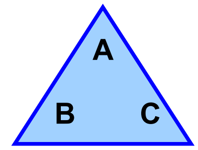
SYMMETRIES: A **symmetry** is a rigid transformation of a figure **onto itself**.

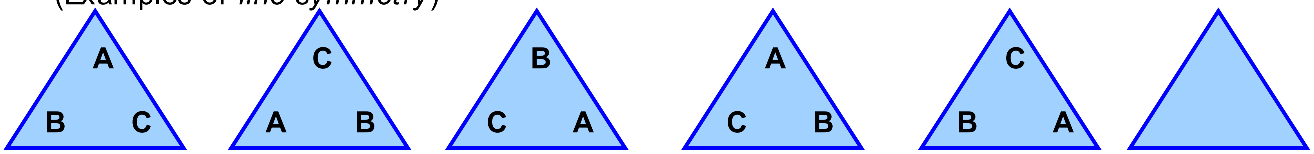
For example, an equilateral triangle ABC may be:
- rotated 120° (so that A→B, B→C and C→A) [[(A,B,C)]]
- rotated 240° (A→C, B→A and C→B). [[(A,C,B)]]

(Examples of *point symmetry* or *rotational symmetry*)



The triangle may also be:
- reflected through the altitude from A … A stays put, B→C, C→B … (A) (BC)
- reflected through the altitude from B [[(B) (A,C)]]
- reflected through the altitude from C. [[(C) (A,B)]]

(Examples of *line symmetry*)



I	σ_1	σ_2	ρ_1	ρ_2	ρ_3
Rotate 360° *(identity)*	*Rotate 120°*	*Rotate 240°*	*Flip over altitude A*	*Flip over altitude B*	*Flip over altitude C*
(A)(B)(C)	(ABC)	(ACB)	(A) (BC)	(B)(AC)	( )( )

Together with the 360° rotational symmetry (which is tantamount to leaving the figure alone!), which every figure has, these symmetries form "the symmetry group of an equilateral triangle".

1. The letter A has *line* symmetry. Draw the line of reflection, or line of symmetry.

2. The letter B also has *line* symmetry. Check out these: C D E F Z

3. Do any of these letters have *rotational* symmetry?

A B C D E F G H I J K L M

N O P Q R S T U V W X Y Z

4. Find all the symmetries of each of the following:

a. isosceles triangle region

b. scalene quadrilateral

c. isosceles trapezoid region

d. parallelogram region

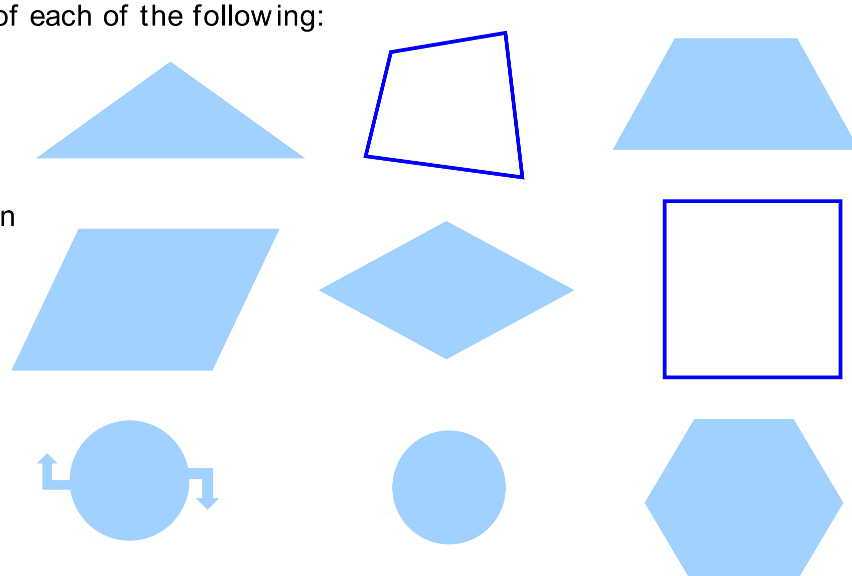
e. rhombus region

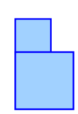
f. square

g. regular hexagon region

h. circular region

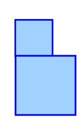
i. the figure at right ↗





5. Name a figure that has TRANSLATIONAL SYMMETRY!

6. Add one square to this figure so that it will have one line & no rotational symmetry.
Add one square to this figure so that it will have one rotational & no line symmetry.

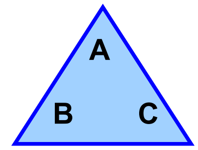


SYMMETRIES: A **symmetry** is a rigid transformation of a figure **onto itself**.

For example, an equilateral triangle ABC may be:

- rotated 120° (so that A→B, B→C and C→A) [[(A,B,C)]]
- rotated 240° (A→C, B→A and C→B). [[(A,C,B)]]

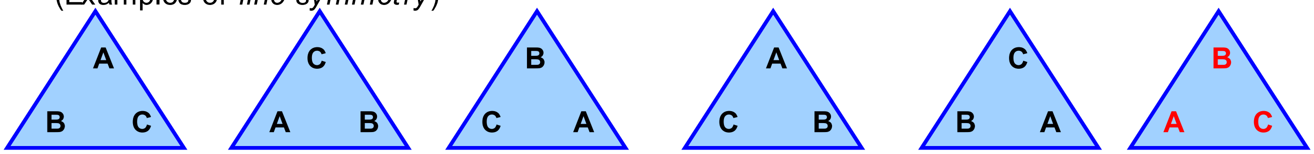
(Examples of *point symmetry* or *rotational symmetry*)



The triangle may also be:

- reflected through the altitude from A ... A stays put, B→C, C→B ... (A) (BC)
- reflected through the altitude from B [[(B) (A,C)]]
- reflected through the altitude from C. [[(C) (A,B)]]

(Examples of *line symmetry*)



I	σ_1	σ_2	ρ_1	ρ_2	ρ_3
Rotate 360° *(identity)*	*Rotate 120°*	*Rotate 240°*	*Flip over altitude A*	*Flip over altitude B*	*Flip over altitude C*
(A)(B)(C)	(ABC)	(ACB)	(A) (BC)	(B)(AC)	(AB)(C)

Together with the 360° rotational symmetry (which is tantamount to leaving the figure alone!), which every figure has, these symmetries form "the symmetry group of an equilateral triangle".

1. The letter A has *line* symmetry. Draw the line of reflection, or line of symmetry.

2. The letter B also has *line* symmetry. Check out these: C D E F Z

None (F) None (Z)

See below

3. Do any of these letters have *rotational* symmetry?

A B C D E F G H (180°) I (180°) J K L M

N (180°) O (180° *) P Q R S (180°) T U V W X (180°) Y Z (180°)

* A circle has infinitely many rotational symmetries; the letter O here is not a perfect circle.

4. Find all the symmetries of each of the following:

a. isosceles triangle region

b. scalene quadrilateral

c. isosceles trapezoid region

d. parallelogram region

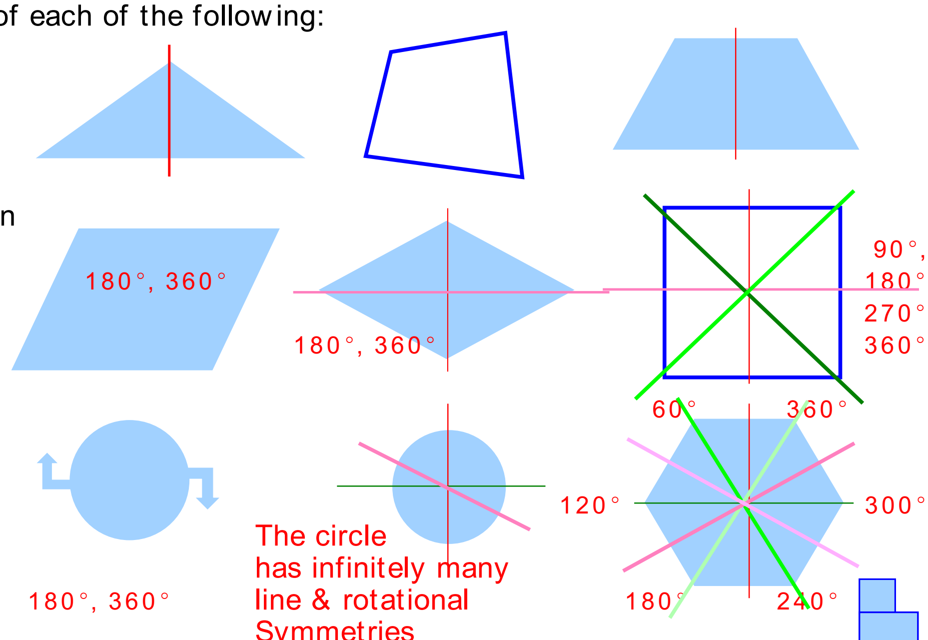
e. rhombus region

f. square

g. regular hexagon region

h. circular region

i. the figure at right ↗

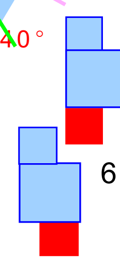


5. A line can be translated along its length. A plane. A frieze design.

6A. Add one square to this figure ...so that it will have one line & no rotational symmetry.

6B. ...so that it will have one rotational & no line symmetry.

Other creative solutions to #5&6 exist, but we show the most obvious here.



6A

6B