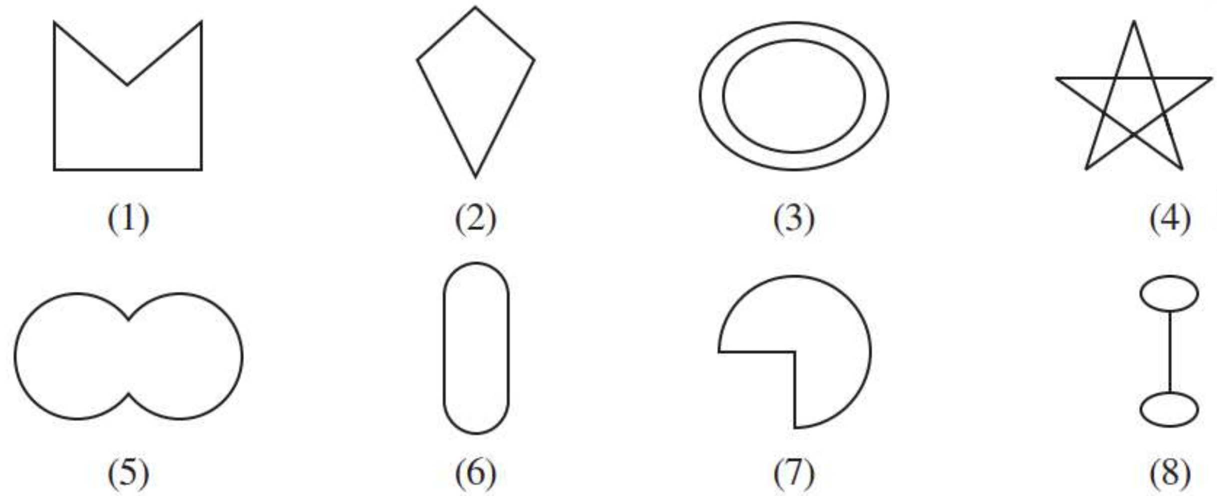
Understanding Quadrilaterals: Exercise 3.1

Q.1 Given here are some figures.



Classify each of them on the basis of the following.

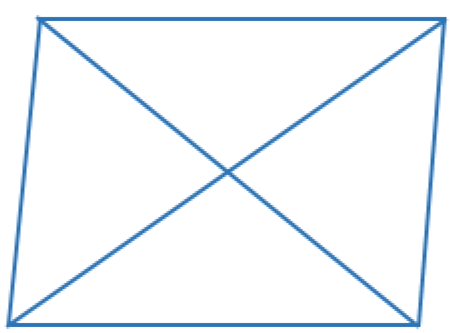
(a) Simple curve **(b) Simple closed curve**
(c) Polygon **(d) Convex polygon**
(e) Concave polygon

Sol. Classification of figures:

(a) Simple Curve	1, 2, 5, 6 and 7
(b) Simple closed curve	1, 2, 5, 6 and 7
(c) Polygon	1 and 2
(d) Convex polygon	2
(e) Concave polygon	1

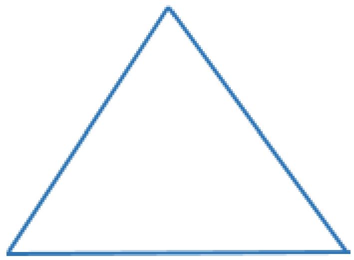
Q.2 How many diagonals does each of the following have?
(a) A convex quadrilateral
(b) A regular hexagon
(c) A triangle

Sol. Number of the diagonals for:
(a) A convex quadrilateral = two diagonals



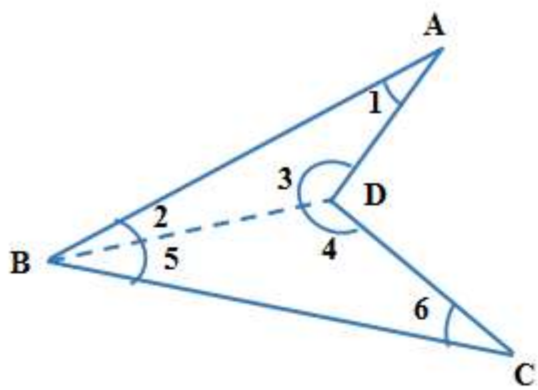
(b) A regular hexagon = 9 diagonals

(c) A triangle = No diagonal



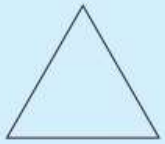
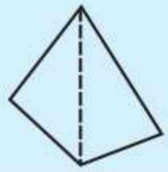
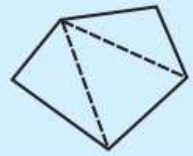
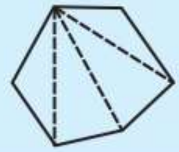
Q.3 What is the sum of the measures of the angles of a convex quadrilateral? Will this property hold if the quadrilateral is not convex?

Sol. The sum of the measures of the angles of a convex quadrilateral is 360°.
Yes. This property will hold true for any quadrilateral, even if the quadrilateral is not convex.
Proof: Let us consider a concave quadrilateral ABCD which is not convex.



Firstly in triangle ABD,
$\angle 1 + \angle 2 + \angle 3 = 180^{\circ}$ .....(i) (Since, angle sum property of triangle)
Now in triangle BCD,
$\angle 4 + \angle 5 + \angle 6 = 180^{\circ}$........ (ii) (Since, angle sum property of triangle)
Now Adding triangle ABD and triangle BCD, which for concave mirror.
So, $\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 180^{\circ} + 180^{\circ}$
$\angle 1 + \angle 2 + \angle 3 + \angle 4 + \angle 5 + \angle 6 = 360^{\circ}$
Thus, hence proved that sum of the measures of the angles of any quadrilateral is 360°.

Q.4 Examine the table. (Each figure is divided into triangles and the sum of the angles deduced from that.)

Figure				
Side	3	4	5	6
Angle sum	180°	$2 \times 180° = (4-2) \times 180°$	$3 \times 180° = (5-2) \times 180°$	$4 \times 180° = (6-2) \times 180°$

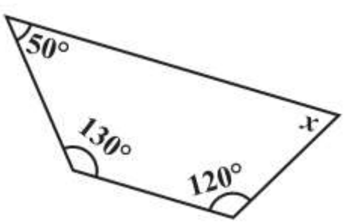
What can you say about the angle sum of a convex polygon with number of sides?
(a) 7 (b) 8 (c) 10 (d) n

Sol. Since, from the table, it is clearly visible that the angle sum for any convex polygon of sides ‘n’ = $(n - 2) \times 180°$. Where n, number of sides of the polygon.
Thus, the angle sum of a convex polygon with given number of sides will be:
(a) $(7 - 2) \times 180° = 900°$
(b) $(8 - 2) \times 180° = 1080°$
(c) $(10 - 2) \times 180° = 1440°$
(d) $(n - 2) \times 180°$

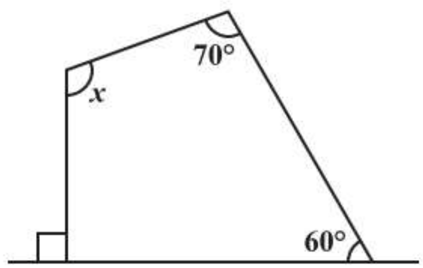
Q.5 What is a regular polygon?
State the name of a regular polygon of:
(i) 3 sides (ii) 4 sides (iii) 6 sides

Sol. A polygon having both equiangular and equilateral is called a regular polygon. This polygon has sides of equal length and angle of equal measures.
(i) A regular polygon of 3 sides: **Triangle**
(ii) A regular polygon of 4 sides: **Quadrilateral**
(iii) A regular polygon of 6 sides: **Hexagon**

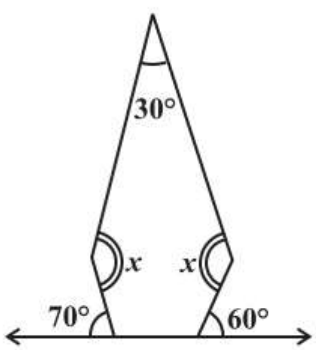
Q.6 Find the angle measure x in the following figures.



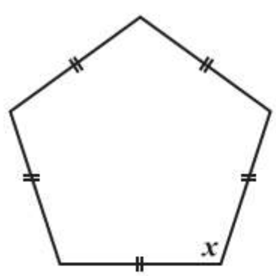
(a)



(b)



(c)



(d)

Sol. (a) Since, sum of the measure of all interior angles of a quadrilateral is 360°.
So, $50^\circ + 130^\circ + 120^\circ + x = 360^\circ$ (By using the angle sum property of a quadrilateral)

$300^\circ + x = 360^\circ$

$x = 360^\circ - 300^\circ$

$x = 60^\circ$

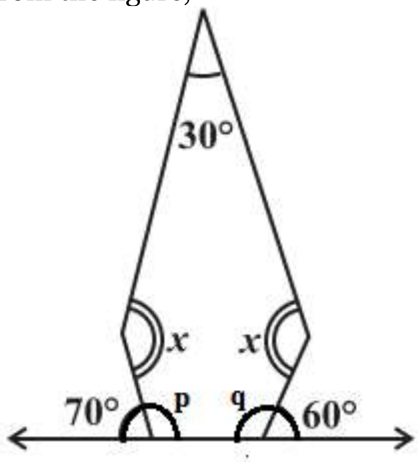
(b) Since, sum of the measure of all interior angles of a quadrilateral is 360°.
So, $60^\circ + 70^\circ + x = 360^\circ$ (By using the angle sum property of a quadrilateral)

$220^\circ + x = 360^\circ$

$x = 360^\circ - 220^\circ$

$x = 140^\circ$

(c) Since, from the figure,



$70^\circ + p = 180^\circ$ (Linear pair angles)

$p = 110^\circ$

$60^\circ + q = 180^\circ$ (Linear pair angles)

$q = 120^\circ$

Since, sum of measure of interior angles of a pentagon is 540°

So, $120^\circ + 110^\circ + 30^\circ + x + x = 540^\circ$

$260^\circ + 2x = 540^\circ$

$2x = 280^\circ$

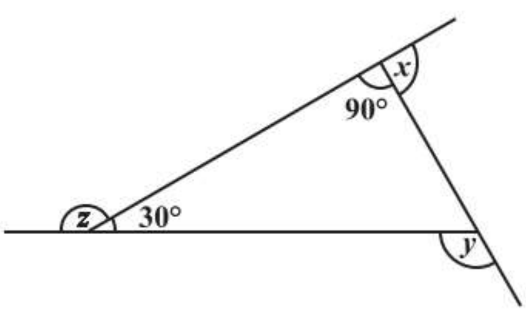
$x = 140^\circ$

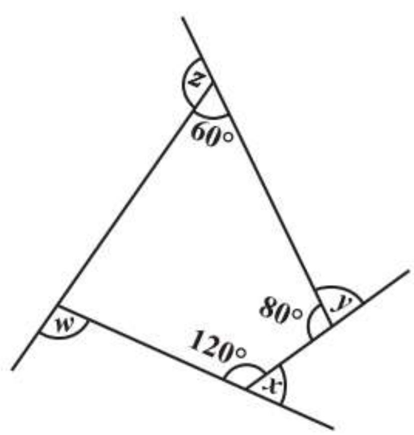
(d) Since, sum of measure of interior angles of a pentagon is 540°

$5x = 280^\circ$

$x = 280^\circ/5 = 108^\circ$

Q.7





(a) Find x + y + z **(b) Find x + y + z + w**

Sol. (a) Since, as we know that sum of linear pair of angles is 180°.

So, $90^\circ + x = 180^\circ$

$x = 180^\circ - 90^\circ$

$x = 90^\circ$

In the same way, $z + 30^\circ = 180^\circ$

$z = 180^\circ - 30^\circ$

$z = 150^\circ$

Now, we use the exterior angle property,

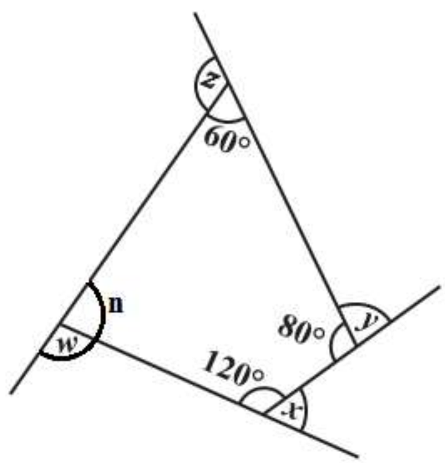
Also, $y = 90^\circ + 30^\circ$

$= 120^\circ$

Then, $x + y + z = 90^\circ + 120^\circ + 150^\circ$

$= 360^\circ$

(b)



Since, sum of the measure of all interior angles of a quadrilateral is 360°.

$60^\circ + 80^\circ + 120^\circ + n = 360^\circ$ (By using the angle sum property of a quadrilateral)

$260^\circ + n = 360^\circ$

$n = 360^\circ - 260^\circ$

$n = 100^\circ$

Now, $w + 100^\circ = 180^\circ$ (Since, sum of linear pair of angles is 180°)

$w = 80^\circ$

$x + 120^\circ = 180^\circ$ (Since, sum of linear pair of angles is 180°)

$x = 60^\circ$

$y + 80^\circ = 180^\circ$ (Since, sum of linear pair of angles is 180°)

$y = 100^\circ$

$z + 60^\circ = 180^\circ$ (Since, sum of linear pair of angles is 180°)

$z = 120^\circ$

So, $x + y + z + w = 60^\circ + 100^\circ + 120^\circ + 80^\circ$

Thus, $x + y + z + w = 360^\circ$