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**IDX G9 MATH H+ STUDY GUIDE ISSUE 4**

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**4.3 Trigonometric Ratios in Acute Triangles**

sin∠A = , cos∠A = , tan∠A = , cot∠A =

Trigonometric identities:

-reciprocals: tan A ⋅ cot A = 1

-quotient: tan A =

-square: sin2 A + cos2 A = 1

-complement: if ∠A, ∠B are complementary, then sin A = cos B, tan A = cot B

Area of a triangle:

-the area of ΔABC is

SΔABC

-if A, B are supplementary, then sin A = sin B

Law of sine:

-in ΔABC,

**4.4 Application in Trigonometric**

-angle of elevation: an angle above the horizontal

-angle of depression: an angle below the horizontal

Course and compass bearing:

-course: angle measured clockwise from the north direction to the direction of the ship or plane

e.g.: N20°E is 20° East of North

-gradient/inclination (i): ratio of the vertical altitude (h) to horizontal length (l)

-angle α between the horizontal face and the surface of the ramp is the angle of inclination

**6.1 Concepts and Properties of Circles**

-circle: a set of points on the same plane equidistant from a fixed point (center)

-radius: distance from the point on the circle to the center

-congruent circles have congruent radii

Relationship between point and circle:

-given point P and circle C with radius R

P is interior of ⊙C ⇔ |PC| < R

P is on ⊙C ⇔ |PC| = R

P is exterior of ⊙C ⇔ |PC| > R

-arc: part of a circle

-semicircle: half of a circle

-minor arc: smaller than a semicircle

-major arc: greater than a semicircle

-chord: a segment with endpoints on a circle

-diameter: chord through the center

-central angle: an angle whose vertex is the center of the circle

-apothem: distance from the center to the chord

Central angle theorem:

-In the same or congruent circle, if two central angles are congruent, then their intercepted arcs,

intercepted chords, and their apothems are respectively congruent.

**6.2 Chords and Arcs**

Perpendicular diameter theorem:

-if a diameter is perpendicular to a chord, it bisects the chord and its corresponding arcs

Corollary to perpendicular diameter theorem:

-arcs included by two parallel chords are congruent

**6.3 Relationship Between Lines and Circles**

-if a line and a circle have no intersection point, the line is exterior of the circle

-if a line and a circle have one intersection point, the line is tangent to the circle

-the line is called the tangent line

-the point is called point of tangency

-if a line and a circle have two intersection points, the line intersects a circle

-the line is called the secant line

Relationship between line and circle:

-given line l and circle C with radius R, denote d be the distance from 𝐶 to line 𝑙

l is exterior of ⊙C ⇔ d > R

l is on ⊙C ⇔ d = R

P intersects ⊙C ⇔ d < R

Properties of tangent lines:

-a line through the center perpendicular to the tangent line must pass through the point of tangency

-a line through the point of tangency perpendicular to the tangent line must pass through the center

Tangent lines theorem:

Through an exterior point of a circle, there are two tangent lines and the line segments from this

point to the point of tangency are congruent. The line through the center and this point bisects the

angle formed by two tangent lines.

Relationship between circles:

-no intersection point: exterior or interior

-same center: concentric

-one intersection point: externally tangent or internally tangent, the intersection point is point of tangency

-two intersection points: intersect

O1 is external to O2 ⇔ O1O2 > R1 + R2

O1 is externally tangent to O2 ⇔ O1O2 = R1 + R2

O1 intersectes O2 ⇔ |R1 – R2| < O1O2 < R1 + R2

O1 is internally tangent to O2 ⇔ O1O2 = |R1 – R2|

O1 is interior of O2 (R1 < R2)) or O2 is interior of O1 (R2 < R1) ⇔ O1O2 < |R1 – R2|

-the line connecting two centers of intersecting circles is the perpendicular bisector of their common chord

-the line connecting two centers of tangent circles passes through the point of tangency

Common tangent (common tangent segment formed by two points of tangency):

-external common tangent: two circles are on the same side of their common tangent

-internal common tangent: two circles are on different sides of their common tangent

**6.4 Angles and Segments in Circles**

-inscribed angle: an angle in which the vertex is on the circle and both sides intersect the circle

Inscribed angle theorem:

-the measure of the inscribed angle is half of the measure of its intercepted arc

Corollary to inscribed angle theorem:

-the measures of inscribed angles with the same or congruent intercepted arcs are congruent

-the measure of inscribed angle of a semicircle is a right angle

-tangent-chord angle: one side of an inscribed angle is tangent to the circle

Tangent chord theorem:

-the measure of the tangent-chord angle is congruent to the measure of half of its intercepted arc

The power of a point:

-through a fixed point P not on ⊙O, a line intersects ⊙O at A, B, then PA ⋅ PB = |r2 – OP2|

- r2 – OP2 is the power of P about ⊙O