Areas in Coordinate Geometry
SWBAT: Calculate the Area of Polygons using Coordinate Geometry

<table>
<thead>
<tr>
<th>1. Rectangle:</th>
<th>2. Square:</th>
<th>3. Parallelogram:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Rectangle Diagram" /></td>
<td><img src="image2" alt="Square Diagram" /></td>
<td><img src="image3" alt="Parallelogram Diagram" /></td>
</tr>
<tr>
<td>$A = bh \text{ or } A = lw$</td>
<td>$A = s^2$</td>
<td>$A = bh$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Triangle:</th>
<th>5. Trapezoid:</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Triangle Diagram" /></td>
<td><img src="image5" alt="Trapezoid Diagram" /></td>
</tr>
<tr>
<td>$A = \frac{1}{2}bh$</td>
<td>$A = \frac{1}{2} (b_1 + b_2)h$</td>
</tr>
</tbody>
</table>
Areas and Coordinates

To find areas of polygons in coordinate geometry, we use the area formulas previously developed. When a figure has one or more sides parallel to either of the axes, the process of finding its area usually is simpler.
SWBAT: Calculate the Area of Polygons using Coordinate Geometry

1. Find the area of trapezoid ABCD if the vertices are A(1,5), B(7,3), C(2,-4) and D(-7,-1).

\[
\text{Area}_{\text{Rect}} = BH = (14)(9) = 126
\]

\[
\text{AREA}_I = \frac{1}{2} bh = \frac{1}{2} (6)(8) = 24
\]

\[
\text{AREA}_{II} = \frac{1}{2} bh = \frac{1}{2} (2)(6) = 6
\]

\[
\text{AREA}_{III} = \frac{1}{2} bh = \frac{1}{2} (5)(7) = 17.5
\]

\[
\text{AREA}_{IV} = \frac{1}{2} bh = \frac{1}{2} (3)(9) = 13.5
\]

Total \( \Delta \text{Area} = 61 \)

Area of Trap. ABCD = 126 - 61 = 65 squ
SWBAT: Calculate the Area of Polygons using Coordinate Geometry

2. If the coordinates of the vertices of polygon PEACH are P(1,1), E(10,4), A(7,8), C(2,9) and H(-3,3), what is the area of pentagon PEACH?

\[ \text{Area}_{\text{Rect}} = BH = (13)(8) = 104 \]

\[ \text{Area}_{I} = \frac{1}{2}bh = \frac{1}{2}(6)(5) = 15 \]

\[ \text{Area}_{II} = \frac{1}{2}bh = \frac{1}{2}(5)(1) = 2.5 \]

\[ \text{Area}_{III} = bh = (3)(1) = 3 \]

\[ \text{Area}_{IV} = \frac{1}{2}bh = \frac{1}{2}(3)(4) = 6 \]

\[ \text{Area}_{V} = \frac{1}{2}bh = \frac{1}{2}(9)(3) = 13.5 \]

Area of PEACH = 104 - 44 = 60 squ
SWBAT: Calculate the Area of Polygons using Coordinate Geometry

3. a. On the same set of axes, draw the graph of each of the following equations: (1) \( x = 6 \), (2) \( y = x \), (3) \( y = \frac{1}{2}x \).

b. The points of intersection of the graphs drawn in part a are the vertices of a triangle. Find the coordinates of these vertices.

c. Find the area of the triangle described in part b.

b) Vertices are: (0,0), (6,3), (6,6)

c) \( \text{Area}_{\text{Square}} = S^2 = (6)^2 = 36 \)

\[
\text{AREA}_I = \frac{1}{2} bh = \frac{1}{2} (6)(6) = 18
\]

\[
\text{AREA}_{II} = \frac{1}{2} bh = \frac{1}{2} (6)(3) = 9
\]

Total Area = \( 27 \)

Area of Triangle = \( 36 - 27 = 9 \) sq
SWBAT: Calculate the Area of Polygons using Coordinate Geometry

4. Given the lengths of the three sides of \( \triangle ABC \), use Heron’s Formula to determine the area.

\[
A = \sqrt{s(s-a)(s-b)(s-c)} \text{ where } a, b, \text{ and } c \text{ are sides and } s = \frac{a+b+c}{2} \quad \text{(round to two decimal places)}
\]

a) \( a = 3 \text{ cm}, \ b = 5 \text{ cm}, \ c = 6 \text{ cm} \)

\[
s = \frac{3 + 5 + 6}{2}
\]

\[
s = 7
\]

\[
A = \sqrt{7(7-3)(7-5)(7-6)}
\]

\[
A = \sqrt{7 \cdot 4 \cdot 2 \cdot 1}
\]

\[
A = \sqrt{56}
\]

\[
A = \sqrt{4\sqrt{14}} = 2\sqrt{14} \approx 7.48
\]

\[
\text{Area} = \frac{7.48}{2\sqrt{14}} \text{ cm}^2
\]

b) \( a = 8 \text{ cm}, \ b = 4 \text{ cm}, \ c = 7 \text{ cm} \)

\[
s = \frac{8 + 4 + 7}{2}
\]

\[
s = 9.5
\]

\[
A = \sqrt{9.5(9.5-8)(9.5-4)(9.5-7)}
\]

\[
A = \sqrt{9.5 \cdot 1.5 \cdot 5.5 \cdot 2.5}
\]

\[
A = \sqrt{195.9375}
\]

\[
A \approx 14.00
\]

\[
\text{Area} = \frac{14.00}{2\sqrt{14}} \text{ cm}^2
\]

c) \( a = 6 \text{ cm}, \ b = 10 \text{ cm}, \ c = 8 \text{ cm} \)

\[
\text{Area} = \frac{14.00}{2\sqrt{14}} \text{ cm}^2
\]
SWBAT: Calculate the Area of Polygons using Coordinate Geometry

4. Given the lengths of the three sides of \( \triangle ABC \), use Heron’s Formula to determine the area.

\[
A = \sqrt{s(s-a)(s-b)(s-c)} \quad \text{where } a, b, \text{ and } c \text{ are sides and } s = \frac{a+b+c}{2}.
\]

(round to two decimal places)

c) \( a = 6 \text{ cm}, \ b = 10 \text{ cm}, \ c = 8 \text{ cm} \)

\[
s = \frac{6 + 10 + 8}{2}
\]

\[
s = 12
\]

\[
A = \sqrt{12(12 - 6)(12 - 10)(12 - 8)}
\]

\[
A = \sqrt{12 \cdot 6 \cdot 2 \cdot 4}
\]

\[
A = \sqrt{576}
\]

\[
A = 24
\]

Area = 24.00 cm\(^2\)
4. Find the area of a triangle whose vertices are (-5,4), (2,1) and (6,5).

\[ Area_{Rect} = BH = (11)(4) = 44 \]

\[ AREA_1 = \frac{1}{2} bh = \frac{1}{2} (1)(11) = 5.5 \]

\[ AREA_II = \frac{1}{2} bh = \frac{1}{2} (4)(4) = 8 \]

\[ AREA_{III} = \frac{1}{2} bh = \frac{1}{2} (7)(3) = 10.5 \]

Total Area = 24

Area of Triangle = 44 - 24 = 20 squ
4. Find the area of a triangle whose vertices are (-5,4), (2,1) and (6,5).

Method 2: Heron’s Formula

\[ AB = \sqrt{(-7)^2 + (3)^2} = \sqrt{58} \approx 7.6158 \]

\[ BC = \sqrt{(4)^2 + (4)^2} = \sqrt{32} \approx 5.6569 \]

\[ AC = \sqrt{(11)^2 + (1)^2} = \sqrt{122} \approx 11.0454 \]

\[ s = \frac{7.6158 + 5.6569 + 11.0454}{2} \]
\[ s \approx 12.1591 \]

\[ A = \sqrt{12.1591(4.5433)(6.5022)(1.1137)} \]
\[ A = \sqrt{400.0381} \]
\[ A \approx 20.00 \text{ squ} \]