Theorem 17: Equal corresponding angles mean that lines are parallel.
Corollary 1: Equal alternate interior angles mean that lines are parallel.
Corollary 2: Supplementary interior angles on the same side of a transversal mean that lines are parallel.
Corollary 3: In a plane, two lines perpendicular to a third line are parallel.

The Parallel Postulate – Through a point not on a line, there is exactly one line parallel to the given line.
Theorem 18: In a plane, two lines parallel to a third line are parallel to each other.

Theorem 19: Parallel lines form equal corresponding angles.
Corollary 1: Parallel lines form equal alternate interior angles.
Corollary 2: Parallel lines form supplementary interior angles on the same side of a transversal.
Corollary 3: In a plane, a line perpendicular to one of two parallel lines is also perpendicular to the other.

Theorem 20: The Triangle Sum Theorem – The sum of the angles of a triangle is 180°.
Corollary 1: If two angles of one triangle are equal to two angles of another triangle, the third angles are equal.
Corollary 2: The acute angles of a right triangle are complementary.
Corollary 3: Each angle of an equilateral triangle is 60°.

Theorem 21: An exterior angle of a triangle is equal to the sum of the remote interior angles.

Theorem 22: The AAS Theorem – If two angles and the side opposite one of them in one triangle are equal to the corresponding parts of another triangle, the triangles are congruent.

Theorem 23: The HL Theorem – If the hypotenuse and a leg of one right triangle are equal to the corresponding parts of another right triangle, the triangles are congruent.

SSS, SAS, AAS, ASA, HL

7.1 – Quadrilaterals

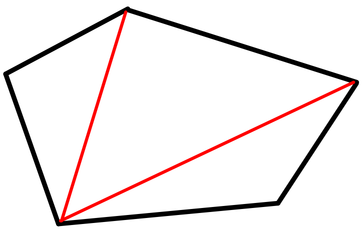
Def: A diagonal of a polygon is a line segment that connects any two nonconsecutive vertices.

Theorem 24: The sum of the angles of a quadrilateral is 360°.

Def: A rectangle is a quadrilateral each of whose angles is a right angle.

Corollary to Theorem 24: A quadrilateral is equiangular iff it is a rectangle.

In the figure below, a pentagon has been divided into triangles by the diagonals from one vertex.



38. How many sides does a pentagon have, (5-gon)

5

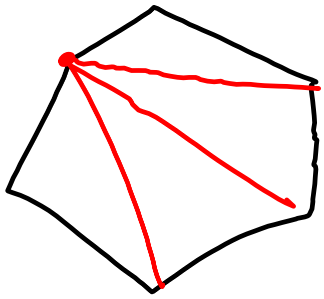
how many diagonals were drawn,

2

and how many triangles were formed?

3

39. Draw a hexagon and the diagonals from one vertex.

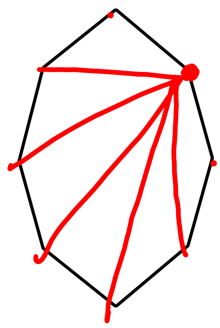


40. How many sides does a hexagon have, 6

how many diagonals did you draw, 3

and how many triangles were formed? 4

41. Draw the diagonals from one vertex for the given figure.



(octagon)

42. How many sides does the polygon have, 8

how many diagonals did you draw, 5

and how many triangles were formed? 6

In general, if a polygon has n sides, in terms of n,

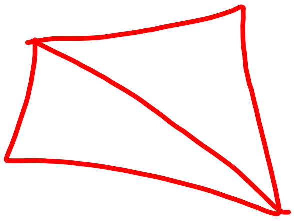
43. how many diagonals can be drawn from one vertex?

$n-3$

44. how many triangles do these diagonals form?

$n-3+1 = n-2$

45. Show that your answers are correct for a quadrilateral.



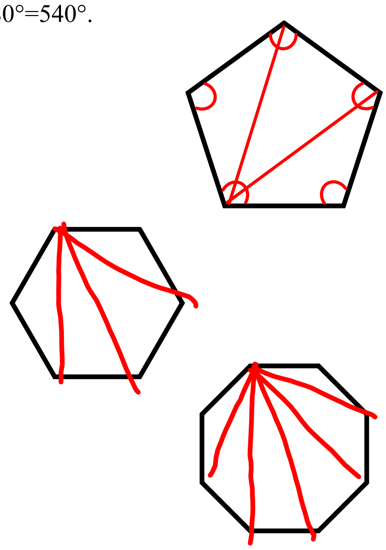
$n=4$

$n-3=1$ ✓

$n-2=2$ ✓

The figure below suggests that the sum of the angles of a pentagon is 3x180°=540°.

If the pentagon is equiangular, then each angle is 540°/5=108°.



46. What is the sum of the angles of a hexagon

$4(180°) = 720°$

47. If the hexagon is equiangular, how large is each angle?

$720°/6 = 120°$

48. What is the sum of the angles of an octagon?

$6(180°) = 1080°$

49. If the octagon is equiangular, how large is each angle?

$1080°/8 = 135°$

50. What, in terms of n, is the sum of the angles of an n-gon?

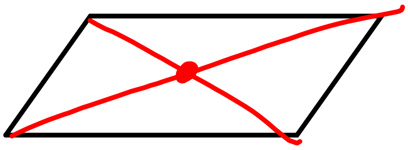
$(n-2)180°$

51. If the n-gon is equiangular, how large is each angle in terms of n?

$$\frac{(n-2)180°}{n}$$

7.2 – Parallelograms and Point Symmetry

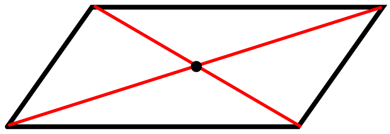
Def: A parallelogram is a quadrilateral whose opposite sides are parallel.



A figure has point symmetry if it looks exactly the same when it is rotated about a point.

Def: Two points are symmetric with respect to a point iff it is the midpoint of the line segment joining them.

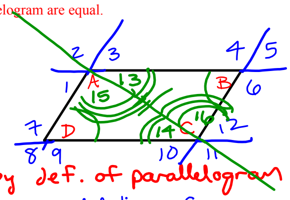
Parallelograms have point symmetry about the point in which their diagonals intersect.



Theorem 25: The opposite sides and angles of a parallelogram are equal.

Given: ABCD is a parallelogram.

Prove: AB=DC, AD=BC, ∠A=∠C, and ∠B=∠D.



Proof:

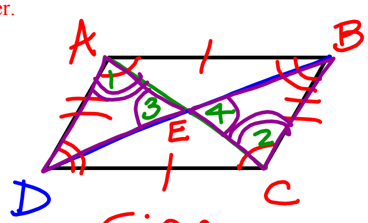
1. AB∥DC & AD∥BC — by def. of parallelogram
2. ∠4=∠C ∠6=∠A; ∠7=∠C ∠9=∠A; ∠3=∠D ∠1=∠B; ∠12=∠D ∠10=∠B; ∠2=∠4, ∠3=∠5; ∠8=∠10, ∠9=∠11 — Parallel lines form equal corresponding angles
3. ∠1=∠3 ∠4=∠6; ∠A=∠2 ∠B=∠5; ∠7=∠9 ∠10=∠12; ∠D=∠8 ∠C=∠11 — vertical angles are equal
4. ∠B=∠D — subst. into ∠1=∠3; ∠A=∠C — subst. into ∠4=∠6
5. Draw AC — 2 points define a line
6. ∠15=∠16, ∠13=∠14 — parallel lines form equal alternate interior ∠'s
7. △ADC≅△CBA — AAS/ASA congruence
8. AD=BC, AB=DC — Corresponding parts of ≅△'s are =

Theorem 26: The diagonals of a parallelogram bisect each other.

Given: ABCD is a parallelogram with diagonals AC and BD.

Prove: AC and BD bisect each other.

(AE=EC & DE=EB)



Statement	Reason
1. ABCD is a parallelogram	Given
2. AB ∥ DC & AD ∥ BC	def. of parallelogram
3. AB = DC & AD = BC ∠A = ∠C & ∠B = ∠D	parallelograms have equal opposite sides & angles
4. ∠3 = ∠4	vertical ∠'s are =
5. ∠1 = ∠2	parallel lines form equal alternate interior ∠'s
6. △ADE ≅ △BCE	AAS congruence
7. AE = CE & DE = BE	corresponding parts of congruent △'s are =
8. E is a midpoint/bisector for the diagonals	def. of midpoint