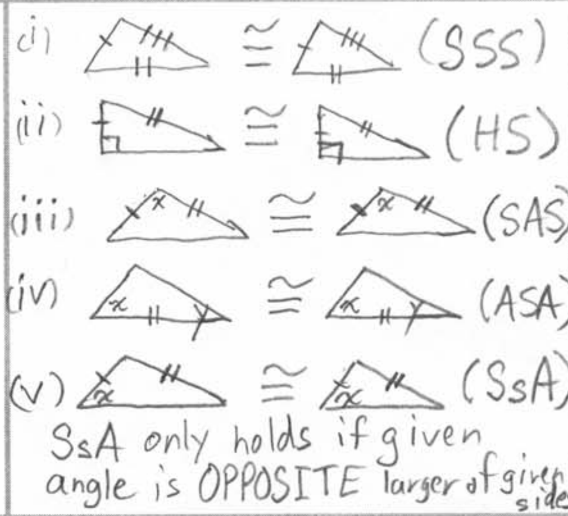
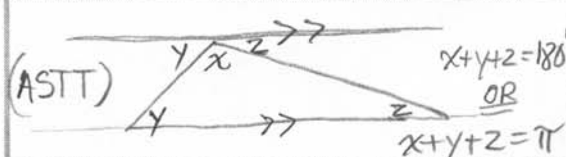
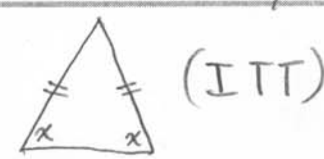
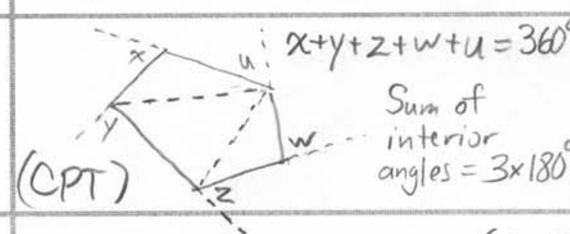
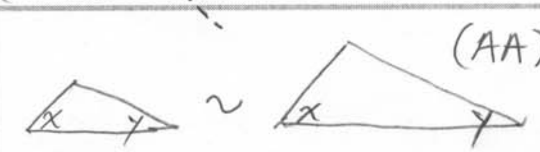
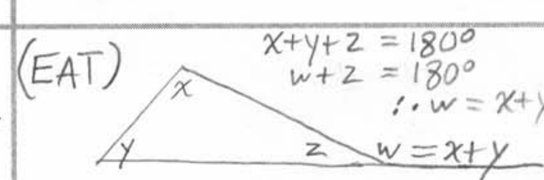
IMPORTANT THEOREMS OF PLANE GEOMETRY

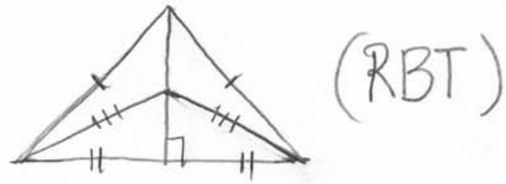
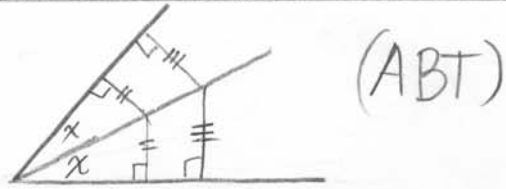
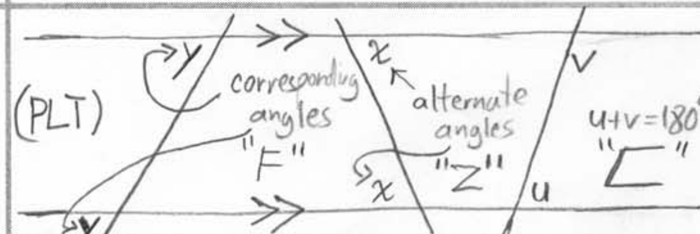
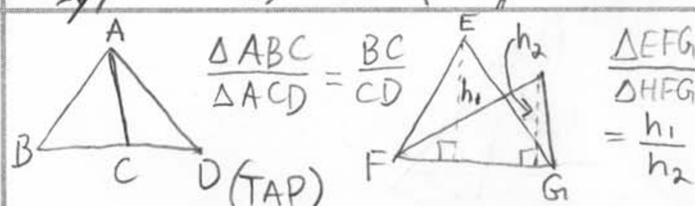
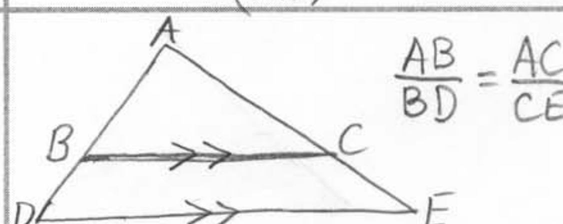
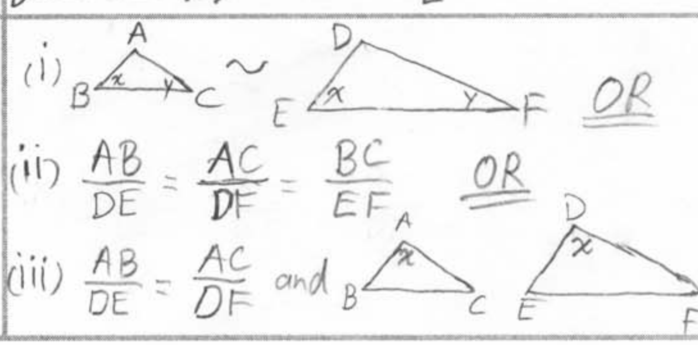
Review of Previously Learned Theorems

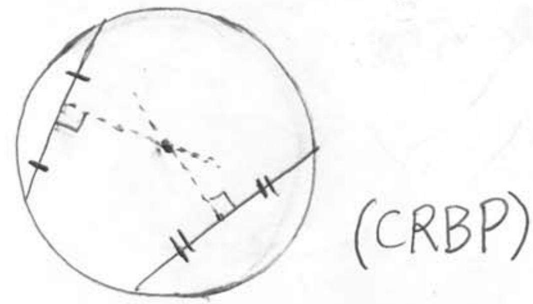
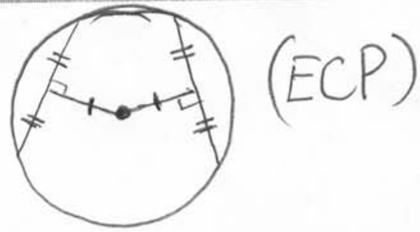
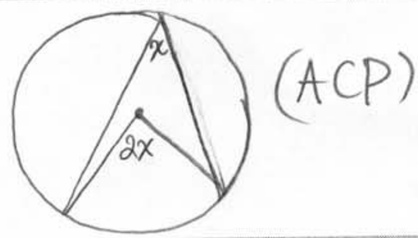
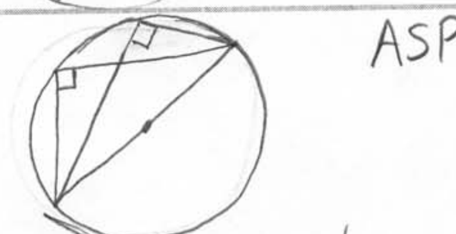
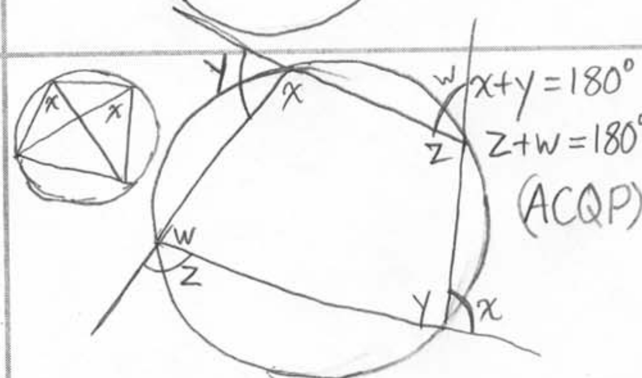
Sketch a diagram to illustrate each theorem or formula.

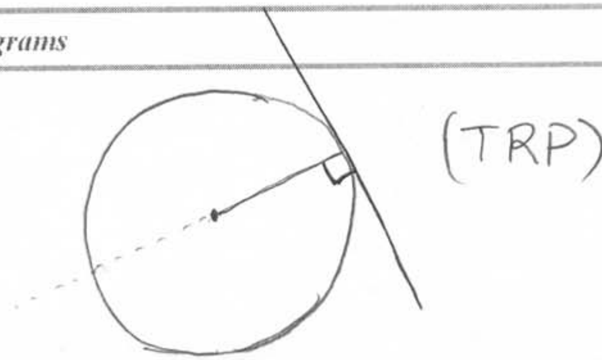
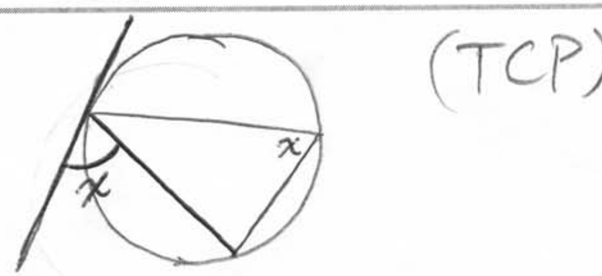
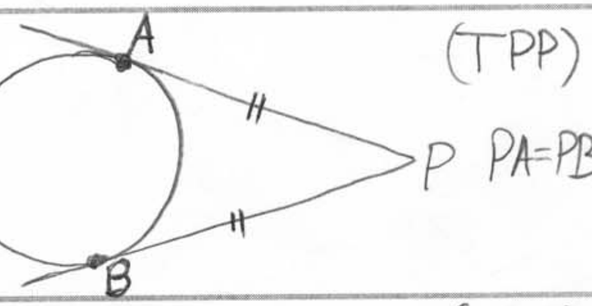
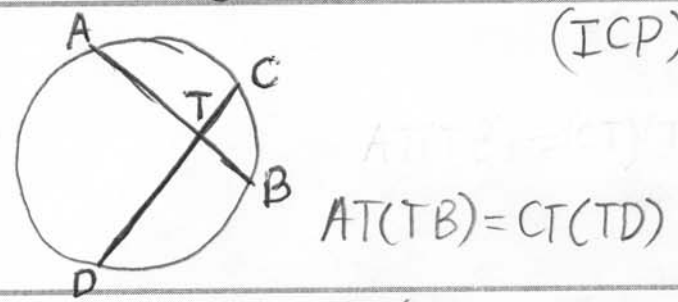
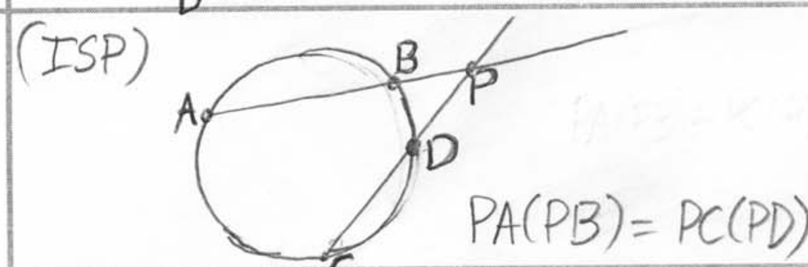
Theorem	*Diagrams*
1. Triangle Congruence Theorem Two triangles are congruent *if and only if* at least *one* of the following conditions is satisfied: i. Corresponding sides are equal (SSS) ii. The hypotenuse and one other side of one right triangle are respectively equal to the hypotenuse and one other side of a second right triangle (HS) (Note that "HS" is a corollary of "SSS.") iii. Two sides and the *contained angle* of one triangle are respectively equal to two sides and the *contained angle* of a second triangle (SAS) iv. Two angles and the *contained side* of one triangle are respectively equal to two angles and the *contained side* of a second triangle (ASA) v. Two sides and a *non-contained* angle of one triangle are respectively equal to two sides and a *non-contained* angle of a second triangle, *and* for each triangle, the given angle is opposite the *larger* of the two given sides (SsA)	
2. Angle Sum Triangle Theorem (ASTT) In any triangle, the sum of the interior angles is 180° (π rad).	
3. Isosceles Triangle Theorem (ITT) A triangle is isosceles *if and only if* the base angles are equal.	
4. Opposite Angle Theorem (OAT) The opposite angles formed by two intersecting lines are equal.	
5. Convex Polygon Theorem (CPT) i. The sum of the interior angles of an n-sided convex polygon is $(n-2)180°$ (i.e. $(n-2)\pi$ rad) ii. The sum of the exterior angles of any convex polygon is 360° (i.e. 2π rad)	
6. Angle-Angle Similarity Theorem (AA) Two triangles are similar *if and only if* two angles of one triangle are respectively equal to two angles of a second triangle.	
7. Exterior Angle Theorem (EAT) (Corollary of ASTT) An exterior angle of a triangle is equal to the sum of the two interior and opposite angles.	

New Geometry Theorems

Sketch a diagram to illustrate each theorem.

Theorem	*Diagrams*
1. Parallelogram Area Property (PAP) Two parallelograms have the same area *if* their bases are of equal length *and* they lie between the same parallel lines. Note: The converse of this statement is *not* true! Why?	
2. Right Bisector Theorem (RBT) A point lies on the right bisector of a line *if and only if* it is equidistant from the endpoints of the line segment.	
3. Angle Bisector Theorem (ABT) A point lies on the bisector of an angle *if and only if* it is equidistant from the arms of the angle.	
4. Parallel Line Theorem (PLT) Two straight lines are parallel *if and only if* i. alternate angles are equal, or ii. corresponding angles are equal, or iii. interior angles are supplementary	
5. Triangle Area Property (TAP) If triangles have equal heights, their areas are proportional to their bases. If triangles have equal bases, their areas are proportional to their heights.	
6. Triangle Proportion Property Theorem (TPPT) A line in a triangle is parallel to a side of the triangle *if and only if* it divides the other sides in the same proportion.	
7. Similar Triangle Theorem (STT) Two triangles are similar *if and only if* i. they are equiangular, or ii. their sides are proportional, or iii. two pairs of sides are proportional and the angles contained by these sides are equal.	

Theorem	*Diagrams*
8. Chord Right Bisector Property (CRBP) i. The right bisector of a chord passes through the centre of the circle. ii. The perpendicular from the centre of a circle to a chord bisects the chord. iii. The line joining the centre of a circle to the midpoint of a chord is perpendicular to the chord. iv. The centre of a circle is the point of intersection of the right bisectors of any two non-parallel chords.	
9. Equal Chords Property (ECP) Chords are equidistant from the centre of a circle *if and only if* the chords are of equal length.	
10. Angle at the Circumference Property (ACP) An angle at the centre of a circle is *twice* the angle at the circumference standing on the *same arc*.	
11. Equal Angles in a Segment Property (EASP) Angles in the same segment of a circle are equal.	
12. Angle in a Semicircle Property (ASP) Any angle in a semicircle is a right angle.	
13. Angles in a Cyclic Quadrilateral Property (ACQP) i. A quadrilateral is cyclic *if and only if* its opposite angles are *supplementary* (incorrect in text, p. 91) ii. A quadrilateral is cyclic *if and only if* the exterior angle at any vertex is equal to the interior angle at the opposite vertex. iii. A quadrilateral is cyclic *if and only if* one side subtends equal angles at the remaining vertices.	

Theorem	*Diagrams*
14. Tangent Radius Property (TRP) For a given circle, i. a tangent is perpendicular to the radius at the point of tangency; ii. a line at right angles to a radius at the circumference is a tangent; iii. a perpendicular to a tangent at the point of contact passes through the centre.	
15. Tangent Chord Property (TCP) The angle formed by a tangent and a chord is equal to the angle subtended by the chord in the segment on the other side of the chord.	
16. Tangent from a Point Property (TPP) Tangent segments from an external point to a circle are equal.	
17. Intersecting Chords Property (ICP) If two chords intersect, the product of the two parts of one is equal to the product of the two parts of the other.	
18. Intersecting Secants Property (ISP) If two secants *AB* and *CD* intersect at point *P*, then *PA•PB = PC•PD*.	
19. Corollary of ICP and ISP If a tangent *PT* is drawn from a point on a secant *AB*, then $PA \bullet PB = PT^2$.