

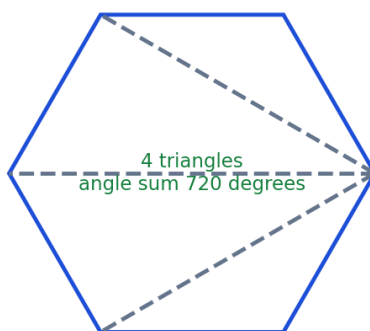
Solutions

4.1 Polygon Angle Sums

4.1.1. A regular hexagon is divided from one vertex into triangles. How many triangles appear, and what is each interior angle?

Solution. There are $6 - 2 = 4$ triangles. The sum is 720° , giving 120° at each vertex.

A regular hexagon



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Four triangles give 720 degrees; each regular-hexagon interior angle is 120 degrees.

4.1.2. A regular polygon has exterior angle 24° . How many sides does it have?

Solution. $n = 360/24 = 15$.

4.1.3. Five interior angles of a hexagon are 100° , 110° , 120° , 130° , 140° . Find the sixth.

Solution. Their sum is 600° . Subtract from 720° to obtain 120° .

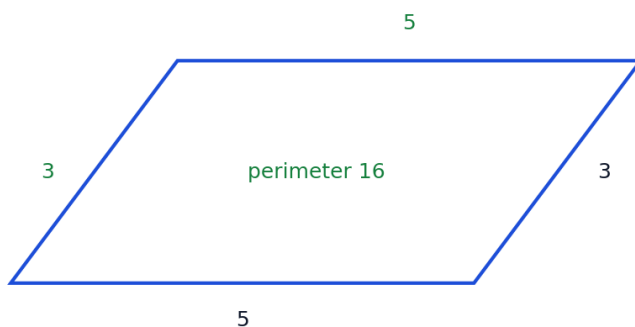
Solutions

4.2 The Quadrilateral Family

4.2.1. A parallelogram has adjacent side lengths 5 and 3. Find its perimeter.

Solution. $P = 2(5 + 3) = 16$ units. Opposite sides match.

A parallelogram



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Each opposite side matches, so perimeter is $2(5 + 3) = 16$.

4.2.2. Does a quadrilateral with perpendicular diagonals have to be a square?

Solution. No. A rhombus with unequal diagonal lengths has perpendicular diagonals but is not a square.

4.2.3. A rhombus has diagonals 6 and 8. Find its side length and area.

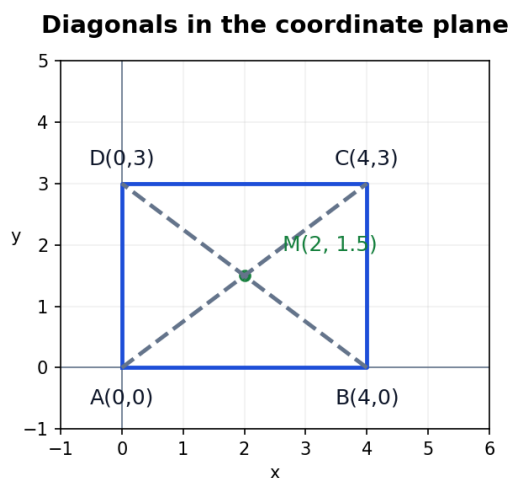
Solution. The diagonals bisect at right angles. Each side is $\sqrt{3^2 + 4^2} = 5$. The area is $6 \cdot 8/2 = 24$.

Solutions

4.3 Coordinate Proofs

4.3.1. For $A = (0, 0)$, $B = (4, 0)$, $C = (4, 3)$, and $D = (0, 3)$, show the diagonals bisect each other.

Solution. The midpoint of AC is $(2, 1.5)$ and the midpoint of BD is also $(2, 1.5)$. Therefore they bisect each other.



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Both diagonal midpoints are $(2, 1.5)$.

4.3.2. Prove $(0, 0)$, $(2, 2)$, $(4, 0)$, $(2, -2)$ form a rhombus.

Solution. All four side lengths are $\sqrt{2^2 + 2^2} = 2\sqrt{2}$, so the quadrilateral is a rhombus.

4.3.3. Why would placing a general triangle at $(0, 0)$, $(a, 0)$, $(0, b)$ invalidate a proof for all triangles?

Solution. It forces a right angle at the origin. A general third vertex must be allowed a nonzero horizontal coordinate.