

Concave polygon

A simple polygon that is not convex is called **concave**,^[1] **non-convex**^[2] or **reentrant**.^[3] A concave polygon will always have at least one reflex interior angle—that is, an angle with a measure that is between 180 degrees and 360 degrees exclusive.^[4]

Some lines containing interior points of a concave polygon intersect its boundary at more than two points.^[4] Some diagonals of a concave polygon lie partly or wholly outside the polygon.^[4] Some sidelines of a concave polygon fail to divide the plane into two half-planes one of which entirely contains the polygon. None of these three statements holds for a convex polygon.

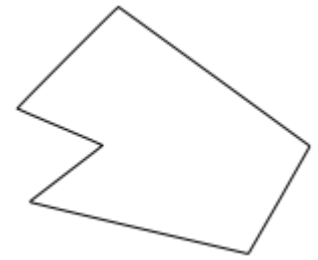
As with any simple polygon, the sum of the internal angles of a concave polygon is $\pi (n - 2)$ radians, equivalently $180^\circ \times (n - 2)$, where *n* is the number of sides.

It is always possible to partition a concave polygon into a set of convex polygons. A polynomial-time algorithm for finding a decomposition into as few convex polygons as possible is described by Chazelle & Dobkin (1985)^[5]

A triangle can never be concave, but there exist concave polygons with *n* sides for any *n* > 3. An example of a concave quadrilateral is the dart.

At least one interior angle does not contain all other vertices in its edges and interior

The convex hull of the concave polygon's vertices, and that of its edges, contains points that are exterior to the polygon.



An example of a concave polygon.

Notes

- McConnell, Jeffrey J. (2006), *Computer Graphics: Theory Into Practice* p. 130, ISBN 0-7637-2250-2
- Leff, Lawrence (2008), *Let's Review: Geometry*, Hauppauge, NY: Barron's Educational Series, p. 66, ISBN 978-0-7641-4069-3
- Mason, J.I. (1946), "On the angles of a polygon", *The Mathematical Gazette*, The Mathematical Association, **30** (291): 237–238, JSTOR 3611229 (<https://www.jstor.org/stable/3611229>)
- Definition and properties of concave polygons with interactive animation(<http://www.mathopenref.com/polygonconcave.html>)
- Chazelle, Bernard Dobkin, David P. (1985), "Optimal convex decompositions", in Oussaint, G.T., *Computational Geometry* (<http://www.cs.princeton.edu/~chazelle/pubs/OptimalConvexDecomp.pdf>)(PDF), Elsevier, pp. 63–133.

External links

- Weisstein, Eric W. "Concave polygon". *MathWorld*.

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