

MATHEMATICS

Class-VI

Topic-11

SYMMETRY



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TERMINOLOGIES

Reflection symmetry, mirror symmetry, line of symmetry, axis of symmetry.

INTRODUCTION

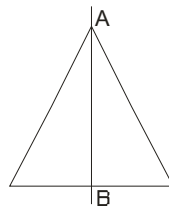
The world is full of beautiful things. Some of them are natural, whereas some of them are man made. Many of these things are beautiful because they possess symmetry . Symmetry refers to the exact match in shape and size between two halves of an object. That is if we fold a picture in half and both the halves – left half and right half – match exactly then we can say that the picture is symmetrical.

11.1 SYMMETRY
(a) Reflection Symmetry

If we draw a vertical line at the middle, the portions on either side of the line are identical. Similarly, in nature we find many flowers, leaves, etc., that have two identical sides if we draw a line through the middle of them.

(b) Mirror Symmetry

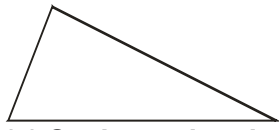
Reflection symmetry is the symmetry with respect to reflection. If a mirror is placed along the line at the middle, the half part of the figure reflects through the mirror creating the remaining identical half. In other words, the line where the mirror is placed divides the figure into two identical parts they are of the same size and also every specific part on one side of the line will have its reflection exactly at the same distance on the other side. Thus, it is also known as mirror symmetry or mirror image symmetry.

(c) Line of Symmetry Or Axis of Symmetry


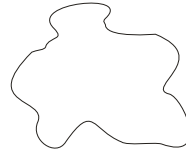
The line AB divides the given figures into two identical parts. If a figure is folded along the line AB, one half of the figure will coincide exactly with the other half. In other words, one half is the mirror image of the other half. In such cases we say that the figure is symmetrical and the line which divides the figure into two identical parts is called the line of symmetry or the axis of symmetry.

(d) Two or More Lines of Symmetry

Some objects and figures have no line of symmetry, a scalene triangle is not symmetrical. We can say that a scalene triangle is asymmetrical. The irregular shapes have no line of symmetry.

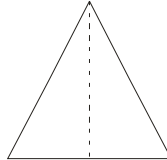


(a) Scalene triangle

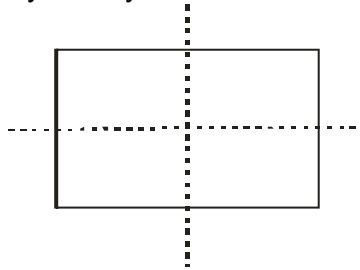


(b) Irregular shape

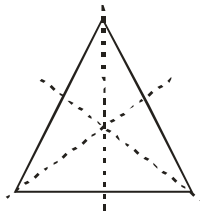
Some objects and figures have more than one line of symmetry. Through this isosceles triangle you can draw one line of symmetry.



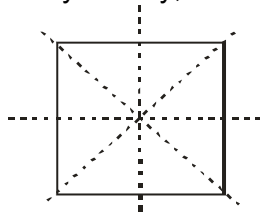
A rectangle has two lines of symmetry.



If we take an equilateral triangle, we can find that three lines of symmetry can be drawn through the triangle



A square would have four lines of symmetry,

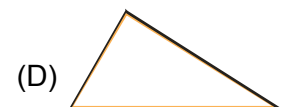
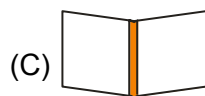
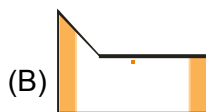
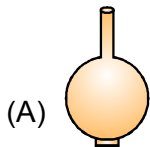


A circle has infinite lines of symmetry.

Ask yourself _____



1. Which of the following figures are symmetrical ?

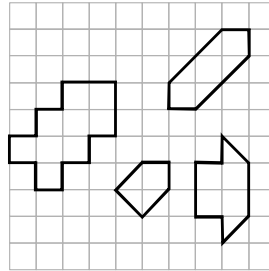




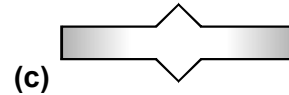
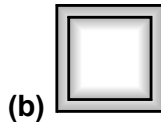
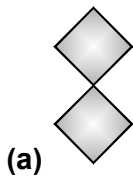
2. Given below are some letters of English alphabet. Draw a line of symmetry in each symmetrical figure.

C F D J T U K

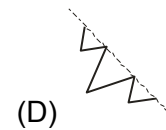
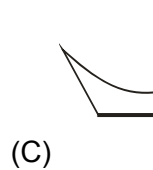
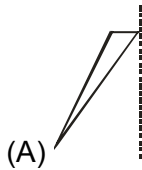
3. Draw the line of symmetry for the following figures :



4. Draw the two lines of symmetry in the following figures :



5. Complete the following figures along the line of symmetry :



Answers

1. (A), (C)



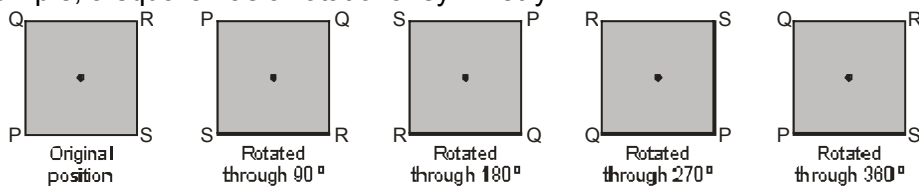
Add your knowledge

Rotational Symmetry : If a shape can fit exactly into itself after a certain rotation (not a full one) about a fixed point (called centre of rotation) then it is said to have rotational symmetry. The angle of turning during rotation is called the **angle of rotation**.

NOTE :

A full rotation does not mean that figure has rotational symmetry as every shape could fit exactly into itself after a full rotation .

For example, a square has a rotational symmetry.

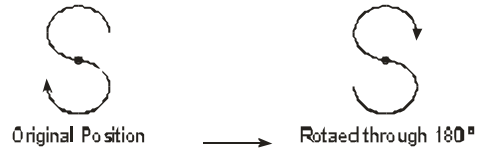


Order of Rotational Symmetry : The number of times a shape fits onto itself in one complete turn is called the order of rotational symmetry.

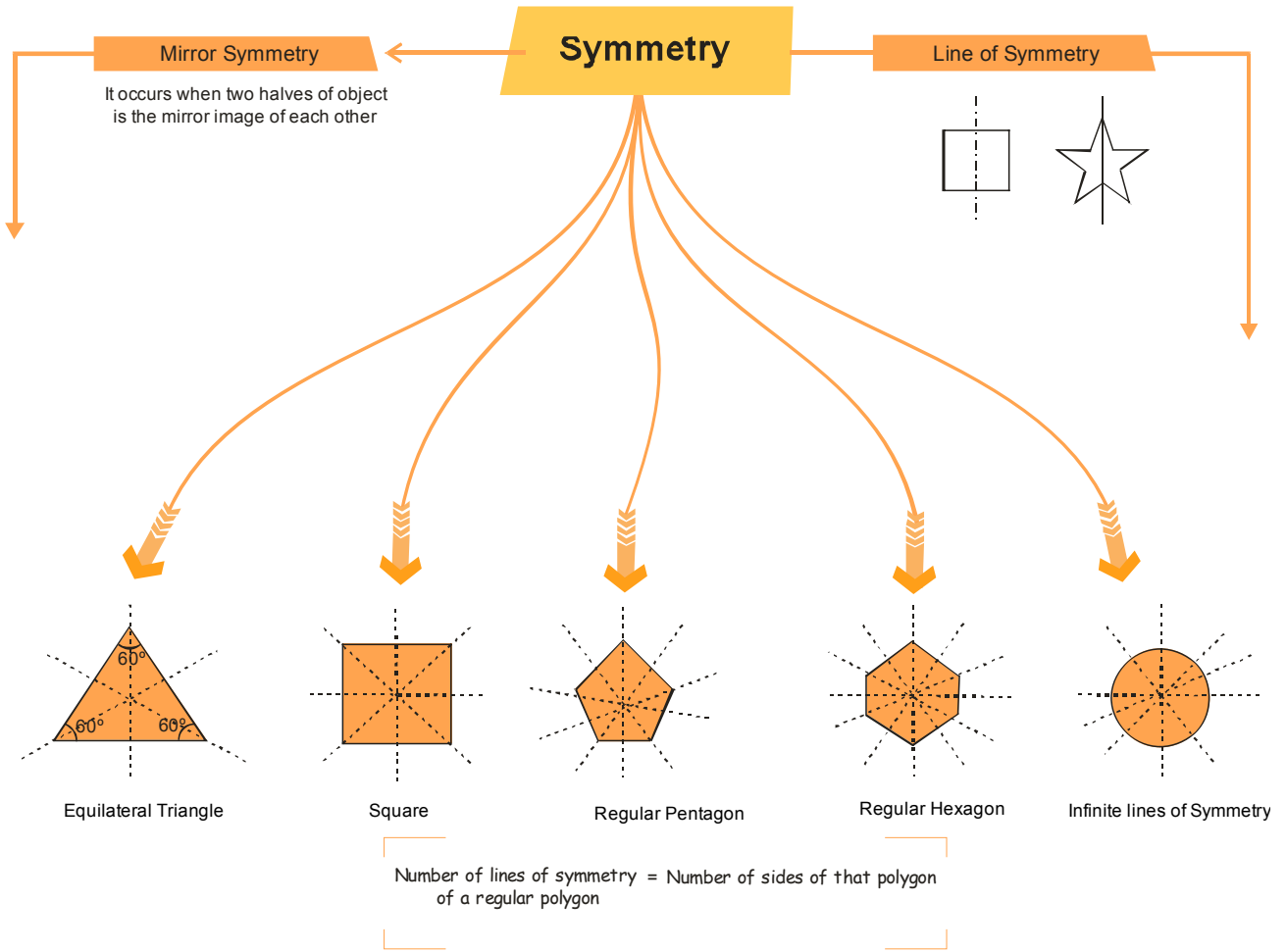
For example, an equilateral triangle has rotational symmetry of order 3 as there are three positions where it appears not to have moved

Point Symmetry :

Some figures appear to be in the same position rotated through half turn (180°) about a fixed point , they are said to have point symmetry.








Concept Map



Summary

1. A line of symmetry divides the figure in two identical parts.
2. Figures can have one line of symmetry, two lines of symmetry, three or more lines of symmetry.
3. An equilateral triangle has three lines of symmetry.
4. An isosceles triangle has one line of symmetry.
5. A scalene triangle has no line of symmetry.
6. An isosceles right-angled triangle has one line of symmetry.
7. A rectangle has two lines of symmetry.
8. A square has four lines of symmetry.
9. Reflection and symmetry are related to each other.

EXERCISE
01
SECTION -A (FIXED RESPONSE TYPE)

1. Which of the following letters does not have any line symmetry ?
 (A) H (B) V (C) Z (D) I
2. How many lines of symmetry does a rectangle have?
 (A) 1 (B) 2 (C) 4 (D) None
3. Which of the following figures does not have 4 lines of symmetry ?
 (A)  (B)  (C)  (D) 
4. Which of the following letters has 2 lines of symmetry?
 (A) M (B) T (C) X (D) C
5. How many lines of symmetry does a butterfly have?
 (A) 1 (B) 2 (C) 0 (D) 3
6. A triangle which has no lines of symmetry is :
 (A) isosceles triangle (B) scalene triangle
 (C) equilateral triangle (D) right angled triangle
7. An equilateral triangles is symmetrical about each of its
 (A) Altitudes (B) Medians (C) Angle bisectors (D) All the above
8. The total number of lines of symmetry of a square is
 (A) 1 (B) 2 (C) 3 (D) 4
9. The no of lines of symmetry of a kite is
 (A) 0 (B) 1 (C) 2 (D) 3
10. The number of lines of symmetry of a regular octagon is
 (A) 3 (B) 5 (C) 8 (D) 10
11. The number of lines of symmetry of the figure  is
 (A) 2 (B) 4 (C) 0 (D) 1
12. Which of the following shapes has more than one line of symmetry?
 (A) Semi-Circle (B) Kite
 (C) Isosceles triangle (D) Rhombus
13. How many lines of symmetry does a rhombus have ?
 (A) 1 (B) 4 (C) 2 (D) 3
14. Alphabet C has :
 (A) vertical line of symmetry (B) horizontal line of symmetry
 (C) neither vertical nor horizontal (D) no line of symmetry
15. A circle has :
 (A) no line of symmetry (B) infinite lines of symmetry
 (C) one line of symmetry (D) none of these
16. Name the quadrilateral which have only one line of symmetry:
 (A) square (B) rhombus (C) kite (D) rectangle

17. Alphabet H has :
 (A) vertical line of symmetry (B) horizontal line of symmetry
 (C) (A) and (B) both (D) no line of symmetry
18. Which of the following words is made of letters having only horizontal line of symmetry?
 (A) MAT (B) HAT (C) BED (D) MOM
19. A rhombus is symmetrical about :
 (A) each of its diagonals
 (B) the line joining the midpoints of opposite sides
 (C) perpendicular bisector of each of the sides
 (D) None of these

FILL IN THE BLANKS




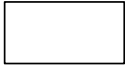

- A parallelogram has _____ line of symmetry
- Scalene triangle has _____ axis of symmetry
- A rhombus has _____ line of symmetry
- A circle has _____ line of symmetry
- _____ triangle has 3 axis of symmetry.

TRUE / FALSE

- A figure can not have more than 2 axis of symmetry.
- Alphabets can also have line of symmetry.
- A rhombus is symmetrical along its diagonal.
- 'H' has 3 lines of symmetry.
- An isosceles right angled triangle is one line of symmetry.

MATCH THE COLUMNS

1. Match the shape in column A with into axis of symmetry in column B

| Column – I | Column – II |
|--|--------------|
| (A)  (Square) | (p) Infinite |
| (B)  (Isosceles triangle) | (q) 2 |
| (C)  (Circle) | (r) 4 |
| (D)  (Rectangle) | (s) 3 |
| (E)  (Equilateral triangle) | (t) 1 |

2. Match the Alphabets in column I with the no of symmetry lines they have in column II

Column – I

- (A) B
- (B) O
- (C) Z

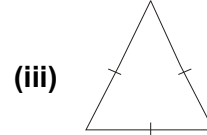
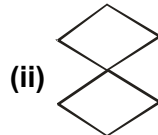
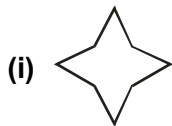
Column – II

- (p) infinite
- (q) 0
- (r) 1

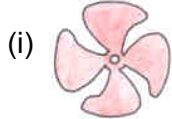
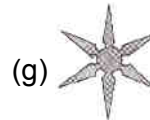
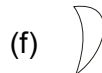
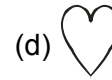
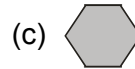
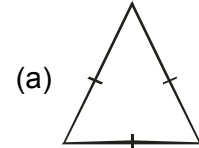
SECTION -B (FREE RESPONSE TYPE)

VERY SHORT ANSWER TYPE

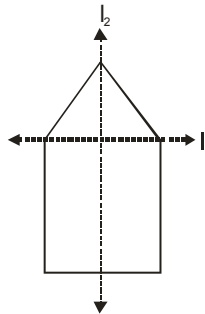
1. The number of line of symmetry in a kite-shaped figure is ?
2. Trace each of the following figures and draw the line of symmetry, if any.



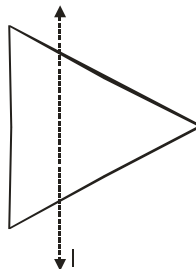
3. Which of the following have lines of symmetry ? How many lines of symmetry does each have ? Draw the lines of symmetry in each of the following.



4. For the following figure, which one is the mirror line (or line of symmetry) l_1 or l_2 ?

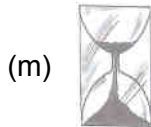
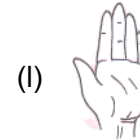
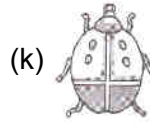
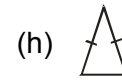
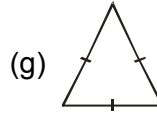
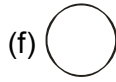
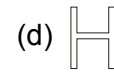
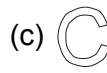
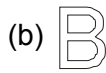
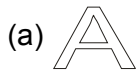


5. In the adjoining figure, line l is the line of symmetry. Draw the image of the triangle and complete the figure so that it becomes symmetrical about line l .



SHORT ANSWER TYPE

6. Draw as many lines of symmetry as possible for each figure.



7. Can you draw a triangle having :

(i) exactly one line of symmetry

(ii) exactly two lines of symmetry

(iii) three lines of symmetry

(iv) no line of symmetry

8. Draw a quadrilateral having

(a) no line of symmetry

(b) one line of symmetry

(c) four lines of symmetry

LONG ANSWER TYPE

9. Consider the english alphabet A to Z . list among them the letters which have

(i) vertical lines of symmetry

(ii) horizontal lines of symmetry

(iii) vertical and horizontal lines of symmetry

(iv) no line of symmetry

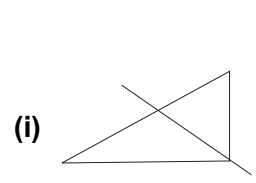
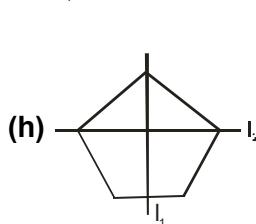
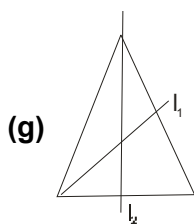
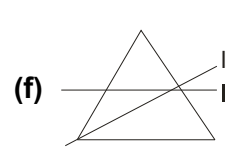
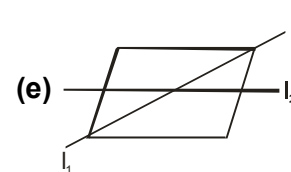
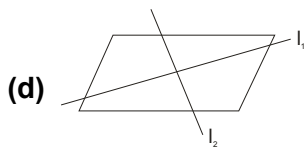
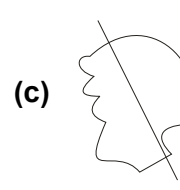
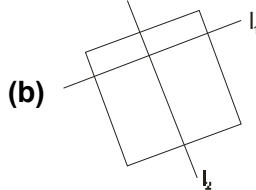
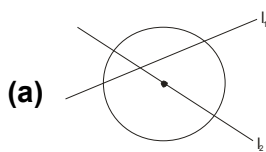
10. How many axes of symmetry can be drawn through:

(a) the English letter C

(b) an isosceles trapezium

(c) a regular pentagon

11. Name the lines which are not lines of symmetry in each of the following.



12. On a squared paper, sketch the following:
- (i) A triangle with a horizontal line of symmetry but no vertical line of symmetry.
 - (ii) A quadrilateral with both horizontal and vertical lines of symmetry.
 - (iii) A quadrilateral with horizontal line of symmetry but no vertical line of symmetry.
 - (iv) A hexagon with exactly two lines of symmetry.
13. Answer the following.
- (a) Make a list of all the capital alphabets in English which have only one line of symmetry.
 - (b) Make a list of all the capital alphabets in English which have two lines of symmetry.
 - (c) Make a list of all the capital alphabets in English which have no line of symmetry.


EXERCISE


02


SECTION -A (COMPETITIVE EXAMINATION QUESTION)


MULTIPLE CHOICE QUESTIONS

1. Which of the following letters does not have the vertical lines of symmetry?
 (A) M (B) H (C) E (D) V
2. Which of the following letters have both horizontal and vertical lines of symmetry?
 (A) X (B) E (C) M (D) K
3. Which of the following letters has only one line of symmetry ?
 (A) H (B) X (C) Z (D) T
4. In the following figures, the figure that is not symmetric with respect to any line is :


 (i)

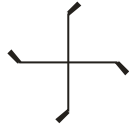
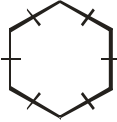

 (ii)

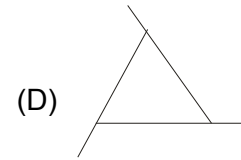
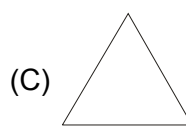
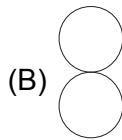
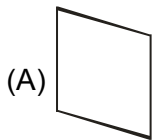

 (iii)


 (iv)

 (A) (i) (B) (ii) (C) (iii) (D) (iv)
5. The number of lines of symmetry in a ruler is
 (A) 0 (B) 1 (C) 2 (D) 4
6. The number of lines of symmetry in a divider is
 (A) 0 (B) 1 (C) 2 (D) 3
7. The number of lines of symmetry in a geometry box is
 (A) 0 (B) 1 (C) 2 (D) 3
8. Is there any letter of English having 3 lines of symmetry ?
 (A) Yes (B) No (C) cannot be said (D) None of these
9. The number of lines of symmetry in a $45^\circ - 45^\circ - 90^\circ$ set-square is
 (A) 0 (B) 1 (C) 2 (D) 3
10. The number of lines of symmetry in a $30^\circ - 60^\circ - 90^\circ$ set-square is
 (A) 0 (B) 1 (C) 2 (D) 3

SECTION -B (TECHIE STUFF)

11. Which of the following letters have rotational symmetry ?
 (A) D (B) H (C) M (D) U
12. The order of rotational symmetry of figure is

 (A) 5 (B) 4 (C) 3 (D) 0
13. The order of rotational symmetry of figure is

 (A) 3 (B) 6 (C) 4 (D) 0
14. Which of the following letters of English alphabet have both line symmetry and rotational symmetry.
 (A) C (B) M (C) I (D) N
15. Which of the following figures does not have both line symmetry and rotational symmetry.



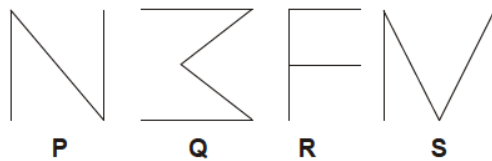
EXERCISE

03

(PREVIOUS YEAR EXAMINATION QUESTIONS)

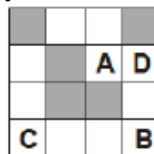
1. Which of the following has no lines of symmetry? **(NSTSE 2010)**
 (A) A rectangle (B) A circle
 (C) A Scalene triangle (D) A square

2. Which of the following shapes do not have a line of symmetry? **(IMO 2010)**



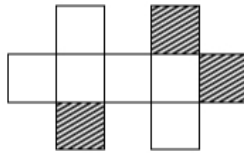
- (A) P and Q only (B) P and R only (C) Q and R only (D) Q and S only

3. Which of the following squares would you shade to make the figure symmetrical?



- (A) B and D (B) A and C (C) D and C (D) B and C **(IMO 2010)**

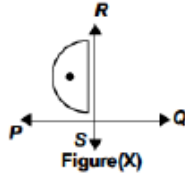
4. How many minimum squares must be shaded to make the given figure symmetric ?



(IMO 2011)

- (A) 1 (B) 2 (C) 3 (D) 4

5. Which of the following shows a reflection of the figure (x) across the RS? (IMO 2012)



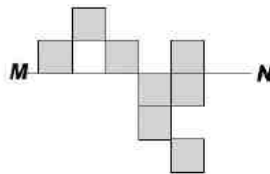
- (A) (B) (C) (D)

6. Which of the following shows a symmetric figure?

(IMO 2012)

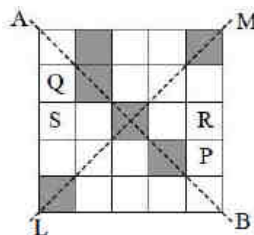
- (A) (B) (C) (D)

7. What is the least number of squares that must be added so that the line MN becomes a line of Symmetry? (IMO 2012)



- (A) 5 (B) 6 (C) 4 (D) 8

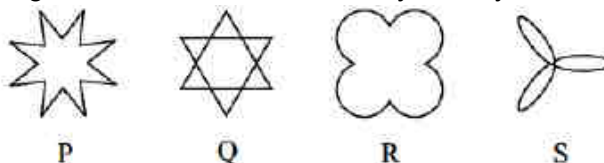
8. Which of the following square(s) must be shaded so that given figure is symmetric along both lines LM and AB? (IMO 2014)



- (A) R and S (B) P only (C) Q and P (D) Q only

9. Which of the following have at least two lines of symmetry?

(IMO 2014)



- (A) Only P (B) Both P and Q (C) Both Q and R (D) P, Q, R and S

ANSWER KEY
EXERCISE 01
SECTION -A (FIXED RESPONSE TYPE)

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|
| Ans. | C | B | C | C | A | B | D | D | B | C | C | D | C | B | B | C | C | C | A |

FILL IN THE BLANKS

1. 0 2. no 3. 2 4. infinte
 5. equilateral

TRUE / FALSE

1. False 2. True 3. True 4. False
 5. True

MATCH THE COLUMNS

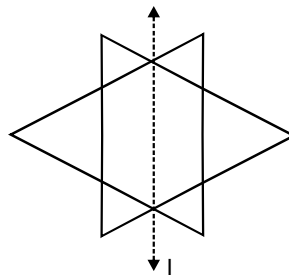
1. (A)– r, (B)–t, (C)–p, (D)–q, (E)–s 2. (A)– r, (B)–p, (C)–q

SECTION -B (FREE RESPONSE TYPE)
VERY SHORT ANSWER TYPE

1. 1 2. (i) 4 (ii) 2 (iii) 3
 3. (a) 1 (b) 2 (c) 6 (d) 1 (e) 2
 (f) 0 (g) 6 (h) 1 (i) 0

4. I_2

5.


SHORT ANSWER TYPE

6. (a) 1 (b) 1 (c) 1 (d) 2 (e) 1 (f) infinite
 (g) 3 (h) 1 (i) 2 (j) 1 (k) 1 (l) 0
 (m) 1
7. (i) Yes, an isosceles triangle (ii) no
 (iii) Yes, an equilateral triangle (iv) Yes, a scalene triangle
8. (a) any quadrilateral having no equal side (b) Kite
 (c) Square

LONG ANSWER TYPE

10. (a) 1 (b) 1 (c) 5
11. (a) l_1 (b) l_1 (c) l_1
 (d) l_1, l_2 (e) l_1, l_2 (f) l_2
 (g) l_1 (h) l_2 (i) l_1
13. (a) A, B, C, D, E, K, M, T, U, V, W, Y (b) H, I, X
 (c) F, G, J, L, N, P, Q, R, S, Z

EXERCISE >> 02

SECTION -A (COMPETITIVE EXAMINATION QUESTION)

MULTIPLE CHOICE QUESTIONS

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|-------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| Ans. | C | A | D | B | C | B | C | A | B | A | B | B | B | C | D |

EXERCISE >> 03

(PREVIOUS YEAR EXAMINATION QUESTIONS)

| Ques. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-------|---|---|---|---|---|---|---|---|---|
| Ans. | C | B | B | B | B | B | B | C | D |