**Things to know:**

\[ m = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{y_2 - y_1}{x_2 - x_1} \]

**Slope:**

**Distance:**

\[ d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \]

**Sum of interior angles:** \(180(n - 2)\)

**Sum of exterior angles:** \(360\)

\[ (x, y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right) \]

**Midpoint:**

**Supplementary:** \(180\)

**Complementary:** \(90\)

- Vertical angles are equal
- Alternate interior angles are equal
- Consecutive angles add to \(180\)

**Inverse:** negate both sides

**Converse:** switch \textit{if} and \textit{then}

**Contrapositive:** switch and negate

**Triangles:**

- **by sides:**
  - Scalene: no sides congruent
  - Isosceles: 2 sides congruent
  - Equilateral: 3 sides congruent

- **by angles:**
  - \(\Delta\) angle sum = \(180\)
  - Acute: all \(<'s\) less than \(90\)
  - Right: one \(90\) angle
  - Obtuse: one obtuse angle
  - Equiangular: - 3 equal angles. (also equilateral)

**Congruent triangles:**

- SSS
- SAS
- AAS
- ASA
- HL (Only right triangles)
- CPCTC (Use AFTER \(\Delta\)'s are proven congruent)

**Similar triangles:**

- AA
- SAS similarity
- SSS similarity

**Inequalities:**

- Sum of the lengths of any two sides of a triangle is greater than the length of the third side.
- Longest side of a triangle is opposite the largest angle.
- Exterior angle of a triangle is greater than either of the two non-adjacent interior angles.

**Mean Proportional of right \(\Delta\):**

\[ \frac{\text{Part 1}}{\text{Altitude}} = \frac{\text{Altitude}}{\text{Part 2}} \]

\[ \frac{\text{Adjacent Part}}{\text{Leg}} = \frac{\text{Leg}}{\text{Whole Hyp.}} \]

**Quadrilaterals:**

**Parallelogram:**

- Opp. sides parallel
- Opp. sides =
- Opp. angles =
- Consecutive angles supp
- Diag. bis each other

**Rectangle:**

- Add 4 rt angles, diag. =

**Rhombus:**

- Add 4 = sides, diag. perp, diag bisect angles.

**Square:**

- All from above.

**Trapezoid:**

- Only one set parallel sides.
- Median of trap is parallel to both bases and = \(\frac{1}{2}\) sum bases.

**Isosceles Trap:**

- Legs =
- Base angles =
- Diagonals =
- Opp. angles supp
Circle Segments
A radius perpendicular to a chord bisects the chord.

Intersecting Chords Rule:
\[(\text{part}) \cdot (\text{part}) = (\text{part}) \cdot (\text{part})\]

Secant-Secant Rule:
\[(\text{whole}) \cdot (\text{external part}) = (\text{whole}) \cdot (\text{external part})\]

Secant-Tangent Rule:
\[(\text{whole}) \cdot (\text{external part}) = (\text{tangent})^2\]

Hat Rule: Two tangents are equal.

Transformations:
\[
\begin{align*}
    r'_{x-axis} (x, y) &= (x, -y) \\
    r'_{y-axis} (x, y) &= (-x, y) \\
    r'_{y=x} (x, y) &= (y, x) \\
    r'_{y=-x} (x, y) &= (-y, -x) \\
    r'_{origin} (x, y) &= (-x, -y)
\end{align*}
\]

\[
\begin{align*}
    T_{a,b} (x, y) &= (x + a, y + b) \\
    D_k (x, y) &= (kx, ky) \\
    R_{90^\circ} (x, y) &= (-y, x) \\
    R_{180^\circ} (x, y) &= (-x, -y) \\
    R_{270^\circ} (x, y) &= (y, -x)
\end{align*}
\]

Isometry: preserves distances

Direct Isometry: preserves orientation.

(ON) Inscribed angle = \(\frac{1}{2}\) the arc

(INSIDE) angle = \(\frac{1}{2}\) the sum

(OUTSIDE) angle = \(\frac{1}{2}\) the difference

Circle Equations:

at the origin: \(x^2 + y^2 = r^2\)
not at the origin: \((x - h)^2 + (y - k)^2 = r^2\)
\((h, k)\) is the center and \(r\) is the radius.

Locus Theorems:
Fixed distance from point.
Fixed distance from a line.
Equidistant from 2 points.
Equidistant 2 parallel lines.
Equidistant from 2 intersecting lines