PROBLEM BASED ON VISUAL ABILITY

Contents

2.2 PROBLEM BASED ON VISUAL ABILITY

In such type of problems your ability to visualize patterns is tested. Under problems on visual ability, we may incorporate the following types of problems.

(i) Spotting out the embedded figure
(ii) Counting the number of figures
(iii) Making boxes
(iv) Dice problems
(v) Construction of squares

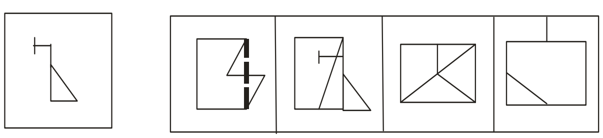
1. Spotting out the Embedded Figure

Embedded Figures: A figure X is said to be embedded in a figure Y, If Y contains figure X as its part.

Spotting out the Embedded Figure: In such a type of problem, a figure (X) is given, followed by four complex figures, in such a way that fig(X) is embedded in one of them. One has to choose that out.

Such problems are purely a test of your visual ability. You should have proper concentration while attempting such types of questions.

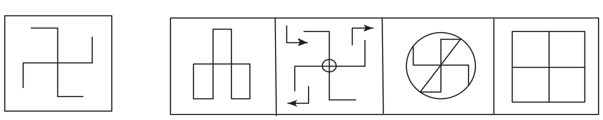
Example:



X a) b) c) d)

Answer: (b)

Example:



X a) b) c) d)

Answer: (b)

2. Counting the Number of Figures

In this type of questions, you are required to count the number of geometrical figures in a given complex figure. For example, you may be asked to count the number of lines or the number of triangles or the number of parallelograms in a given complex figures or to count the number of cubes in a given stack of cubes.

Counting the number of lines

For counting the number of lines in a given figure, divide the lines of the given figure into three categories:

(i) Horizontal lines
(ii) Vertical lines
(iii) Slanting lines

Once you have divided the lines into these categories, counting them would be very easy. Finally add up all of them to get your answer.

Counting triangles
For counting the number of triangles, start with the simplest triangles. By simplest triangles, we mean the smallest triangles that are at once visible to the eye.

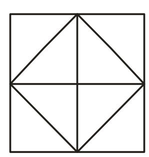
Counting the number of squares, parallelograms and rectangles
The process of counting the number of squares or parallelograms or rectangles is similar to the process of counting triangles. You should start with the simplest squares (or parallelograms or rectangles) and then move on to larger ones.

Counting pentagons, hexagons etc.
Counting pentagons, hexagons etc requires a little more visual ability than the previous examples. First of all you should identify the components that make up the pentagon or hexagon. For example, sometimes two triangles and one parallelogram may make up a pentagon, sometimes two parallelogram and three triangles may be making a hexagon. So first you should identify the components making up a pentagon or hexagon and then attempt the counting.

Counting cubes in a given stack
In these types of questions a stack of cubes is given and you have to count the number of cubes or the stack.

The best way to go about this counting would be to count column by column. First of all make a quick inspection of how many columns have 1 cube, how many columns have 2 cubes, how many have 3 and so on. In this way count the cubes in all the columns and finally add them.

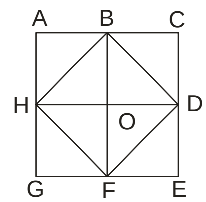
Example: The number of triangles in the following figure is:



(a) 8
(b) 10
(c) 12
(d) 14

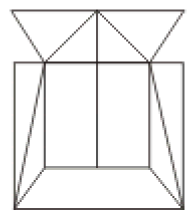
Answer: (c)

The figure is labeled as:



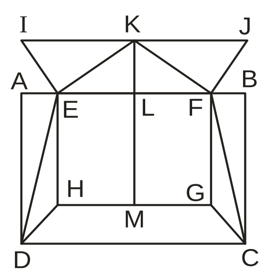
The simplest triangles are ABH, BHO, BOD, BCD, DEF, DOF, HOF and FGH i.e., 8.
The triangles having two components each are HBD, BDF, HDF and BHF i.e., 4.
∴ The total number of triangles in the figure = 8 + 4 =12.

Example: State the minimum number of straight lines required to make the fig. given below:



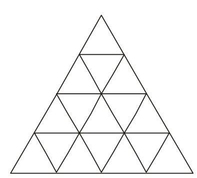
(a) 16
(b) 17
(c) 18
(d) 19

Answer: (b)
All the vertices of the figure are labeled as shown
Horizontal lines are IJ, AB, HG and DC i.e., 4.



Vertical lines are AD, EH, KM, FG and BC i.e. 5
Slanting lines are DE, CF, IE, EK, JF, KF, DH and CG i.e., 8.
Thus, there are 5 + 5 + 8 = 18 straight lines in the figure.

Example: Determine the number of parallelograms in the following figure:

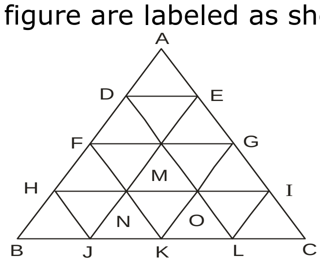


(a) 39
(b) 36

(c) 28
(d) 20

Answer: (a)

All the vertices in the figure are labeled as shown below:



The parallelograms composed of two triangles each are ADME, DFNM, EMOG, FHJN, MNKO, GOLI, DEGM, FMON, MGIO, HNKJ, NOLK, OICL, DEMF, MGON, FMNH, OILK, NOKJ and HNJB i.e., 18.

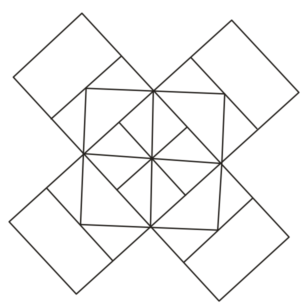
The parallelograms composed of four triangles each are AGOD, EILM, DOKF, AFNE, DHJM, ENKG, NICK, HOLJ, FGIN, HOKB, NILJ and FGOH i.e., 12.

The Parallelograms composed of six triangles each are HICJ, HILB, DECL, ADLI, AEJH and DEJB i.e., 6.

The parallelograms composed of eight triangles each, are FGCK, FGKB and AGKF i.e., 3.

∴ Total number of parallelograms in the figure = 18 + 12 + 6 + 3 = 39.

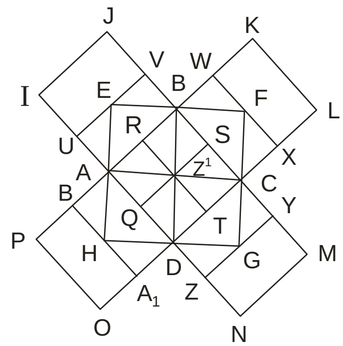
Example: How many squares does the following figure have?



(a) 22
(b) 20
(c) 18
(d) 16

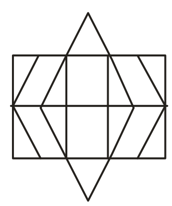
Answer: (c)

All the vertices in the figure are labeled as shown below:



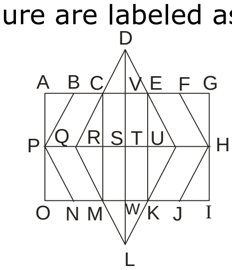
The squares having two components each are BRZS, CSZT, DTZQ and AQZR i.e., 4.
The squares having three components each are FBZ'C, GCZ'D, HDZ'A and EAZ'B i.e., 4.
The squares having four components each are APOD, DNMC, BCLK and BJIA i.e., 4.
The squares having seven components each, are UVSQ, WXTR, YZQS and A_1B_1RT i.e., 4.
ABDC is the only square having eight components.
EFGH is the only square having twelve components.
∴ In all, there are 4 + 4 + 4 + 4 + 1 + 1 = 18 squares in the figure.

Example: Determine the number of rectangles and hexagons in the following figure:



(a) 8 rectangles, 3 hexagons
(b) 15 rectangles, 3 hexagons
(c) 24 rectangles, 5 hexagons
(d) 30 rectangles, 5 hexagons

Answer: (d)
All the vertices in the figure are labeled as shown below:



The simplest rectangles are CVSR, VETS, STKW and RSWM i.e., 4.
The rectangles having two components each are CETR, RTKM, CVWM and VEKW i.e., 4.
The rectangles having three components each are ACRP, EGHT, THIK and PRMO i.e., 4.

The rectangles having four components each are AVSP, VGHS, SHIW, PSWO and CEKM i.e., 5.
The rectangles having five components each are AETP, CGHR, RHIM and PTKO i.e., 4.
The rectangles having six components each are ACMO and EGIK i.e., 2.
The rectangles having eight components each are AGHP, PHIO, AVWO and VGIW i.e., 4.
The rectangles having ten components each are AEKO and CGIM i.e., 2.
AGIO is the only rectangle having sixteen components.
∴ Total number of rectangles in the given figure = 4 + 4 + 4 + 5 + 4 + 2 + 4 + 2 + 1 = 30.
Also, the hexagons in the given figure are CDEKLM, CEUKMQ, CFHJMQ, BEUKNP and BFHJNP.
∴ There are 5 hexagons in the given figure.

3. Making Boxes

In these questions six squares are given, attached to each other in one way or the other. Now you are required to mentally fold the squares such that a box is created. Now, you have to compare the box with four of the answer choices and predict which answer-choices are similar to the box.

The rule of 'third'

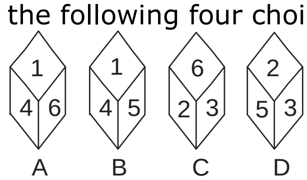
A rule to determine which square is opposite to which one is called the rule of 'third'.

The rule is: If three squares lie in a straight row then starting from any square (say X) the third square of that row will be opposite the square (X) when the box is constructed.

The rule of 'not opposite'

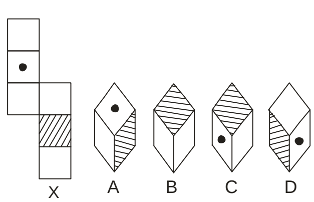
Look at the four answer choices given with the sample example given in the beginning of this section. There are four choices, each giving a view of the box when it is closed. Now, in this 'view' three faces of the box are visible. These three faces are adjacent faces. In fact, in any 'view' of a box, only its adjacent faces can be seen together. It is impossible to have any one face and its opposite face simultaneously in one single view. This gives rise to our rule of 'not opposite' which says that.

For example, consider the following four choices based in Fig.



Now, by the rule of third we have already determined that in Fig. 1 is opposite 3, 4 is opposite 6, and 2 is opposite 5. ∴ By the rule of 'Not opposite', it is impossible to have 1 and 3 together or 4 and 6 together or 3 and 5 together in any one choice. Therefore, choices A and D are wrong (In choice A we have 4 and 6 together, in choice D we have 2 and 5 together.) Therefore choices B and C are correct.

Example:



(a) A, B and D
(b) A, B and C only
(c) B only
(d) B and D only

Answer: By the rule of third, we infer that the plain square above the dotted square would come opposite the plain square below the dotted square. Similarly, by the rule of third, the other pair of plain squares will also be opposite each other. Hence, the only pair of squares remaining would be opposite each other i.e., the dotted square would come opposite the shaded square. Therefore, by the rule of not opposite, an answer choice should not have a dotted square and a shaded square together. But figures A, C and D have them together. Therefore only B is correct. Hence answer choice would be (c).

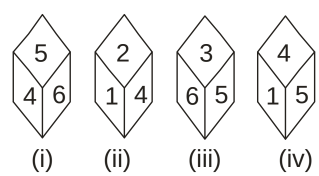
4. Dice Problems

In these problems, some figures are given showing different positions of a dice. The candidate is required to predict the number opposite a given number on the dice. The number opposite a given number can be found by the application of the following simple rules:

The rule of not adjacent

The rule of not adjacent states that if any number appears together with any other number in any one position of the dice then the two numbers will be on adjacent faces and hence they would not be opposite to each other. (In other words two numbers are opposite only if they are not adjacent.)

Example: What number is opposite 3?



(a) 1
(b) 2
(c) 4
(d) 6

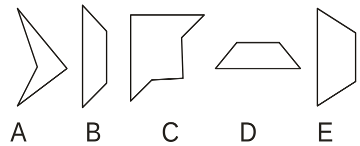
Answer: (c)

Looking at fig, we see that 5 and 6 are adjacent to 3. Now, looking at fig, we see that the same pair of numbers, i.e., 5 and 6, is adjacent to 4. Therefore 3 and 4 are opposite to each other. Hence 4 is opposite 3.

5. Construction of Squares

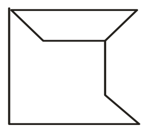
This type of problems has three pieces of a square, in a set of five pieces. Out of the five, the three correct pieces would make up a square. The problem involves the selection of these three correct pieces.

Example: Select three out of the following five alternative figures which together form one of the four alternatives (a), (b), (c) or (d) and when fitted together will form a complete square.

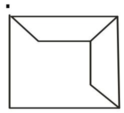


(a) ACD
(b) CDE
(c) BCD
(d) ACE

Answer: We see that C is a part of all the answers. Therefore C must be one of the three correct figures. [It must be so because C is the only fig having a right angle.] Now let us check which of the figures fits with C. We see that fig (B) fits with C as shown:



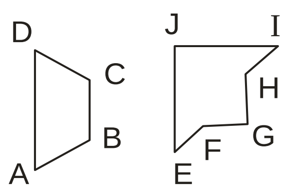
Finally, fig (D) completes the square by fitting into the above combination. The completed square appears as shown:



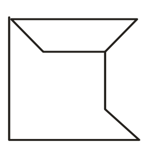
$\therefore$ Figures (B), (C) and (D) will together form a square.
Hence, alternative (b) is the answer.

How can we detect whether a given piece fits with another?

Suppose one of the given pieces is x and other piece is y. Then, see the angles made by all the pairs of adjacent sides in both the figures x and y. If any angle for any pair of adjacent sides of x equals another angle for any pair of adjacent sides of y then measure (mentally) the length of the adjacent sides making this angle in both x and y. If both these lengths are also equal then the two pieces will definitely fit. For example consider the two figures:



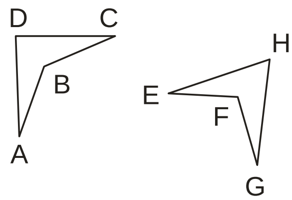
We have named the vertices for our convenience. We see that $\angle EFG = \angle DCB$. Therefore we look at the lengths of the adjacent sides (EF, FG and DC, CD respectively).We see that, DC = EF, CB = FG. It means that since the angle and the sides making the angle are both pair wise equal, the pieces must fit. We find that the pieces would fit indeed resulting in a shape such as the one below:



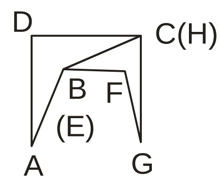
The second and equally important rule

If by placing a fig (x) and another fig (y) in some combination, an extra right angle is generated, then the two pieces are very likely (but not definitely likely) to fit with each other.

This is explained by the following diagram:



We see that $\angle DCB + \angle EHG = 90°$ approximately. (We need not required to measure it. It can be concluded from observation.) Hence if we, $\angle DCG = 90°$ is an extra right angle, combine these two figures an extra right angle may be generated. Hence, generated the two figure may fit. We do this in the following way:



We therefore conclude that while attempting problems on square-making one should begin with a piece that has a right angle (between two outer edges). Then try to fit in another piece into its hollow portion. If this doesn't fit then select another piece. Thus get two pieces fitting into each other and with their help find the third figure too which fits into the pieces to get a complete square. While trying to select which piece would fit in with a pre-selected piece, use the two rules discussed above.