Square

Four points, A(4, 0), B(0, 3), C(-3, -1), and D(1, 4) are drawn on the x/y co-ordinate plane.

1. Find the length of the line AB.

\[ D = \sqrt{\left(x_2-x_1\right)^2 + \left(y_2-y_1\right)^2} \]
\[ = \sqrt{(4)^2 + (-3)^2} = \sqrt{16+9} \]
\[ = \sqrt{25} = 5 \text{ units} \]

2. Find the slope of the line AB.

\[ m = \frac{y_2-y_1}{x_2-x_1} = \frac{3-0}{0-4} = -\frac{3}{4} \]

3. Join the sides of the quadrilateral ABCD. Prove that ABCD is a square.

length of \( \overline{AD} \) = \( \sqrt{(0+4)^2 + (3-1)^2} = \sqrt{16+4} = \sqrt{20} = 5 \text{ units} \)
length of \( \overline{BC} \) = \( \sqrt{(1+3)^2 + (-4+1)^2} = \sqrt{16+9} = \sqrt{25} = 5 \text{ units} \)
length of \( \overline{CD} \) = \( \sqrt{(-3+0)^2 + (-1-3)^2} = \sqrt{9+16} = \sqrt{25} = 5 \text{ units} \)
length of \( \overline{AB} \) = 5 units \( \rightarrow \) \( ABCD \) is a square (the opposite sides of a square are \( \parallel \))

slope of \( \overline{BC} \) = \( \frac{3+1}{0+3} = \frac{4}{3} \) \( \rightarrow \) \( \overline{AB} \perp \overline{BC} \) (\( \perp \) negative reciprocals) \( \rightarrow \) \( \angle ABC \) is a right \( \angle \) \( \rightarrow \) \( ABCD \) is a rectangle

\( ABCD \) is a square.

(by def. of a square - a square is a parallelogram that is both a rectangle and a rhombus)
Square

Four points, A(4, 0), B(0, 3), C(-3, -1), and D(1, 4) are drawn on the x/y co-ordinate plane.

1. Find the length of the line AB.
   \[ d = \sqrt{(x_2-x_1)^2+(y_2-y_1)^2} \]
   \[ \sqrt{16+9} = \sqrt{25} = 5 \]

2. Find the slope of the line AB.
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} \]
   \[ m = \frac{3 - 0}{0 - 4} = \frac{-3}{-4} = \frac{3}{4} \]

3. Join the sides of the quadrilateral ABCD. Prove that ABCD is a square.
   \[ \overline{AB} = 5, \frac{-3}{4} \]
   \[ \overline{AD} = 5, \frac{-4}{-3} = +1\frac{1}{3} \]
   \[ \overline{DC} = 5, \frac{-3}{4} \]
   \[ \overline{CB} = 5, +1\frac{1}{3} \]

\[ \overline{CB} \parallel \overline{AD} \text{ because they have the same slope} \]
\[ \overline{DC} \parallel \overline{AB} \text{ because they have the same slope} \]
Square

Four points, A(4, 0), B(0, 3), C(-3, -1), and D(1, 4) are drawn on the x/y co-ordinate plane.

1. Find the length of the line AB.

\[ 3^2 + 4^2 = c^2 \]
\[ 9 + 16 = c^2 \]
\[ 25 = c^2 \]
\[ c = 5 \]

\[ \sqrt{5} \]

2. Find the slope of the line AB.

\[ \frac{3-0}{0-4} = \frac{3}{4} \]

\[ -\frac{3}{4} \]

3. Join the sides of the quadrilateral ABCD. Prove that ABCD is a square.

slope of \( \overline{AB} \): \( -\frac{3}{4} \)
slope of \( \overline{AD} \): \( \frac{1}{3} \)
slope of \( \overline{CD} \): \( \frac{3}{4} \)
slope of \( \overline{BC} \): \( \frac{1}{3} \)

\( \overline{AB} \perp \overline{AD} \)
\( \overline{AB} \perp \overline{BC} \)
\( \overline{CD} \perp \overline{AD} \)
\( \overline{BC} \parallel \overline{AD} \)

length of \( \overline{AB} \): 5
length of \( \overline{AD} \): \( 3^2 + 4^2 = c^2 \)
\[ c^2 = 25 \]
\[ c = 5 \]

length of \( \overline{CD} \): \( 4^2 + 3^2 = c^2 \)
\[ c = 5 \]

length of \( \overline{BC} \): \( 3^2 + 4^2 = c^2 \)
\[ c = 5 \]
Four points, A(4, 0), B(0, 3), C(-3, -1), and D(1, 4) are drawn on the x/y co-ordinate plane.

1. Find the length of the line AB.
   \[ \sqrt{(4-(-3))^2 + (0-3)^2} = \sqrt{7^2 + 3^2} = \sqrt{49 + 9} = \sqrt{58} \approx 7.62 \]  
   \[ \checkmark \]

2. Find the slope of the line AB.
   \[ \frac{3-0}{0-4} = \frac{-3}{4} \]  
   \[ \checkmark \]

3. Join the sides of the quadrilateral ABCD. Prove that ABCD is a square.

   **Slopes**
   - DA = \( \frac{0-(-4)}{4-1} = \frac{4}{3} \)  
     \[ \checkmark \]
   - BA = 3 - 0 \quad \frac{3-0}{0-4} = \frac{-3}{4} \)  
     \[ \checkmark \]
   - CB = 3 - (-1) \quad \frac{4}{0-(-3)} = \frac{4}{3} \)
   - CD = \( \frac{-4-1}{1-(-3)} = \frac{-3}{4} \)

   **Lengths**
   - \( \sqrt{(4-(-3))^2 + (0-3)^2} = \sqrt{7^2 + 3^2} = \sqrt{49 + 9} = \sqrt{58} \approx 7.62 \)  
   - \( \sqrt{(3-0)^2 + (0-(-4))^2} = \sqrt{3^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5 \)  
   - \( \sqrt{(3-(-1))^2 + (0-(-3))^2} = \sqrt{4^2 + 3^2} = \sqrt{16 + 9} = \sqrt{25} = 5 \)  
   - \( \sqrt{(4-(-3))^2 + (1-3)^2} = \sqrt{7^2 + 2^2} = \sqrt{49 + 4} = \sqrt{53} \approx 7.28 \)  
     \[ \checkmark \]
Four points, A(4, 0), B(0, 3), C(-3, -1), and D(1, 4) are drawn on the x/y co-ordinate plane.

1. Find the length of the line AB.
   \[ \sqrt{5} \checkmark \]

2. Find the slope of the line AB.
   \[ m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{3 - 0}{0 - 4} = \frac{3}{-4} = -\frac{3}{4} \]

3. Join the sides of the quadrilateral ABCD. Prove that ABCD is a square.

<table>
<thead>
<tr>
<th>Slopes</th>
<th>( \text{rise} \over \text{run} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>(-\frac{3}{4})</td>
</tr>
<tr>
<td>BC</td>
<td>(\frac{4}{3})</td>
</tr>
<tr>
<td>CD</td>
<td>(-\frac{3}{4})</td>
</tr>
<tr>
<td>AD</td>
<td>(\frac{4}{3})</td>
</tr>
</tbody>
</table>

   | Lengths | \[ \begin{array}{c} AB = 5 \hfill \sqrt{5} \\
                   BC = 5 \hfill \sqrt{5} \\
                   CD = 5 \hfill \sqrt{5} \\
                   AD = 5 \hfill \sqrt{5} \end{array} \]

   By the Pythagorean Theorem, the diagonals AC and BD are equal and perpendicular, hence the quadrilateral is a square.

   It is a square.