11-2 Notes: Curves, Polygons, and Symmetry - Answers

Simple Closed Curves
- **Plane curve**: a set of points that can be drawn without lifting the pencil
- **Simple**: without lifting the pencil, do not retrace any of its points
- **Closed curve**: drawn by starting and stopping at the same point
- **Jordan Curve Theorem**: A simple closed curve c separates a plane into three disjoint sets of points called the interior, the exterior, and the curve itself.
- **Region**: Union of simple closed curve and its interior.
- **Convex Region**: a region is convex if, for any two points in the region, the line segment joining them lies completely in the region.
- **Nonconvex (concave) region**: a region is concave if, for any two points in the region, the line segment joining them does not lie completely in the region.
- **Convex curves**: Curves bounding convex regions are called convex curves.

Circles
- **Circle**: the set of all points in a plane at a given distance from a fixed point in the plane is a circle.
- **Center**: the fixed point in the center of a circle
- **Radius**: a line segment connecting the center to a point on the circle
- **Diameter**: a line segment connecting two points on the circle, containing the center
- **Chord**: a line segment connecting two points on the circle, not containing the diameter
- **Disk**: the area of a circle plus the points of the circle

Polygons
- **Polygon**: a polygon is a simple closed curve that is the union of three or more line segments, such that all the points are coplanar and distinct, no three consecutively named points are collinear.
- **Sides**: the line segments that form the polygon are called sides
- **Vertices**: the points defining the sides are called vertices
- **Adjacent vertices**: endpoints on the same side (line segment)
• **Diagonals:** line segments joining *non-adjacent* vertices

• **Adjacent sides:** sides with a common vertex

• **Interior angles:** we refer the *angles* of a convex polygon as the *interior* angles

• **Regular polygon:** a simple *convex* polygon with all sides of *equal* length and all angles of *equal* measure is called a *regular* polygon. Such a polygon is said to be *equilateral* and *equiangular*.

• **Exterior angles:** formed by extending one *side* of a polygon and measuring the *angle* formed; the interior angle and the *exterior angle* are supplementary to each other, their measures sum to 180 degrees

### Regular Polygons or n-gons (n sides):

<table>
<thead>
<tr>
<th>Name</th>
<th>Number of Sides</th>
<th>Number of angles</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Triangle</strong></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2. <strong>Quadrilateral</strong></td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>3. <strong>Pentagon</strong></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4. <strong>Hexagon</strong></td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>5. <strong>Heptagon or 7-gon</strong></td>
<td>7</td>
<td>7</td>
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<tr>
<td>6. <strong>Octagon</strong></td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

### Triangles

• **Equilateral:** all three sides are of *equal* length and all 3 angles are of equal *measure*

• **Isosceles:** at least two sides are congruent (have *equal* length); the angles *opposite* these sides are also congruent

• **Scalene:** no two sides are *congruent* (no two sides have equal *length*)

### Quadrilaterals

**Quadrilateral Definitions:**

1. A **parallelogram** is a *quadrilateral* with both pairs of opposite sides *parallel*

2. A **trapezoid** is a quadrilateral with exactly one pair of *opposite* sides parallel

3. A **rectangle** is a parallelogram with a *right* angle. One right angle implies that all *four* angles are *right* angles.

4. A **square** is a **rectangle** with all sides of *equal* length.

5. A **rhombus** is a **parallelogram** with all sides of *equal* length.
6. A kite is a quadrilateral with two distinct pairs of adjacent sides of equal length

Angles of Polygons
- Interior angles – any polygon: may all be of different measures
- Interior angles – regular polygon: are ALWAYS equal measures
- Central angle: formed by connecting the center of a regular polygon with a pair of adjacent vertices

<table>
<thead>
<tr>
<th>Angle Measures of Regular n-gons:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sides</td>
</tr>
<tr>
<td>------------------</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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<td>4.</td>
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<td>5.</td>
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Symmetry and Its Relation to Planar Figures
- A geometric figure has a line of symmetry if it is its own image when folded along the line.
  o How many lines of symmetry does each drawing have?

<table>
<thead>
<tr>
<th></th>
<th>a.</th>
<th>b.</th>
<th>c.</th>
<th>d.</th>
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<tbody>
<tr>
<td>a.</td>
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<td>b.</td>
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<td>c.</td>
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<td>d.</td>
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<tr>
<td>lines</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>none</td>
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Turn (rotational) symmetries
- A figure has turn symmetry (or rotational symmetry) when a tracing of the figure can be rotated more than 0° and less than 360° about some point (the center of the turn) so that it matches the original figure.
- Examples:
- If a figure has $\alpha$ degrees of turn symmetry, it will coincide with itself when rotated $n\alpha$ degrees for any integer $n$.
- Rotations clockwise are in the negative direction, while rotations counterclockwise (widdershins) are in the positive direction.

Point symmetry
- A figure with 180° turn symmetry is said to have point symmetry.

- Examples:

Classification of Polygons by their symmetries
- Omit