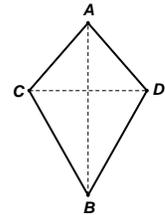


GSP 10.2 Quadrilateral Diagonals and Area

- ✓ Partner work required (if possible)
- ✓ Name example: Burton_Ciaccetta_9.2CirclesQuadrilateralsAngles.gsp
- ✓ Save your work frequently. Sometimes the network crashes your application.
- ✓ Use multiple tabs; 1 for part 1, 2 for part 2, etc.

1. Kite Diagonals and Area

A **kite** is a quadrilateral with two pairs of adjacent sides that are congruent. There is an interesting relationship between the area of a kite and the product of the lengths of its two diagonals.



Question 1

What is the relationship between the **area** of a kite and **the product of the lengths of its two diagonals**, regardless of how the kite is moved and transformed?

Construction Directions 1: Make a Flexible Kite, Diagonals and Interior

- Use the *Line Tool* to create an approximately horizontal line. Select the line and one point on the line; use Construct > Perpendicular line to create a pair of perpendicular lines.
- Mark the vertical line as the line of symmetry by double clicking on the line (a line of symmetry animation will show). Reflect the point on the horizontal line over the vertical line by using Transform > Reflect.
- Add two points to the vertical line, drag one above the horizontal line and one below the horizontal line.
- Connect the four points on the perpendicular lines to make a kite, hide the perpendicular lines and connect points with line segments to make the diagonals of the kite. Construct the interior of the kite and then measure the area of the kite and the lengths of both diagonals.
- Select your measurements, then use the GSP Calculator (Number > Calculate) to explore the relationship between the kite area and the product of the lengths of the diagonals.
- Copy your construction, measurement and calculation at least three times so you have at least four copies of your set up.

Demonstration 1

Demonstrate what happens in this case by moving around the vertices of your kites. The constructions must remain kites no matter how the vertices are moved.

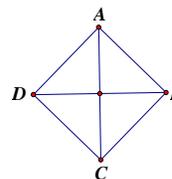
Answer for 1

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet.

2. Square Diagonals and Area

Question 2

What is the relationship between the **area** of a square and **the product of the lengths of its two diagonals**, regardless of how the square is moved and transformed?



Construction Directions 2a: Make a Flexible Square

Pick the method you like best

- One method: (refer to the kite directions) Make two perpendicular lines, reflect a point over one line and then rotate the two points to the perpendicular line. Hide the perpendicular lines.
- A second method: Create a circle and use the inscribed regular polygon technique to make a flexible square. Hide the circle.
- A third method: Create a line segment using the line segment tool (you must be able to change the line segment length) and use the vertex angle technique to make a flexible square.

Construction Directions 2b: Make Diagonals and Interior

- Construct the interior and diagonals of your square and then measure the area of the square and the lengths of both diagonals.
- Select your measurements, then use the GSP Calculator (Number > Calculate) to explore the relationship between the square area and the product of the lengths of the diagonals.
- Copy your construction, measurement and calculation at least three times so you have at least four copies of your set up.

Demonstration 2

Demonstrate what happens in this case by moving around the vertices of your squares. The constructions must remain squares no matter how the vertices are moved.

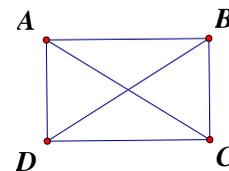
Answer for 2

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet.

3. Rectangle Diagonals and Area

Question 3

What is the relationship between the **area** of a rectangle and **the product of the lengths of its two diagonals**, regardless of how the rectangle is moved and transformed?



Construction Directions 3a: Make a Flexible Rectangle

- Think about the definition of a rectangle and make a flexible rectangle. Be sure that you can transform your construction into a non-square rectangle. Sets of perpendicular and parallel lines are very helpful. Hide the lines when you have made your rectangle.

Construction Directions 3b: Make Diagonals and Interior

- Construct the interior and diagonals of your rectangle and then measure the area of the rectangle and the lengths of both diagonals.
- Select your measurements, then use the GSP Calculator (Number > Calculate) to explore the relationship between the rectangle area and the product of the lengths of the diagonals.
- Copy your construction, measurement and calculation at least three times so you have at least four copies of your set up.

Demonstration 3

Demonstrate what happens in this case by moving around the vertices of your rectangles. The constructions must remain rectangles no matter how the vertices are moved.

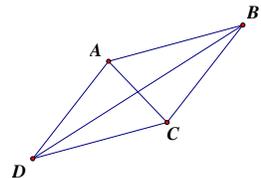
Answer for 3

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet.

4. Parallelogram Diagonals and Area

Question 4

What is the relationship between the **area** of a parallelogram and **the product of the lengths of its two diagonals**, regardless of how the parallelogram is moved and transformed?



Construction Directions 4a: Make a Flexible Parallelogram

- Think about the definition of a parallelogram and make a flexible parallelogram. Be sure that you can transform your construction into a non-rectangular and non-rhombus parallelogram. Two sets of parallel lines are very helpful. Hide the parallel lines when you have made your parallelogram.

Construction Directions 4b: Make Diagonals and Interior

- Construct the interior and diagonals of your parallelogram and then measure the area of the parallelogram and the lengths of both diagonals.
- Select your measurements, then use the GSP Calculator (Number > Calculate) to explore the relationship between the parallelogram area and the product of the lengths of the diagonals.
- Copy your construction, measurement and calculation at least three times so you have at least four copies of your set up.

Demonstration 4

Demonstrate what happens in this case by moving around the vertices of your parallelogram. The constructions must remain parallelograms no matter how the vertices are moved.

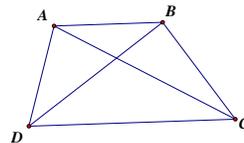
Answer for 4

Give you answer by using the *Text Tool* and directly typing your answer into your GSP worksheet.

5. Trapezoid Diagonals and Area

Question 5

What is the relationship between the **area** of a trapezoid and **the product of the lengths of its two diagonals**, regardless of how the trapezoid is moved and transformed?



Construction Directions 5a: Make a Flexible Trapezoid

- Think about the definition of a trapezoid and make a flexible trapezoid. One set of parallel lines is very helpful. Hide the parallel lines when you have made your trapezoid.

Construction Directions 5b: Make Diagonals and Interior

- Construct the interior and diagonals of your trapezoid and then measure the area of the trapezoid and the lengths of both diagonals.
- Select your measurements, then use the GSP Calculator (Number > Calculate) to explore the relationship between the trapezoid area and the product of the lengths of the diagonals.
- Copy your construction, measurement and calculation at least three times so you have at least four copies of your set up.

Demonstration 5

Demonstrate what happens in this case by moving around the vertices of your trapezoid. The constructions must remain trapezoids no matter how the vertices are moved.

Answer for 5

Give your answer by using the *Text Tool* and directly typing your answer into your GSP worksheet.

6. Quadrilaterals Diagonals and Area

Question and Answer 6

What is the relationship between the **area** of a quadrilateral and **the product of the lengths of its two diagonals**, regardless of how the quadrilateral is moved and transformed?

You do not have to construct any quadrilaterals to answer this question. Give an overview answer for the five types of quadrilaterals explored in questions #1 - #5. Use the *Text Tool* and directly type your answer into your GSP worksheet. Clearly mark it as the answer to #6. Think about how kites, squares, rectangles, parallelograms and trapezoids are related.