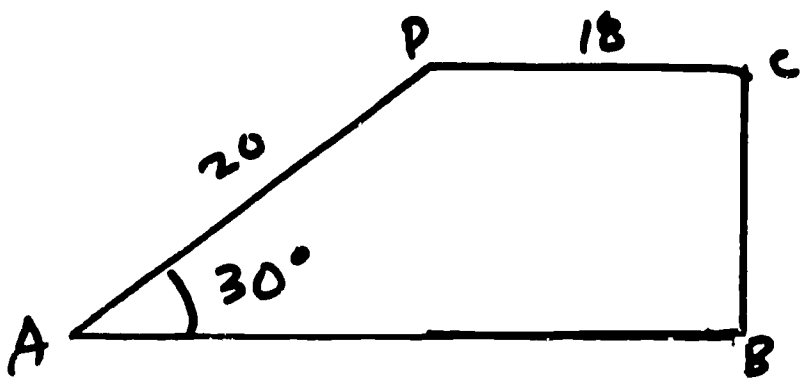
The number $\pi$ represents the ratio of the area of a circle to its _____.

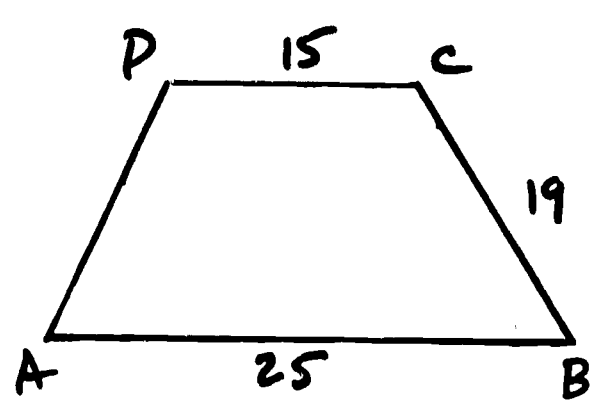
On the level of application, the student must be able to solve problems that deal with the determination of an area by use of mathematical formulas developed in this unit. For example,

Find the circumference of a circle the diameter of which is 5.7 inches.

Find the radius of a circle the circumference of which is 8.25 feet.

On the level of analysis, the student must be able to find the area of geometric figures that are combinations of the basic geometric figures



GEOMETRY OBJECTIVES: SET # 2

# UNIT I

Concepts: Sets-definitions, symbols, properties of numbers
Angles and lines - relationships, definitions

Goal 1. The student will understand the concepts, symbols and applications of geometric and algebraic sets.

Objective 1. Given 10 examples of algebraic and geometric sets, the student will form the union and intersection of designated pairs of sets. 80% Accuarcy. 10 minutes

Test Sample 1. Form the Union and Intersection of the following pairs of sets:

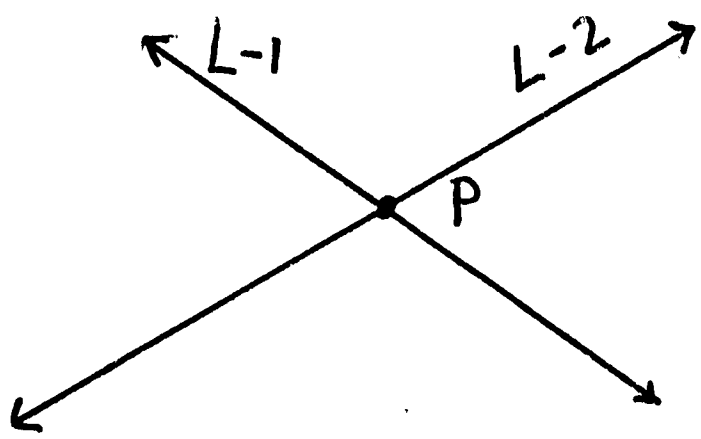
$A = \{1,2,3\}$ $\quad A \cup B =$ _____

$B = \{3,4,5\}$ $\quad A \cap B =$ _____

Test Sample 1a. Let A = line 1 (L-1)

B = line 2 (L-2)

What is $A \cap B$ ?




Goal 2. The student will know the axioms of the real numbers.

Objective 2. Given 10 statements concerning real numbers, the student will write down the axiom which justifies

the statement. 85% accuracy. 5 minutes.

Test Item 2. Which of the axioms of the real numbers may be used to justify the following statements? Write your answer in the blank space provided.

(1) $(a+3)+b = b+(a+3)$ _____

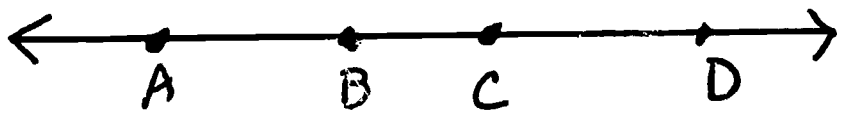
(2) $(a+3)\cdot b = a\cdot b+3\cdot b$ _____

(3) $(a+3)+b = a+(3+b)$ _____

Goal 3. The student will know the axioms of lines, segments and angles.

Objective 3. Given a line with labled points, the student will be able to answer 5 questions concerning midpoints and congruent segments. 90% accuracy. 5 minutes

Test Item 3. Given line $\overleftrightarrow{AD}$, answer the following questions in writing.




(1) Can $\overline{AB} = \overline{BC}$ ? Why? _____

(2) Can B and C both be midpoints of $\overline{AB}$? Why?

(3) Can C be the midpoint of $\overline{AB}$ ? Why?

<u>Assessment</u>: No pre-assessment is possible. I expect that 90% of the students will complete 90% of the objectives in the first unit. Such a high rate is expected since the material is very basic and simple.

<u>References</u> : 1. <u>Set Operations</u>, <u>S-3</u>
2. <u>Set Operations</u>, <u>S-2</u>
3. <u>Points</u>, <u>Lines</u>, <u>Planes</u>

Programmed Materials See Page

## UNIT II

Content: Inductive and deductive reasoning; theorems
The triangle and congruency

Goal 1. The student will understand elementary logic

Objective 1. Given 10 English sentences, the student will put each statement into " if - then " form. 80% accuracy 15 minutes.

Test Item 1. Rewrite the following statements in "if - then" form in the blank space provided.

a) Reading without sufficient light causes eyestrain.

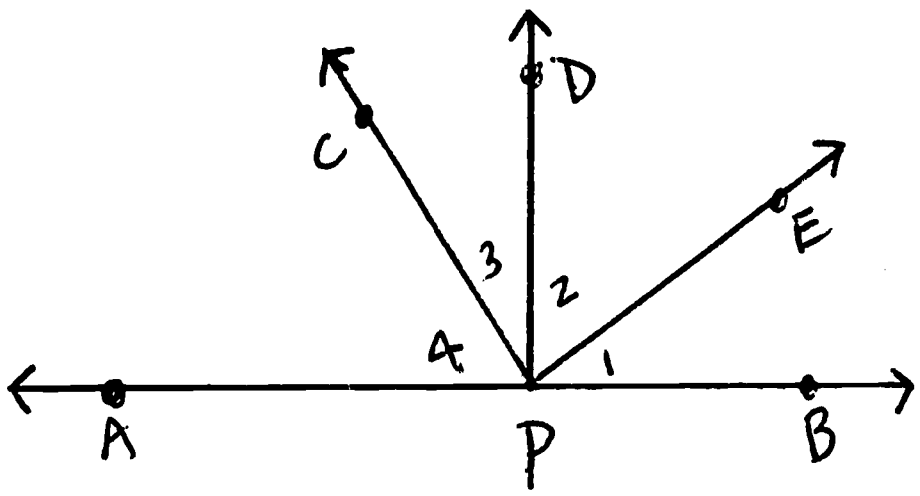
b) I will go to the show only if it rains.

Goal 2. The student will be able to write proofs of simple theorems using Statement - Reason form.

Objective 2. Given 5 simple theorems concerning angle and line relationships, the student will prove the theorems using the Statement - Reason form of proof. The theorems may or may not be original. 75% accuracy. 40 minutes.

Test Item 2. Given $\overleftrightarrow{AB}$, $P \in \overleftrightarrow{AB}$, $\overrightarrow{PD} \perp \overleftrightarrow{AB}$, $\overrightarrow{PC} \perp \overrightarrow{PE}$

Prove that $\angle 1 \cong \angle 3$



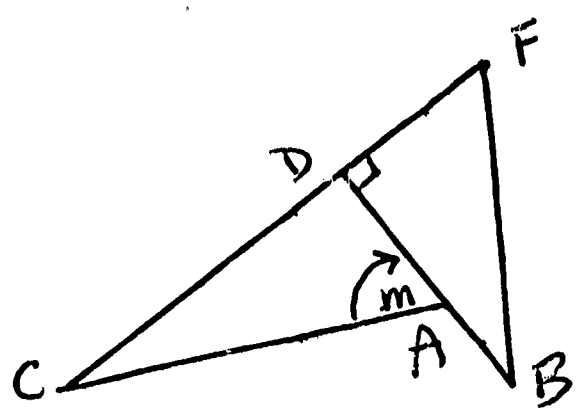
Goal 3. The student will know simple theorems concerning triangles and will be able to apply them by proving pairs of triangles congruent.

Objective 3. Given 5 labled figures, the student will prove designated triangles congruent using the theorems proved in the text book. 80% accuracy. 35 minutes.

<u>Note</u>: In the remainider of the course, every theorem will be proved using the Statement - Reason form of proof.

Test Item 3. Given $\overline{BD} \perp \overline{CF}$ ; $\overline{DF} \cong \overline{DA}$ ; $\angle m \cong \angle F$

Prove that $\triangle ACD \cong \triangle FBD$

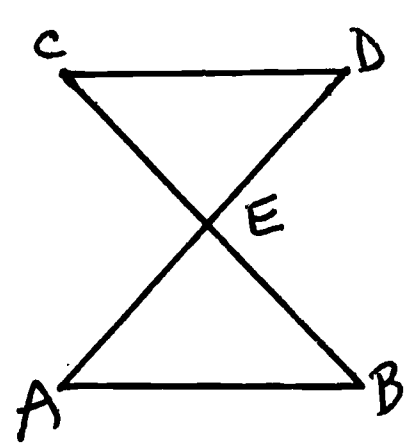



Goal 4. The student will apply the concept of congruency to the concept of corresponding parts of congruent triangles.

Objective 4. Given 5 labled figures, the student will prove designated segments or angles congruent. It is assumed that the student will first prove pairs of triangles congruent and then apply the concept of "corresponding parts". 80 % accuracy. 25 minutes.

Test Item 4. Given E is the midpoint of $\overline{BC}$ and $\overline{AD}$

Prove that $\overline{CD} \cong \overline{AB}$.



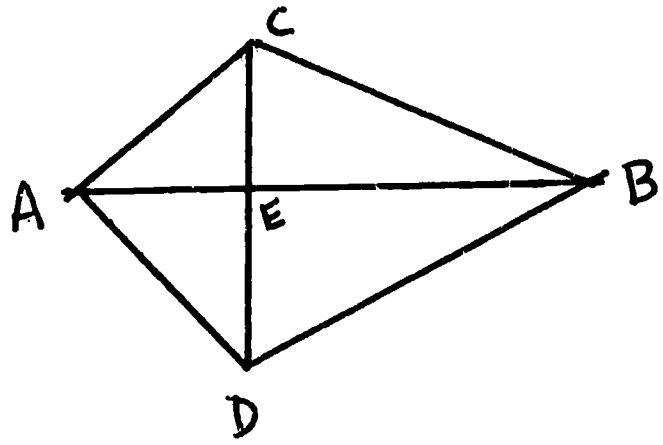
# UNIT III

Contents : Perpendicular lines; auxiliary sets; exterior angle of triangle; converses of theorems.

Goal 1. The student will know theorems pertaining to perpendicular lines, perpendicular bisectors and distance.

Objective 1. Given 5 labled figures, the student will prove statements using the theorems proved in class which pertain to perpendiculsr lines. It is assumed that the student will know how to prove triangles congruent (Unit II). 75% accuracy. 40 minutes.

Test Item 1. Given $\triangle ADC$ equilateral, $\triangle BCD$ isosceles with base $\overline{CD}$, Prove that $\overline{AB} \perp \overline{CD}$, $\overline{AB}$ bisects $\overline{CD}$.

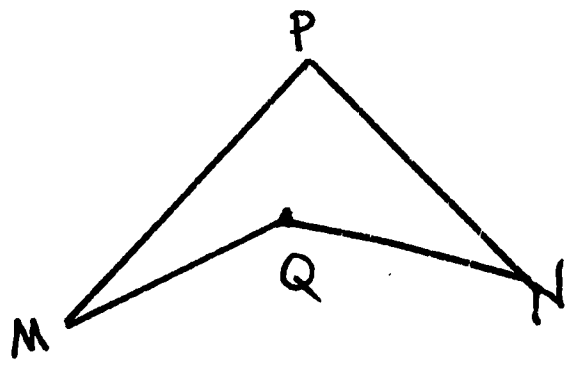



Goal 2. The student will be able to construct auxiliary sets to aid him in solving (proving) a problem (theorem) in geometry.

Objective 2. Given 5 plane, labled figures the student will prove a statement concerning the figure. It is assumed that the student must construct auxiliary sets in order to prove the statement. 75% accuracy. 40 minutes.

Test Item 2. Given $\overline{MP} \cong \overline{NP}$, $\overline{MQ} \cong \overline{NQ}$

Prove that $\angle M \cong \angle N$



Goal 3. The student will know how to form converses of statements (may or may not pertain to geometry).

Objective 3. Given 5 English sentences, the student will put the sentences into " if - then " form and then write the converses of these statements. 80% accuracy. 10 minutes

Test Item 3. Below each statement that follows there are two blank spaces. On the first space you will rewrite the original statement in " if-then " form. On the second space you will write the <u>converse</u> of the original statement in "if-then" form. 80% accuracy.

a) My dog always sleeps when it rains.

_____

_____

b) I will go if I can find my hat.

_____

_____

<u>Assessment</u>; No pre-assessment possible. I expect that 80% of the students will complete 80% of the objectives. This unit is about average in difficulty.

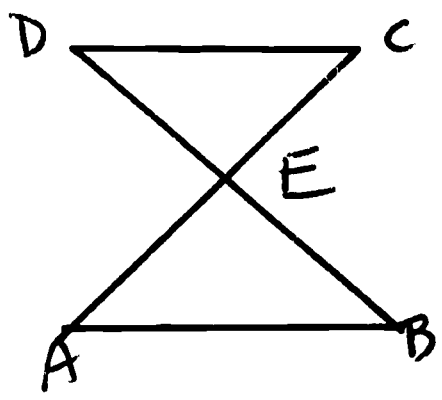
# UNIT IV

Contents : Quadrilaterals, parallel lines, parallograms Pythagorean theorem; Polygons and area of polygons; Further properties of the triangle.

Goal 1. The student will know basic theorems pertaining to parallel lines and will be able to prove that lines are parallel using these theorems.

Objective 1. Given 5 labled figures the student will prove designated pairs of lines parallel using the theorems proved in the text book. 80% accuracy. 30 minutes.

Test Item 1. Given that E is the midpoint of $\overline{AC}$ and $\overline{BD}$, Prove that $\overline{DC} \parallel \overline{AB}$.



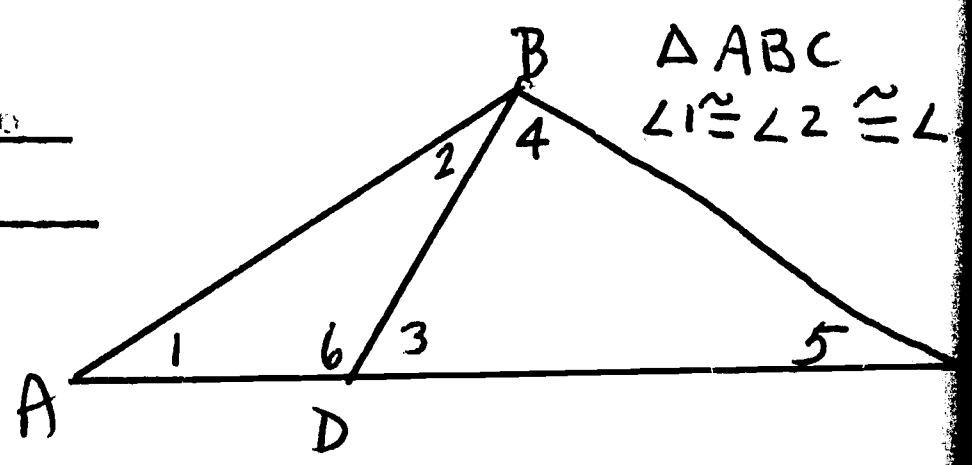

Goal 2. The student will know the property of exterior angles of triangles.

Objective.2. Given a labled figure of a triangle, the student will answer 5 questions concerning the relationships of its interior and exterior angles. 90% accuracy. 5 minutes

Test Item 2. Fill in the blank spaces below.

a) If $\angle 3 = 60^\circ$, then $\angle 1 =$ 60° ____

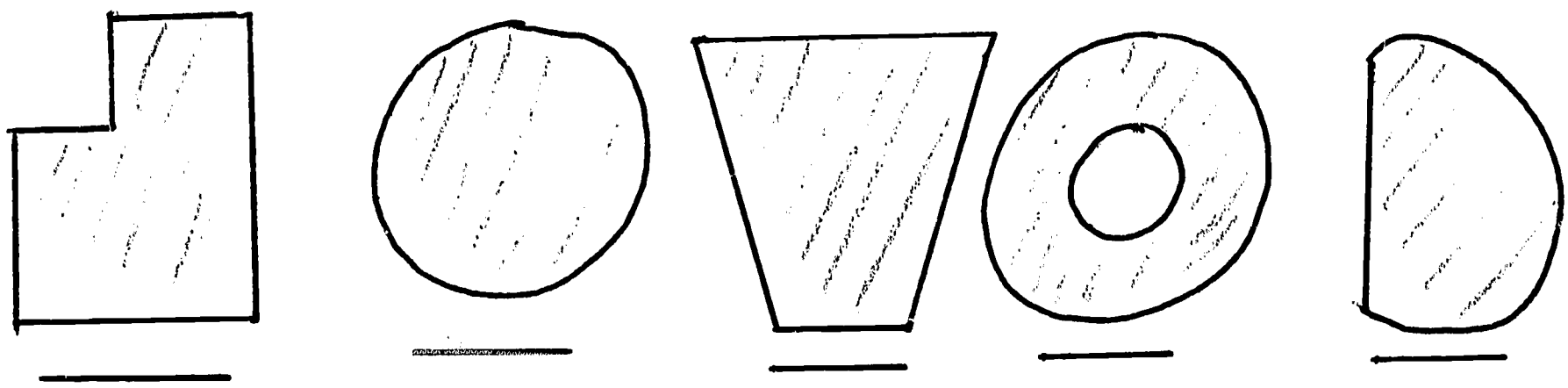
b) If $\angle 6 = 120^\circ$, then $\angle 4 =$ ____



Goal 3. The student will understand the definition of <u>convexity</u>.

Objective 3. Given 5 plane figures, the student will determine whether or not the figures are <u>convex</u>. 80% accuracy. 5 minutes.

Test Item 3. Below there are 5 plane figures. Under each figure write "Yes" if it is convex or "No" if it is not convex.

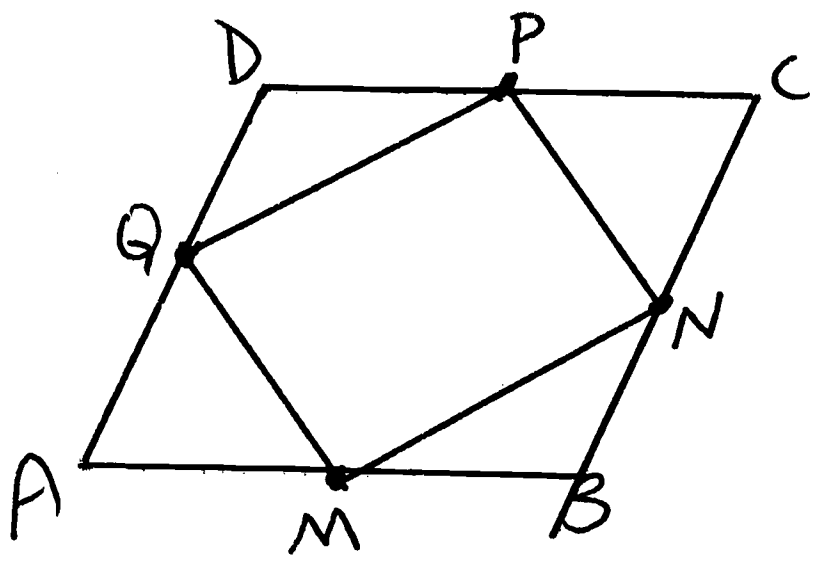


Goal 4. The student will know the definitions of various convex quadrilaterals and the theorems pertaining to each.

Objective 4. Given 5 plane, labled figures, the student will prove statements using the theorems which were proved in the text concerning quadrilaterals. 80% accuracy. 40 minutes.

Test Item 4. Given rhombus A, B, C, D such that M,N,P,Q are midpoints of the sides.

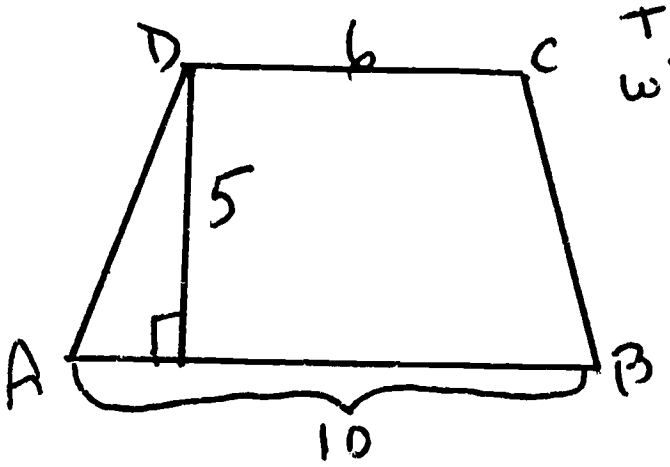
Prove that MNPQ is a parallelogram.



Goal 5. The student will know how to calculate the area of triangles and convex quadrilaterals.

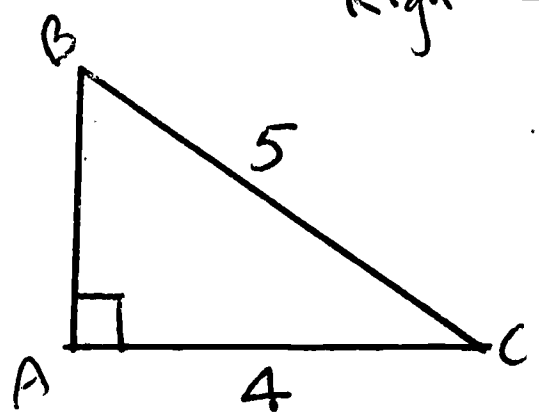
Objective 5. Given 5 triangles or convex quadrilaterals which are numerically labled, the student will calculate the area of each. It is possible that he may have to apply theorems concerning these polygons. 80% accuracy. 20 minutes

Test Item 5. Find the areas of the following figures:




TRAPEZOID ABCD
with AB ∥ DC

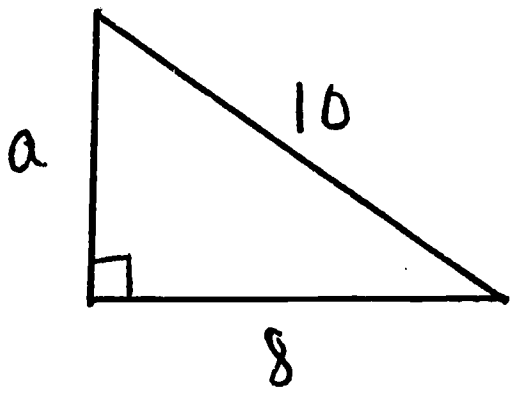
Right △ABC



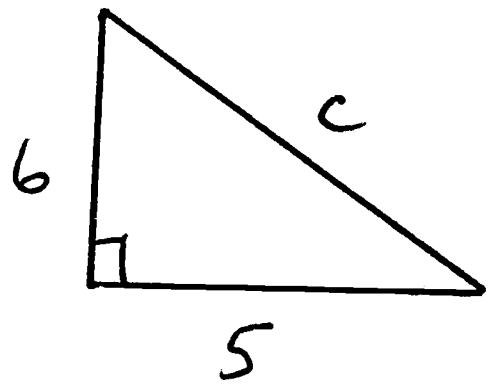

Goal 6. The student will know the Pythagorean theorem and its applications.

Objective 6. Given 5 right triangles with 2 sides numerically labled, the student will find the third side using the Pythagorean theorem. 90% accuracy. 5 minutes.

Test Item 6. Find the third side of each of the following <u>right</u> triangles.




a = _____




c = _____

# UNIT V

Contents: Proportion and Similarity

Goal 1. The student will understand the concept of proportion and any theorems pertaining to this concept.

Objective 1. Given 5 statements of proportion, the student will solve for the unknown variable in each proportion. 80% accuracy. 5 minutes.

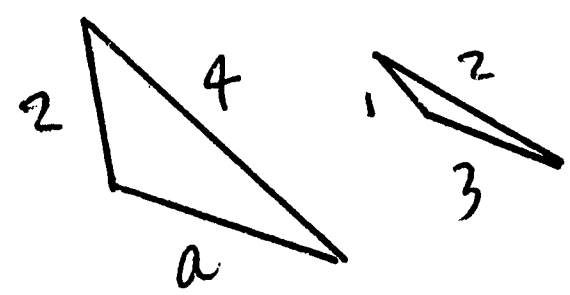
Test Item 1. Sove for the variable indieated.

a) $a/5 = 10/25$ a = _____

b) $a + 5/6 = 6/a-5$ a = _____

Objective 1a. Given 5 pairs of similar polygons, whose sides are numerically labled, the student will find the designated unknown side (s). 80% accuracy. 5 minutes.

Test Item 1a. Find the missing sides in each pair of similar polygons below.




a = _____

Goal 2. The student will know how to prove triangles similar.

Objective 2. Given 5 plane, labled figures, the student will prove designated pairs of triangles similar using the theorems proved in the text. 75% accuracy. 25 minutes.

UNIT VI

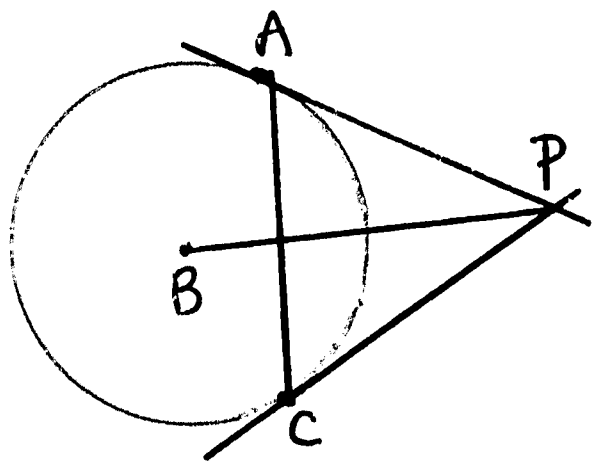
UNIT VI

Contents: Circles, and the parts of circles.
Areas of circular regions.

Goal 1. The student will know the parts of the circle (central angle, chord, secant, tangent, arc) and any theorems pertaining to them.

Objective 1. Given 5 circles, the student will prove a simple theorem pertaining to each circle using the theorems proved in the text. 75% accuracy. 40 minutes.

Test Item 1. Given $\overline{PA}$ and $\overline{PC}$ tangent to circle B at A and C Prove that $\overline{PB}$ is the bisector of $\overline{AC}$.




Goal 2. The student will be able to calculate the area of circular regions and regular polygons inscribed in circles.

Objective 2. Given 5 circular regions, or polygons, the student will calculate the areas indicated. 80% accuracy. 15 minutes.