

2015-2016 Math League Contests, Grades 3-4

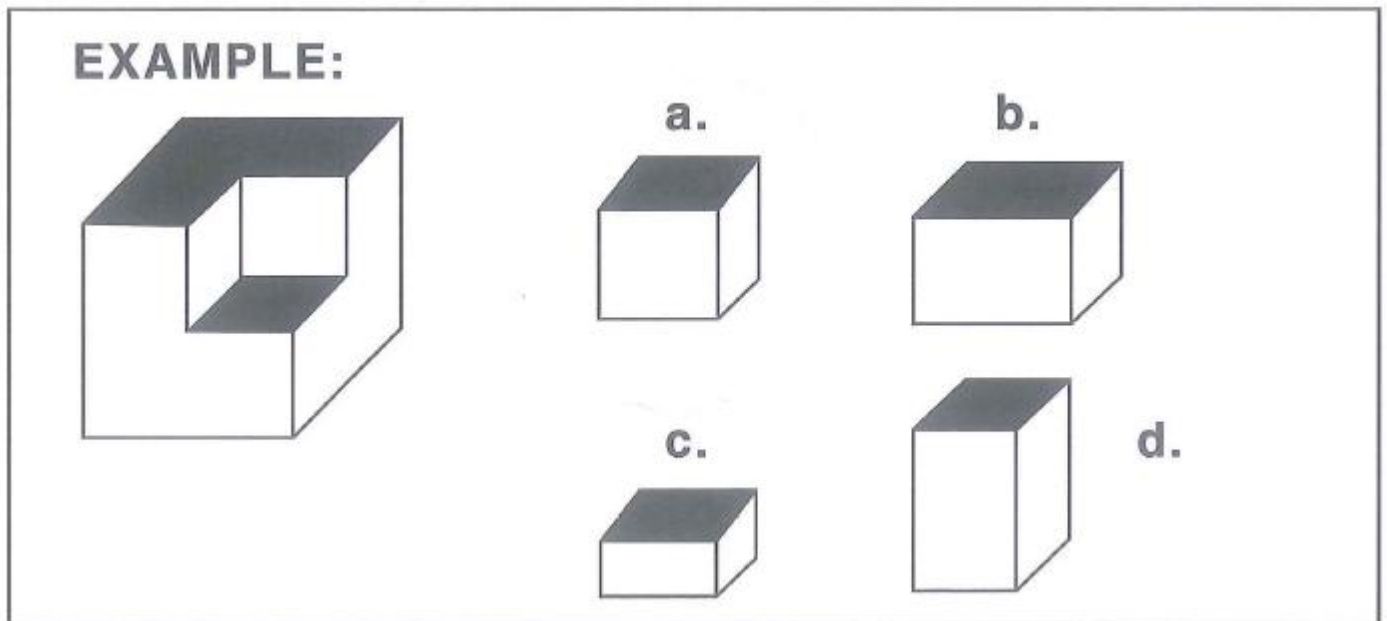
Second-Round, Jan – Feb 2016

Instructions:

1. This second-round contest (Grades 3-4) consists of 42 questions in total. Each question is worth 10 points. Unanswered questions or wrong answers get no credit. The perfect score is 420. These questions are designed to test your ability of math, figural in particular, and verbal.
2. For all the questions below, login to your account at <http://www.mathleague.cn/>, and enter your answers. Answers written on this document or any other place will NOT be credited.
3. **Don't be intimidated by the sheer number of questions and pages in this contest. They are not as hard as they may first appear. They are fun questions. No one is expected to answer all questions correctly. Students who can work out a few questions should be commended.**
4. The more questions you answered correctly, the more credit you will get. The total credit, or perfect score, is 420. The problems are ordered by content, NOT DIFFICULTY. It is to your advantage to attempt problems from throughout the test.
5. You can seek help by reading books, searching the Internet, asking an expert, and etc. But you can't delegate this to someone else and turn in whatever he/she wrote for you. To make it clear, the purpose of the second-round contest is to test your ability to read and research. You need to be the one who understand the topics and solve the problems. You will be caught if it is not the case during the interview.
6. If you have any questions regarding the contest, please contact us at once at INFO@LTHOUGHTS.COM
7. This document contains 39 pages in total, including this page.
8. Submission of your answers:
 - a) For all the questions below, login to your account at <http://www.mathleague.cn/>, and enter your answers. Answers written on this document or any other place will NOT be credited.
 - b) You need to submit your answers no later than 12:00AM, Feb 7, 2016, Beijing Time. Later submission will not be accepted.
9. Subjects tested:
 - a) COMPLETE THE CUBE WITH ONE PIECE (QUESTIONS 1-5)
 - b) RECOGNIZING VIEWS OF A SOLID (QUESTIONS 6-7)
 - c) HOW MANY CUBES MAKE UP THE SOLID? (QUESTION 8)
 - d) RECOGNIZING VOLUME (QUESTIONS 9-11)
 - e) WHICH FIGURE IS NOT CONGRUENT? (QUESTIONS 12-13)
 - f) COMPLETING TRUE-FALSE TABLES (QUESTIONS 14-18)
 - g) RECOGNIZING CONGRUENT PARTS (QUESTION 19)
 - h) FOLLOWING DIRECTIONS (QUESTIONS 20-27)
 - i) STACKING SHAPES (QUESTIONS 28-33)
 - j) DESCRIBING LOCATIONS ON A GRID (QUESTIONS 34-37)
 - k) DEPICTING DIRECTIONS (QUESTIONS 38 – 39)
 - l) DEDUCTIVE REASONING (QUESTIONS 40 – 42)

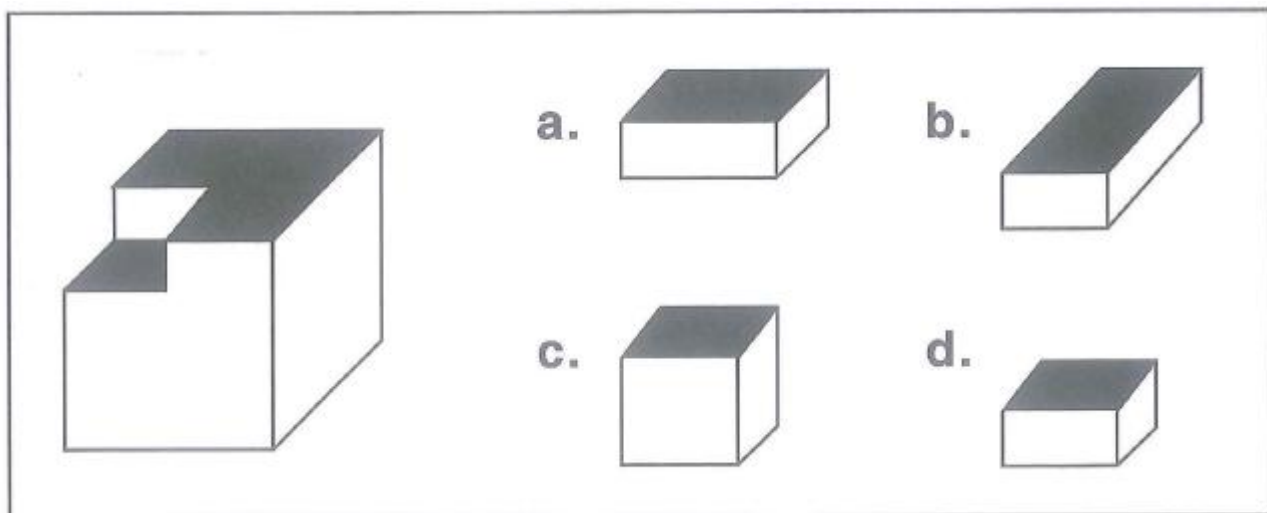
COMPLETE THE CUBE WITH ONE PIECE (QUESTIONS 1-5)

Each cube has a piece missing. Identify the piece that will fit the cube.

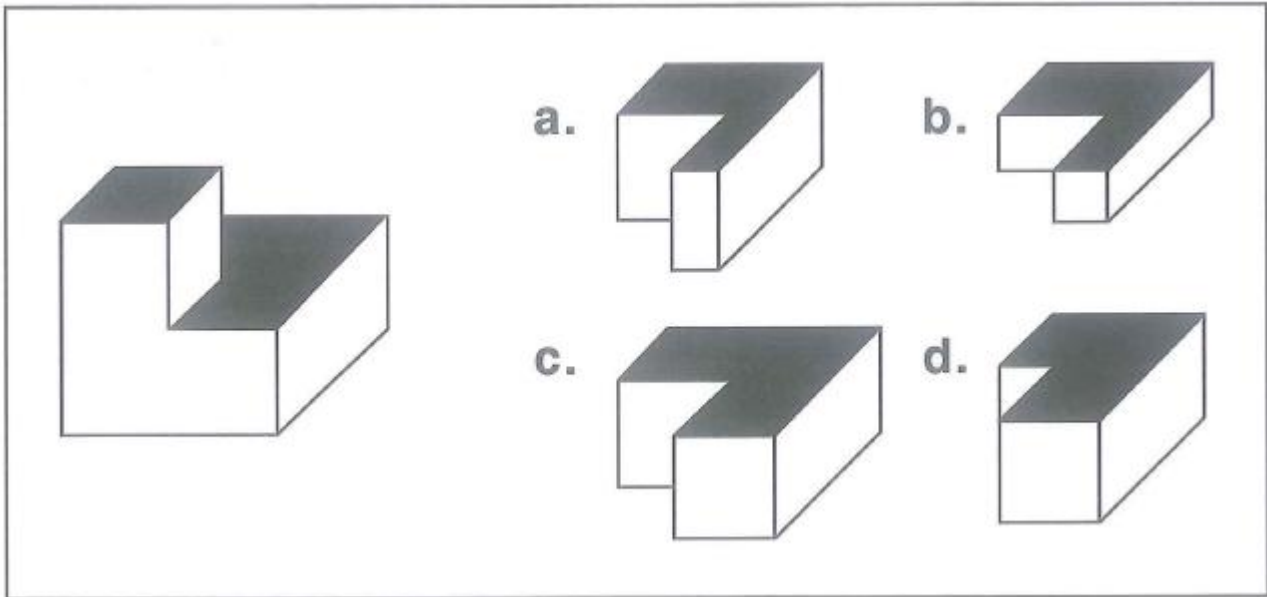


Answer: a.

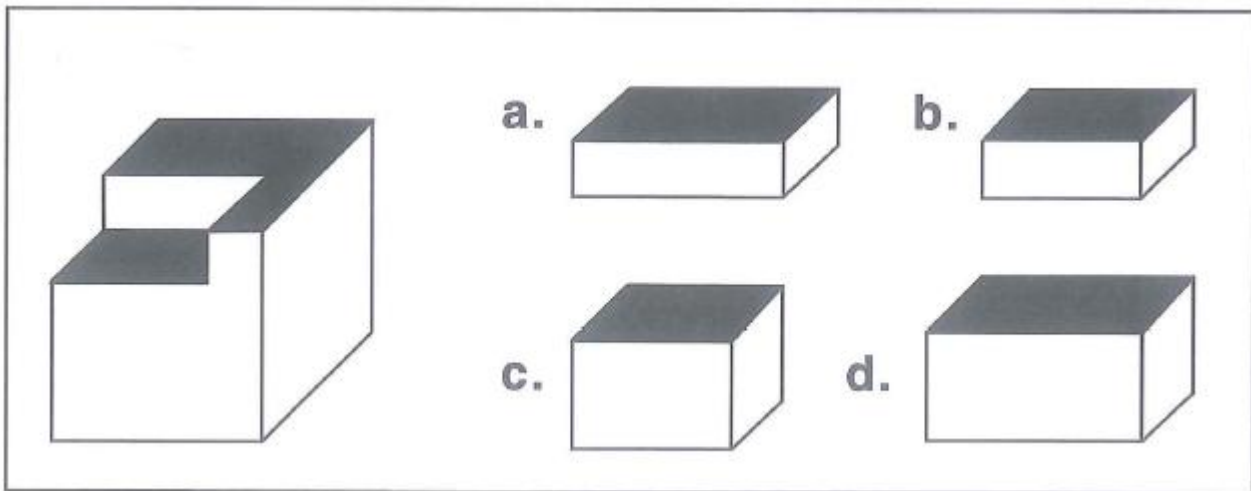
Question 1:



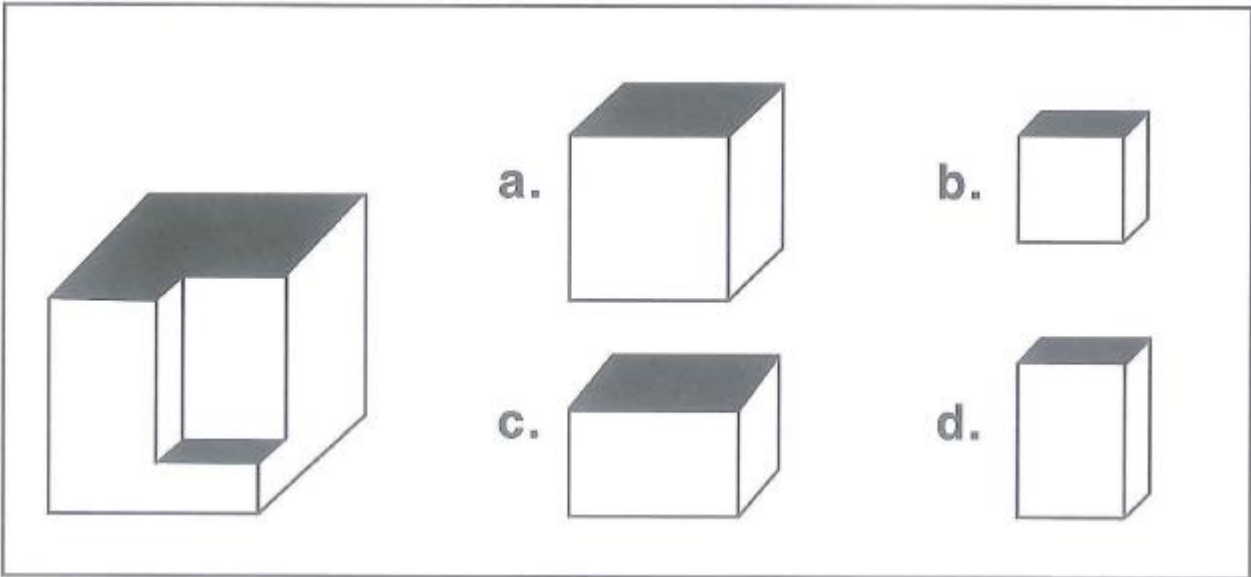
Question 2:



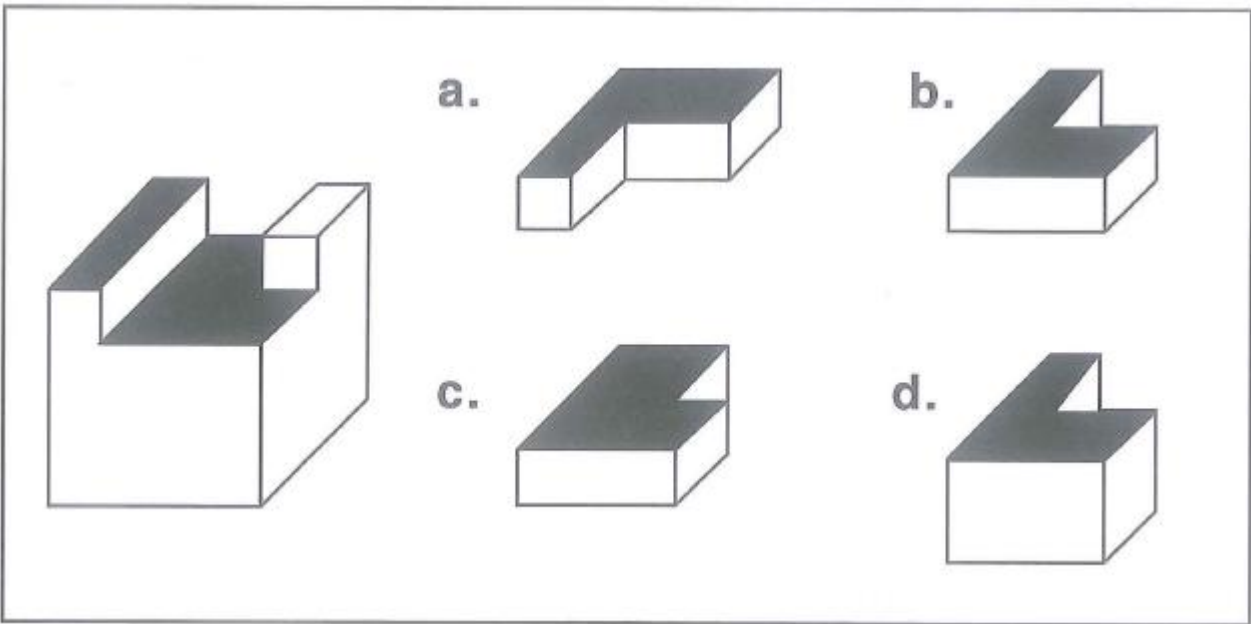
Question 3:



Question 4:

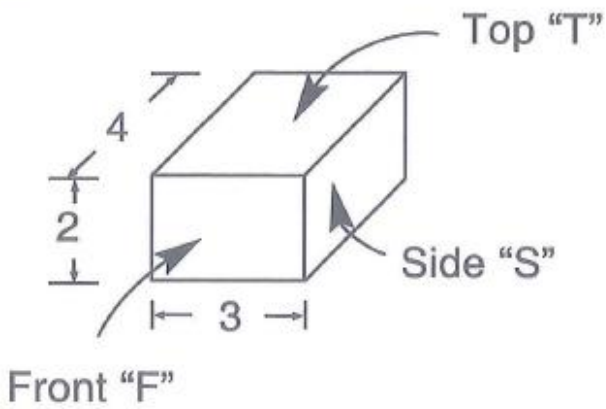


Question 5:



RECOGNIZING VIEWS OF A SOLID (QUESTIONS 6-7)

Imagine that you are drawing a pattern to cover each face of a solid.

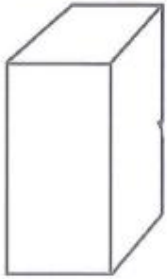


The top is 3 units by 4 units.
The side is 2 units by 4 units.
The front is 2 units by 3 units.

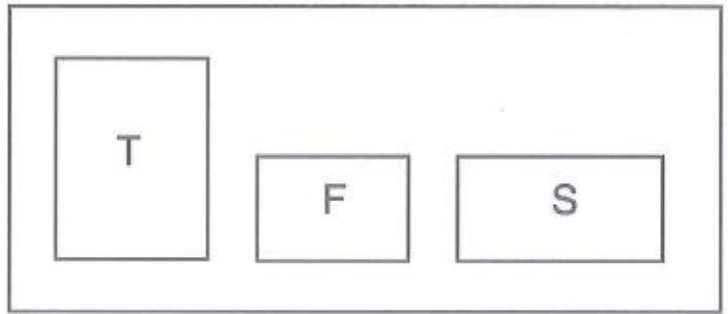
Example:

Which group of pattern pieces fit the following solid on the left?

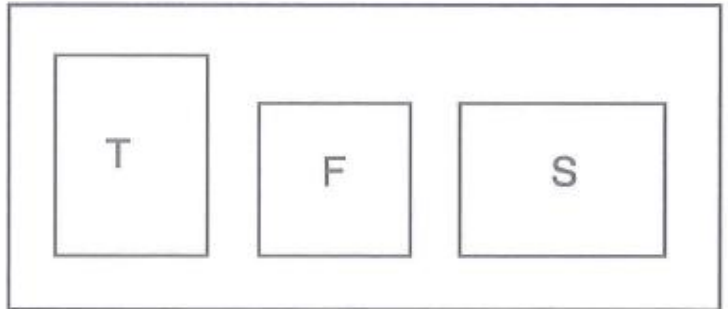
EXAMPLE:



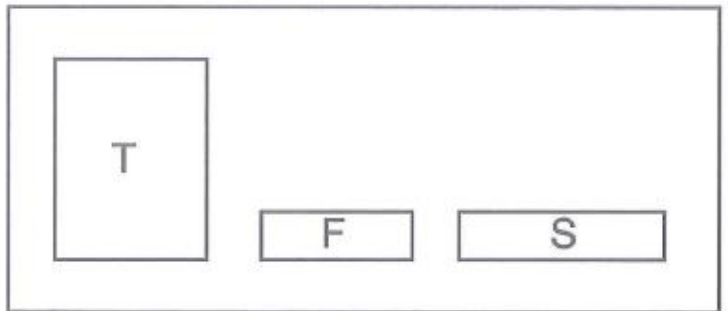
a.



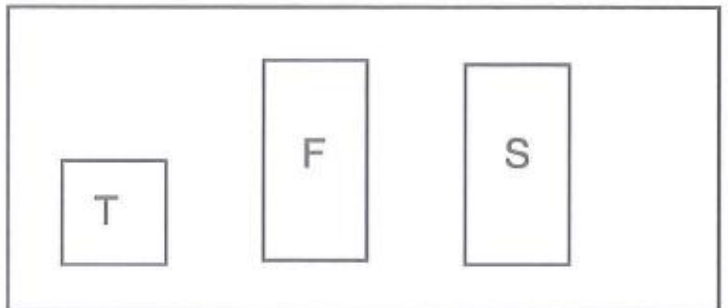
b.



c.



d.

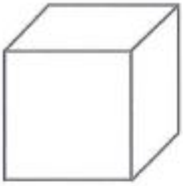


Answer: d.

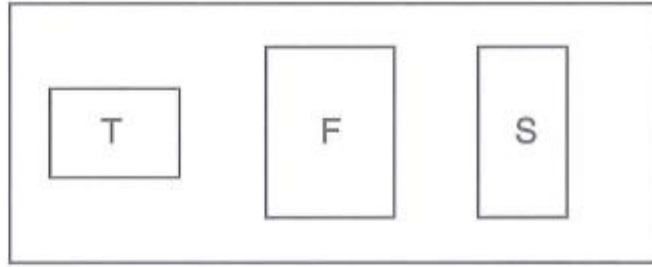
Question 6:

Which group of pattern pieces fits each solid on the left?

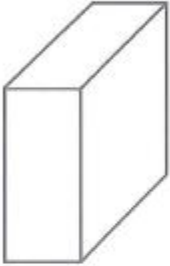
A-236



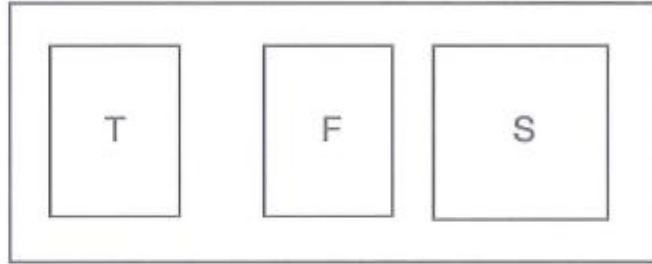
a.



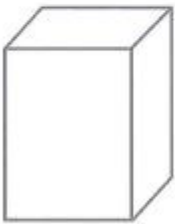
A-237



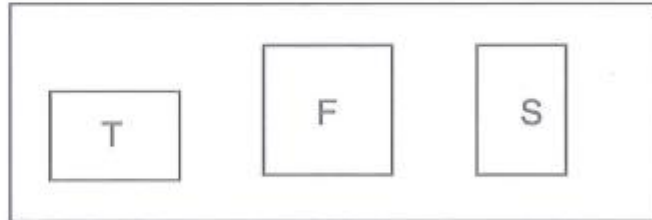
b.



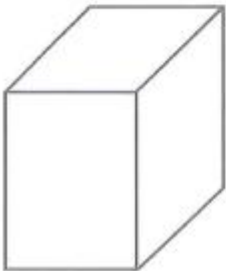
A-238



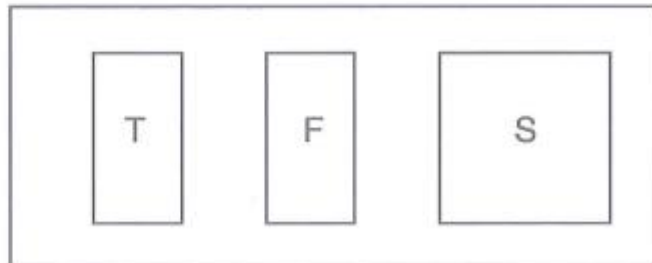
c.



A-239



d.



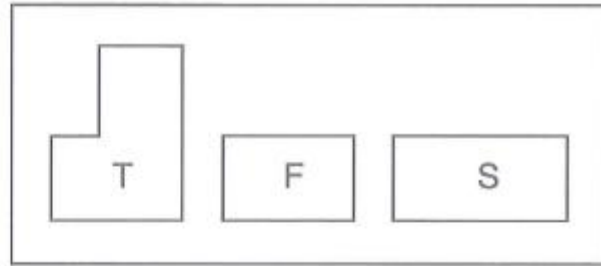
Question 7:

Which group of pattern pieces fits each solid on the left?

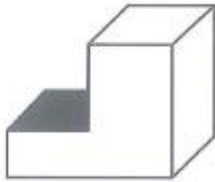
A-245



a.



A-246



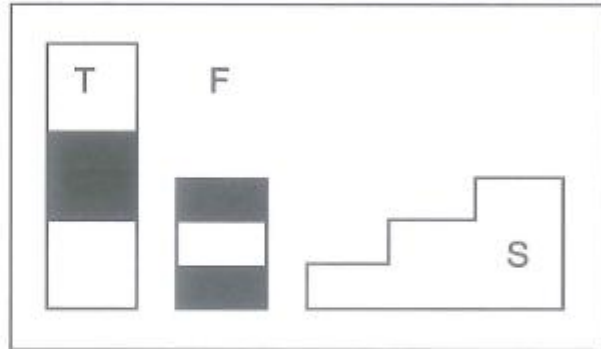
b.



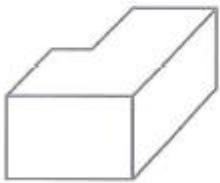
A-247



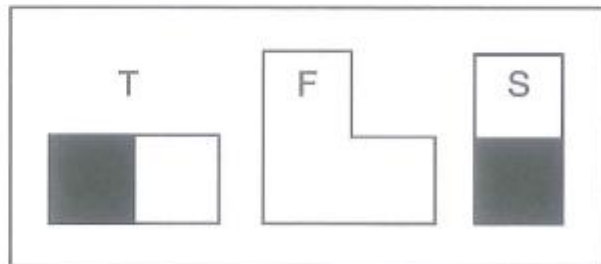
c.



A-248



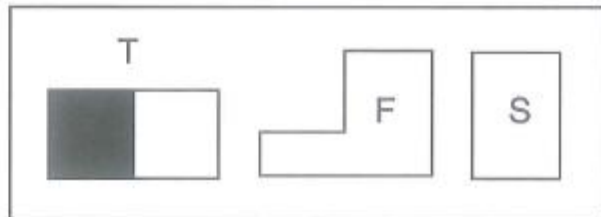
d.



A-249



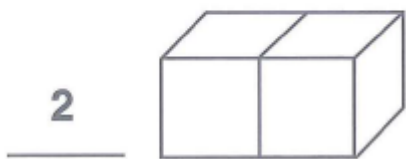
e.



(end of Question 7)

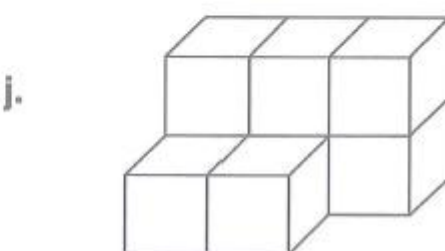
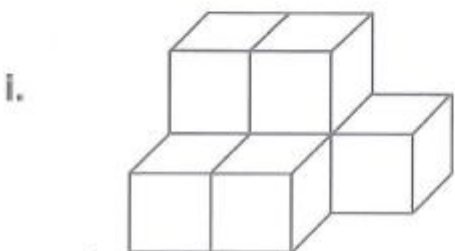
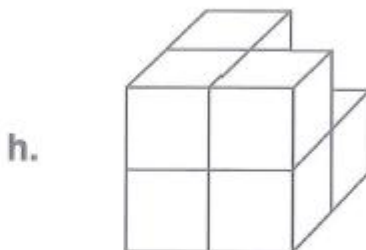
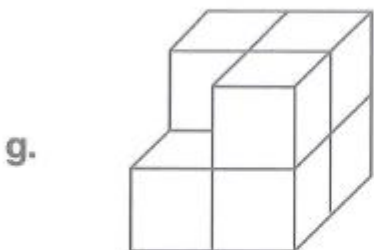
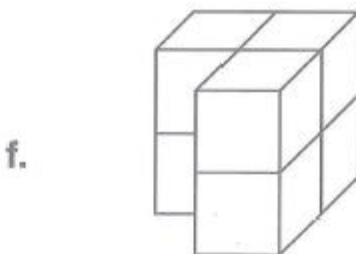
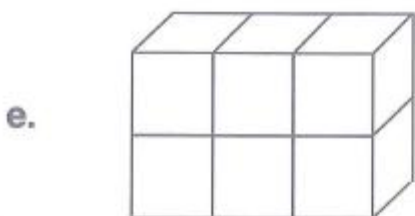
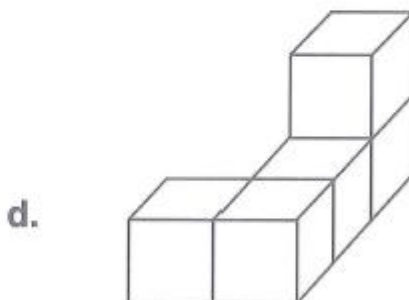
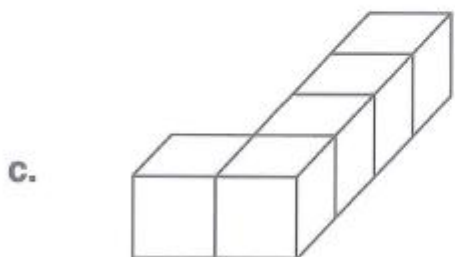
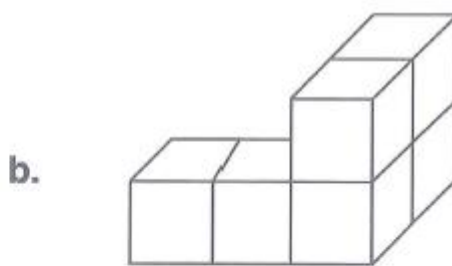
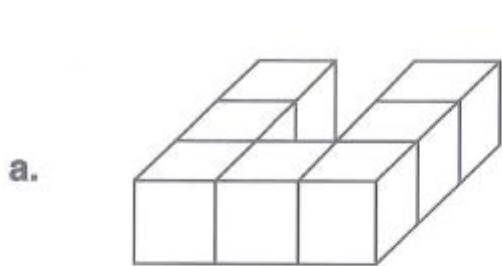
HOW MANY CUBES MAKE UP THE SOLID? (QUESTION 8)

EXAMPLE:



Question 8:

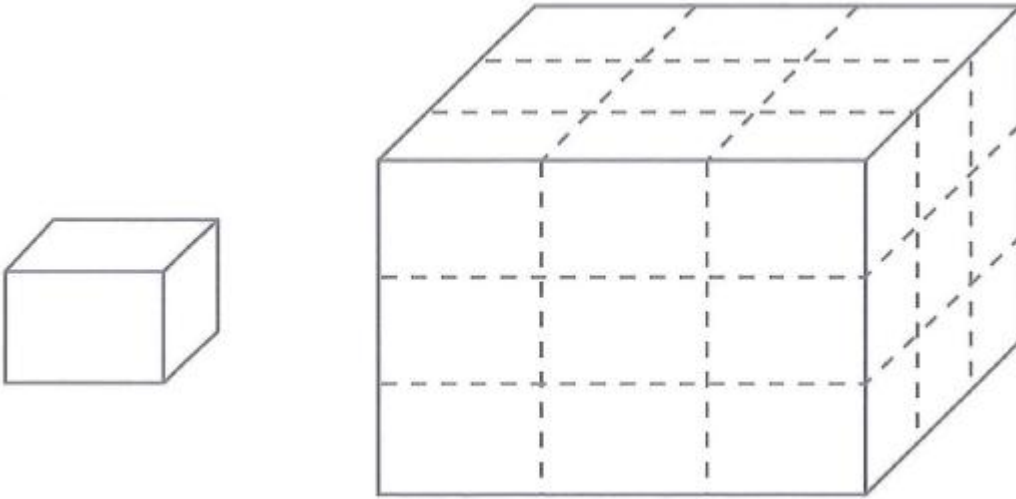
Find the number of cubes that make up each of the solids.



RECOGNIZING VOLUME (QUESTIONS 9-11)

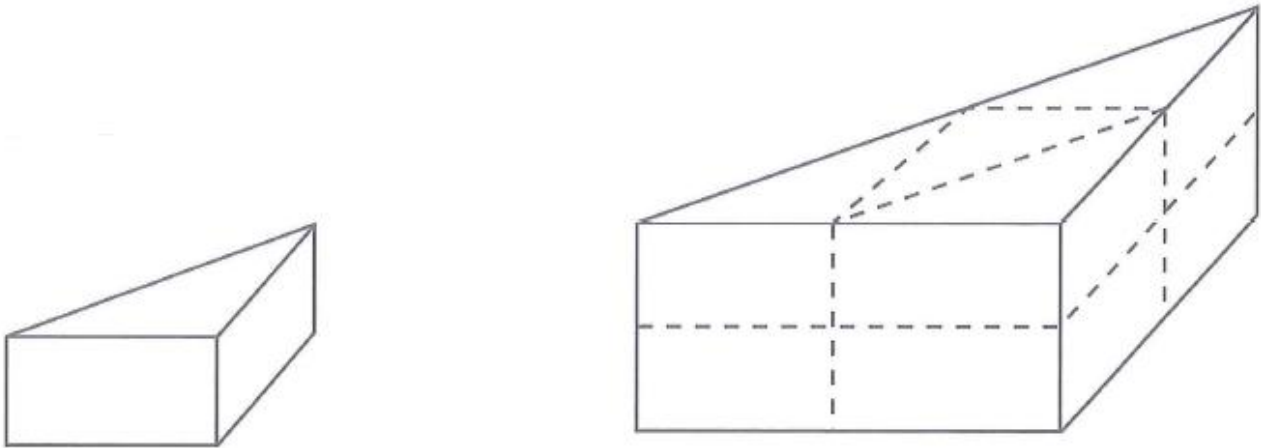
Question 9:

Decide how many of the solids on the left are contained in the solid on the right.



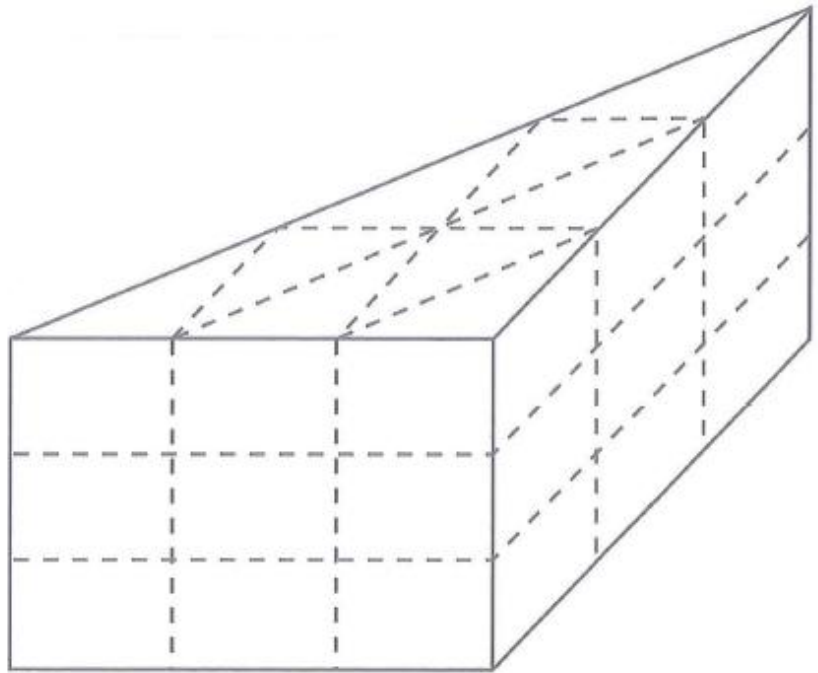
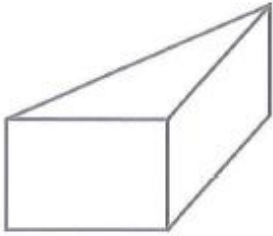
Question 10:

Decide how many of the solids on the left are contained in the solid on the right.



Question 11:

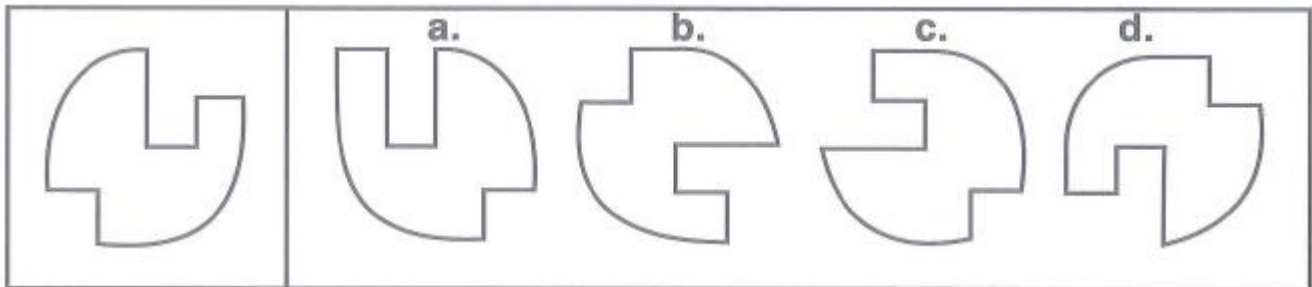
Decide how many of the solids on the left are contained in the solid on the right.



WHICH FIGURE IS NOT CONGRUENT? (QUESTIONS 12-13)

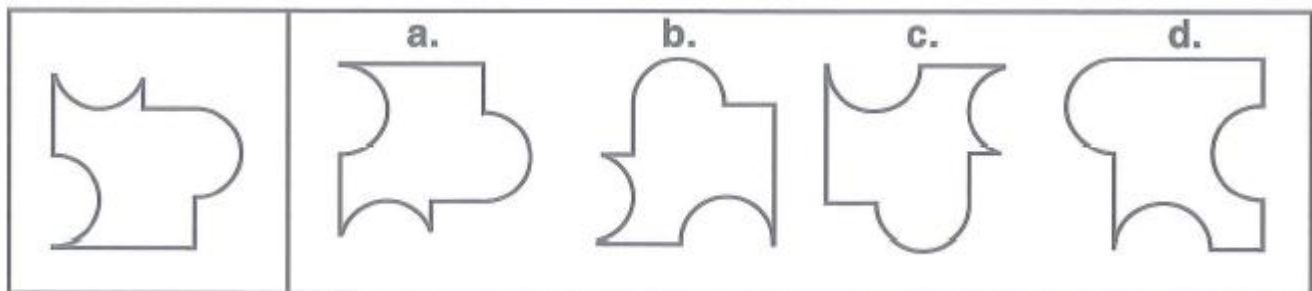
Question 12:

Which figure is not congruent to the first figure in the row?



Question 13:

Which figure is not congruent to the first figure in the row?











COMPLETING TRUE-FALSE TABLES (QUESTIONS 14-18)

EXAMPLE: Shade the figures below so that they meet the following conditions.

1. Large figures are not striped.
2. Hexagons are not checked.
3. There is only one gray figure.
4. No small figure is checked.

In each space on the grid, write **True** or **False**, depending on whether the figure can be shaded to fit the conditions given.

Use these shades only ↓					
					
					
					

Clue 1 - "Large figures are not striped." Write **F** (for false) in the "striped" row under the large figures.

	F		F		F

Clue 2 - "Hexagons are not checked." Write **F**s in the "checked" row and the "hexagon" columns.

	F		F		F
			T		
			F	F	

If the large hexagon is neither striped nor checked, then it must be gray.

Clue 3 - "There is only one gray figure." Since we have deduced from clues 1 & 2 that the hexagon is gray, no other figure can be gray. In the "gray" row mark all the other figures **F**.

	F		F		F
	F	F	T	F	F
	T		F	F	T

If the large square and circle are neither striped nor gray, then they must be checked.

Clue 4 - "No small figure is checked." Write an **F** in the "checked" row and remaining "small" column.

	F	T	F	T	F
	F	F	T	F	F
	T	F	F	F	T

If the small square and small hexagon are neither gray nor checked, then they are striped.

Hint:

Each figure has one of the three shades: striped, gray, or checked.

Striped: 

Gray: 









Checked (=Checkered): 

Question 14:

Shade the figures below so that they meet the following conditions.

1. Squares are not striped.
2. The circle is not checked.
3. No large figure is gray.
4. No small figure is checked.
5. No hexagon is striped.

In each space on the grid, write **True** or **False**, depending on whether the figure can be shaded to fit the conditions given.

Use these shades only ↓					
					
					
					

Hint:

Each figure has one of the three shades: striped, gray, or checked.

Striped: 

Gray: 





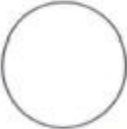



Checked (=Checkered): 

Question 15:

Shade the figures below so that they meet the following conditions.

- | |
|---|
| <ol style="list-style-type: none"> 1. Polygons are not gray. 2. Small figures are not striped. 3. There is one gray figure. 4. Large polygons* are not striped. |
|---|

In each space on the grid, write **True** or **False**, depending on whether the figure can be shaded to fit the conditions given.

Use these shades only ↓					
					
					
					

*A polygon is a closed figure having sides that are all line segments.

Hint:

Each figure has one of the three shades: striped, gray, or checked.

Striped: 

Gray: 









Checked (=Checkered): 

Question 16:

Shade the figures below so that they meet the following conditions.

- | |
|--|
| <ol style="list-style-type: none"> 1. It is not true that the circle is gray. 2. Large figures are not checked. 3. Squares are not striped. 4. Small figures are not gray. 5. Hexagons are not striped. |
|--|

In each space on the grid, write **True** or **False**, depending on whether the figure can be shaded to fit the conditions given.

Use these shades only ↓					
					
					
					

Hint:

Each figure has one of the three shades: striped, gray, or checked.

Striped: 

Gray: 

Checked (=Checkered): 

Question 17:

Shade the figures below so that they meet the following conditions.

- | |
|--|
| <ol style="list-style-type: none"> 1. Small figures are not striped. 2. No figure is gray. 3. Non-polygons are striped. 4. The squares are not shaded alike. 5. The non-square polygons are shaded alike. |
|--|

In each space on the grid, write **True** or **False**, depending on whether the figure can be shaded to fit the conditions given.

Use these shades only ↓					

Hint:

Each figure has one of the three shades: striped, gray, or checked.

Striped:

Gray:

Checked (=Checkered):

Question 18:

Shade the figures below so that they meet the following conditions.

1. No large polygon is striped.
2. Small figures are not shaded the same.
3. Large figures are not shaded the same.
4. No square is checked.
5. No hexagon is gray.
6. No small figure is striped.

In each space on the grid, write **True** or **False**, depending on whether the figure can be shaded to fit the conditions given.

Use these shades only ↓					

Hint:

Each figure has one of the three shades: striped, gray, or checked.

Striped:

Gray:

Checked (=Checkered):

(end of Question 18)

RECOGNIZING CONGRUENT PARTS (QUESTION 19)

The following figure has been divided into congruent parts. The parts might not face the same direction.

EXAMPLE:

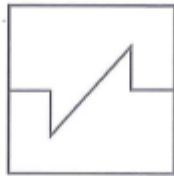


Question 19:

Evaluate if each figure below has been divided into congruent parts. The parts might not face the same direction.



a.



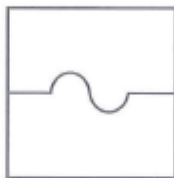
b.



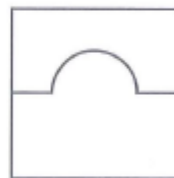
c.



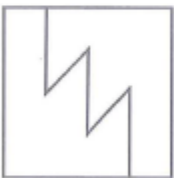
d.



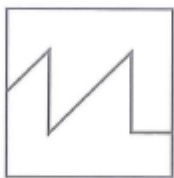
e.



f.



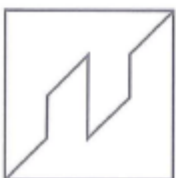
g.



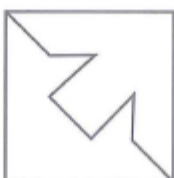
h.



i.



j.



k.



FOLLOWING DIRECTIONS (QUESTIONS 20 - 27)

Question 20:

Read the directions below, then identify the figure that correctly represents the directions.

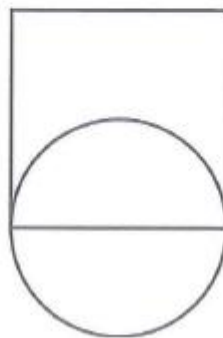
DIRECTIONS: Draw a square. Use the top side of the square as the base of a half circle.

FIGURES:

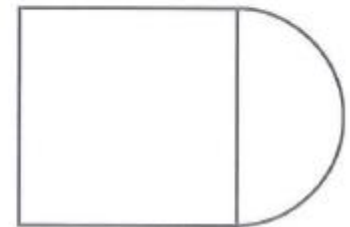
a.



b.



c.



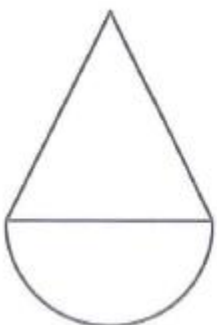
Question 21:

Read the directions below, then identify the figure that correctly represents the directions.

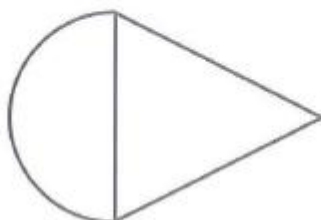
DIRECTIONS: Draw a vertical line. Use the lines as part of a half circle and part of a triangle. The triangle should be to the left of the half circle.

FIGURES:

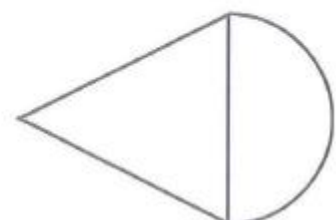
a.



b.



c.

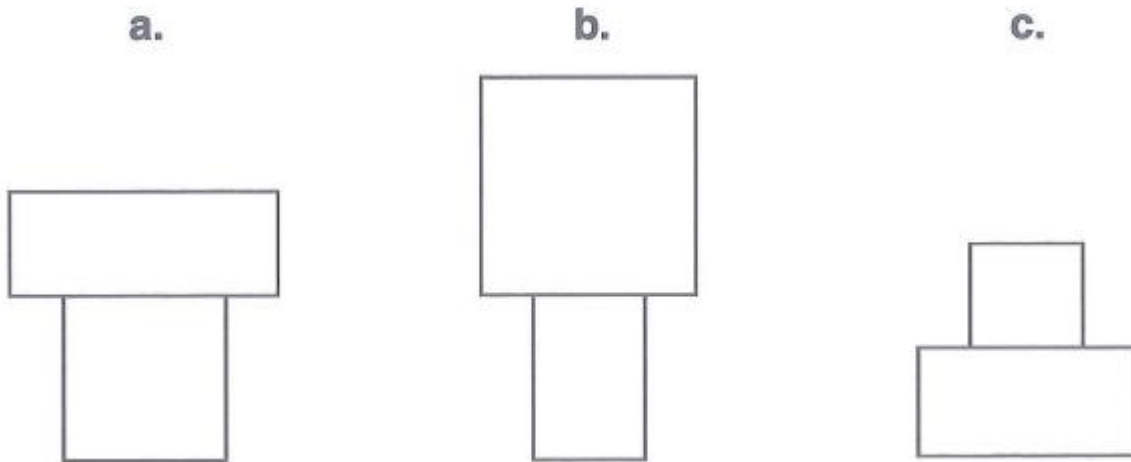


Question 22:

Read the directions below, then identify the figure that correctly represents the directions.

DIRECTIONS: Draw a small square above and touching a larger rectangle.

FIGURES:

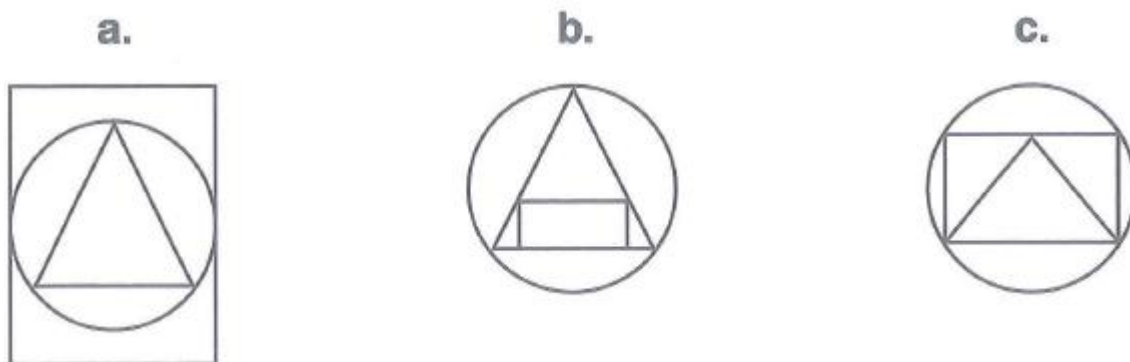


Question 23:

Read the directions below, then identify the figure that correctly represents the directions.

DIRECTIONS: Draw a large circle. Inside the circle draw a triangle. Inside the triangle draw a rectangle.

FIGURES:

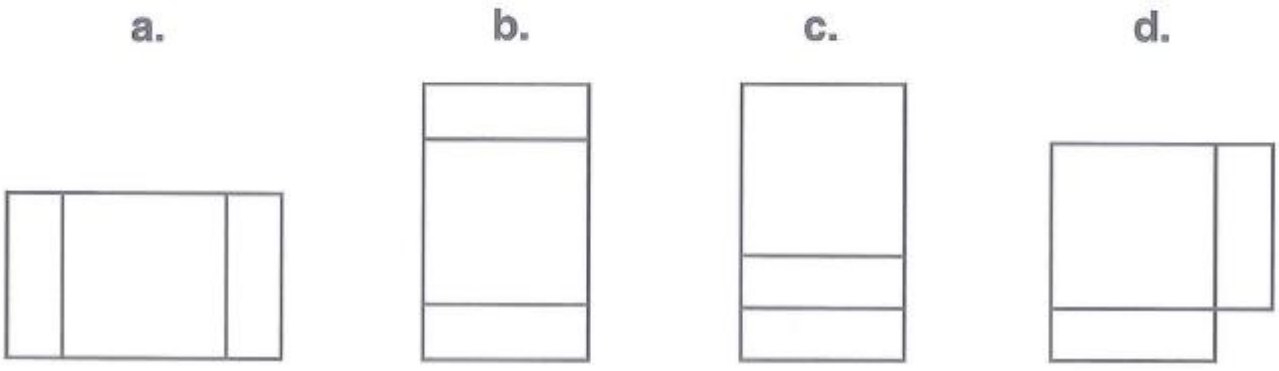


Question 24:

Read the directions below, then identify the figure that correctly represents the directions.

DIRECTIONS: Draw a square and two rectangles. The long side of the rectangles should be the same length as a side of the square. The rectangles should touch opposite sides of the square to form a tall rectangle.

FIGURES:

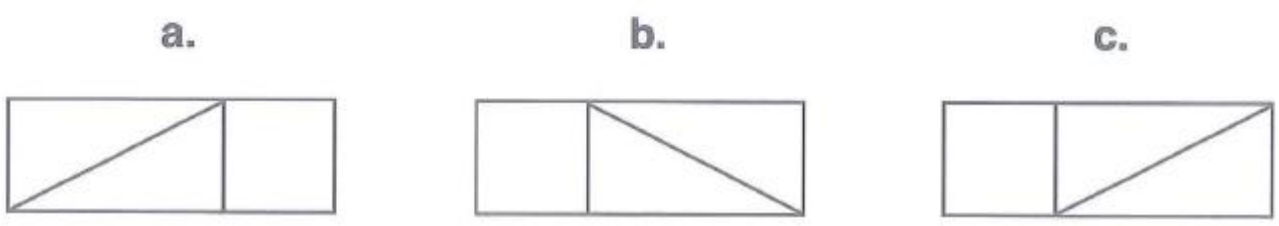


Question 25:

Read the directions below, then identify the figure that correctly represents the directions.

DIRECTIONS: Draw a rectangle. Divide the rectangle into two equal triangles by drawing a line from the upper right corner to the lower left corner. Draw a square using the left side of the rectangle as the right side of the square.

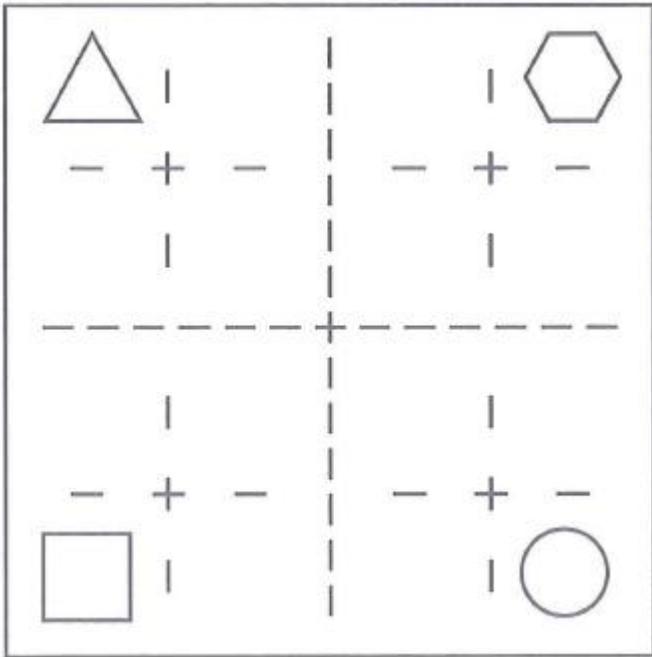
FIGURES:



Question 26:

Complete the sentence below with the correct words from the choice box.

CHOICE BOX
center, left, lower, right, upper



Example:

The hexagon is near the upper right corner.

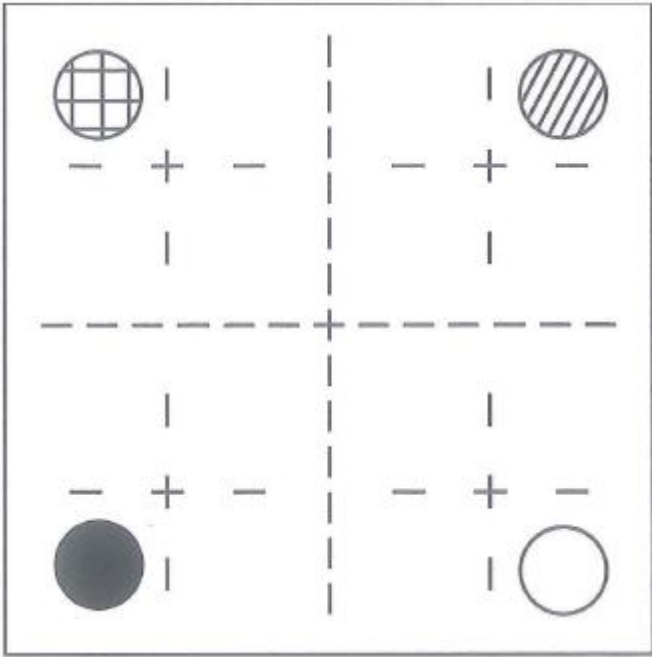
- (1) The circle is near the _____ corner.
- (2) The square is near the _____ corner.
- (3) The triangle is near the _____ corner.

Question 27:

Complete the sentence below with the correct words from the choice box.

CHOICE BOX

center, left, lower, right, upper



- (1) The white circle is near the _____ corner.
- (2) The striped circle is near the _____ corner.
- (3) The black circle is near the _____ corner.
- (4) The checkered circle is near the _____ corner.

STACKING SHAPES (QUESTIONS 28-33)

Question 28:

Here are four shapes. Listed below are eight different combinations of shapes by placing one shape on another. Select the stack that fits each description.



EXAMPLE:

The circle is on the rectangle.

Answer: d

B-39 The rectangle is on the square.

Answer:

B-40 The square is under the hexagon.

Answer:

B-41 The circle is on the hexagon.

Answer:

B-42 The hexagon is under the rectangle.

Answer:

a.



b.



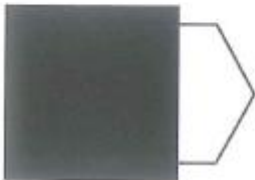
c.



d.



e.



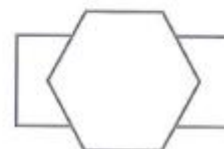
f.



g.

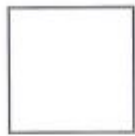


h.



Question 29:

Here are four shapes. Listed below are eight different combinations of shapes by placing one shape on another. Select the stack that fits each description.



- B-43 The triangle is on the square. Answer: _____
- B-44 The circle is on the triangle. Answer: _____
- B-45 The square is on the rectangle. Answer: _____
- B-46 The rectangle is under the circle. Answer: _____
- B-47 The triangle is under the square. Answer: _____
- B-48 The circle is under the rectangle. Answer: _____
- B-49 The triangle is on the circle. Answer: _____

a.



b.



c.



d.



e.



f.



g.

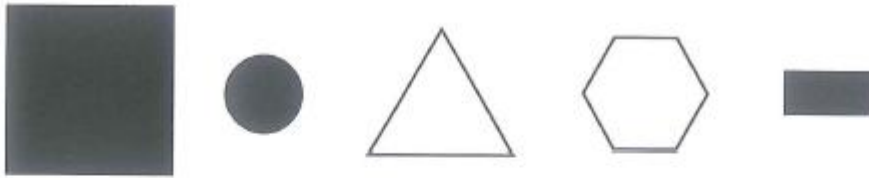


h.



Question 30:

Here are four shapes. Listed below are eight different combinations of shapes by placing one shape on another. Select the stack that fits each description.

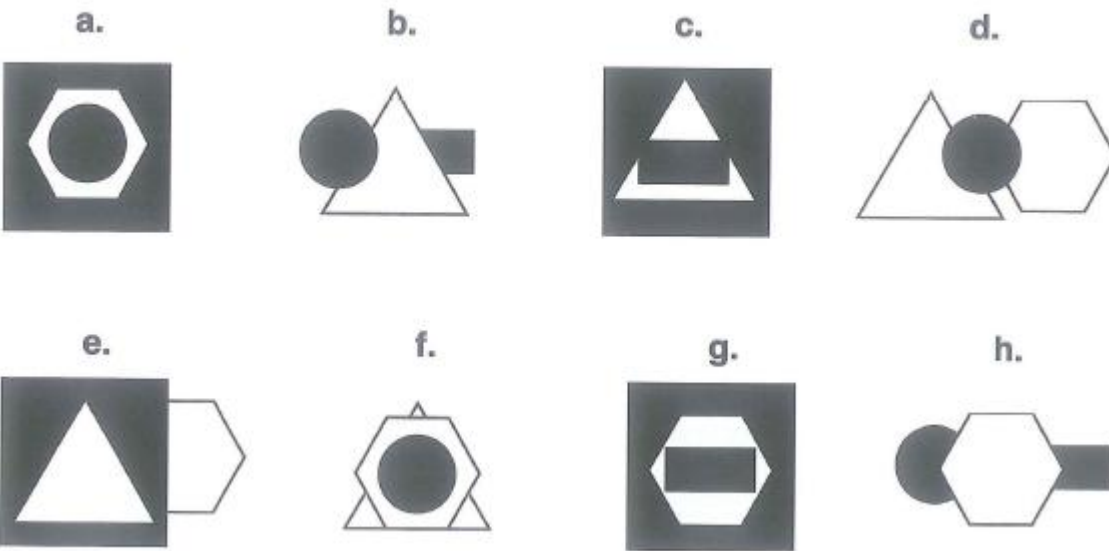


B-50 The hexagon is on the triangle and under the circle. Answer: _____

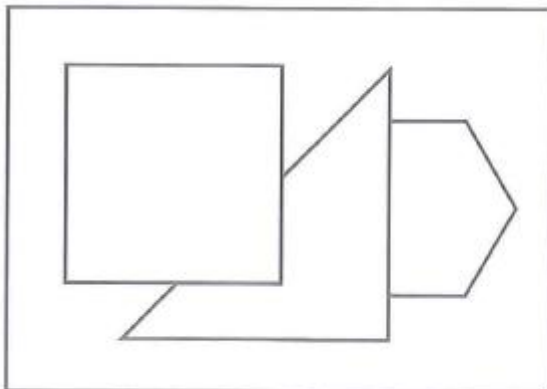
B-51 The triangle is under the rectangle and on the square. Answer: _____

B-52 The circle is on the triangle, and the triangle is on the rectangle. Answer: _____

B-53 The circle is on both the triangle and hexagon. Answer: _____



Question 31:

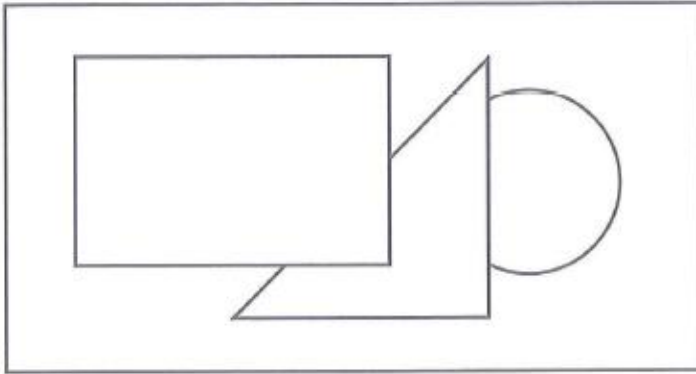


Here are a square, a triangle, and a hexagon.

The hexagon is under the (a.) _____.

The square is on top of the (b.) _____.

Question 32:



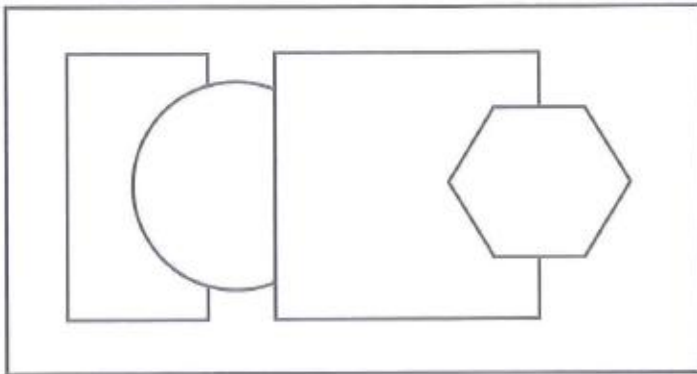
Here are a rectangle, a triangle, and a circle.

The (a.) _____ is on top.

The (b.) _____ is on the bottom.

The (c.) _____ is in between.

Question 33:



Here are a rectangle, a circle, a square, and a hexagon.

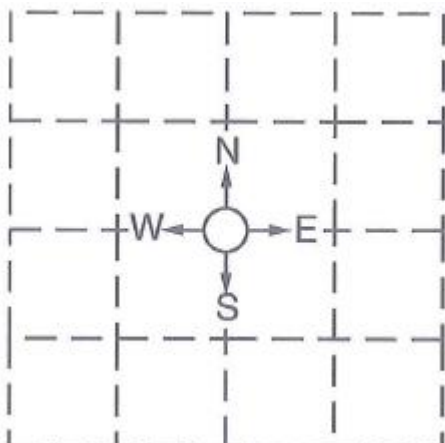
The circle is on top of the (a.) _____.

The circle is underneath the (b.) _____.

The (c.) _____ is the uppermost shape.

DESCRIBING LOCATIONS ON A GRID (QUESTIONS 34-37)

Question 34:



For the following exercises, take paths along the dashed lines and make as few turns as needed.

A unit is the length of the side of one of the small squares of the grid.

B-106 How far is it from the northeast corner to the northwest corner? Answer: _____ units

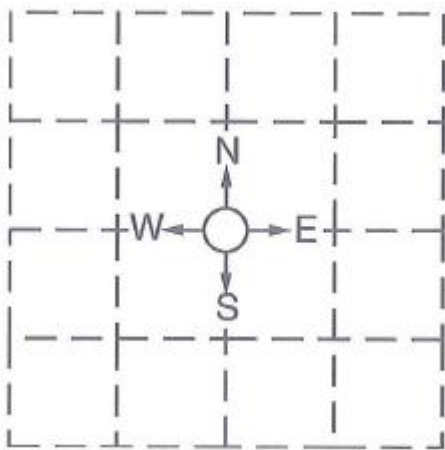
B-107 How far is it from the northwest corner to the southwest corner? Answer: _____ units

B-108 How far is it from the southwest corner to the northeast corner? Answer: _____ units

B-109 How far is it from the center of the grid to the northeast corner? Answer: _____ units

B-110 How far is it from the center of the grid to any corner? Answer: _____ units

Question 35:



You are standing at the center of the grid facing the northeast corner. You lift your right arm and it points southeast.

B-111 You lift your left arm and it points in which direction? Answer: _____

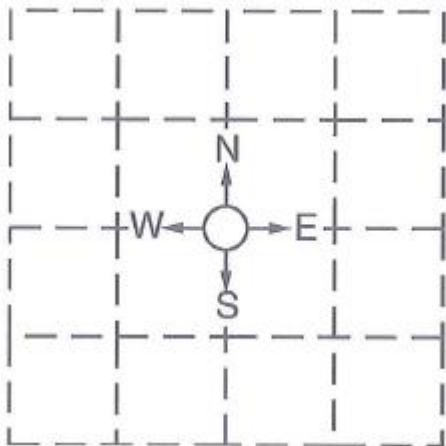
B-112 What direction is directly behind you? Answer: _____

Staying at the center, you now turn so that you are facing southwest.

B-113 What direction is to your left? Answer: _____

B-114 What direction is behind you? Answer: _____

Question 36:



You are standing at the center of the grid facing north. The direction to the left and north is northwest.

B-117 What direction is to the left and south?
Answer: _____

B-118 What direction is to the right and south?
Answer: _____

B-119 What direction is to the right and north?
Answer: _____

Staying at the center, you now turn and face west.

B-120 What direction is it to your right and behind you? Answer: _____

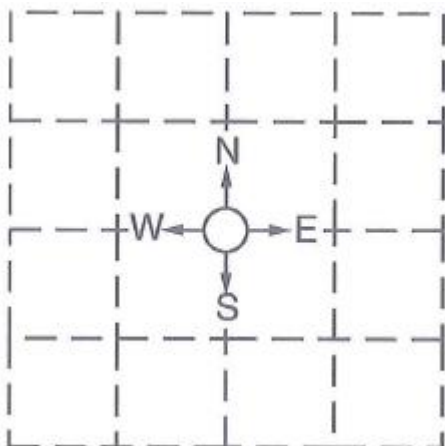
B-121 What direction is to your left and in front of you? Answer: _____

Staying at the center, you turn so that northeast is behind you.

B-122 What direction is to your right? Answer: _____

B-123 What direction is in front of you and to your left? Answer: _____

Question 37:



You are standing at the center of the grid.

B-124 Which way are you facing if northwest is behind you? Answer: _____

You turn so that northwest is on your right.

B-125 Which way are you facing? Answer: _____

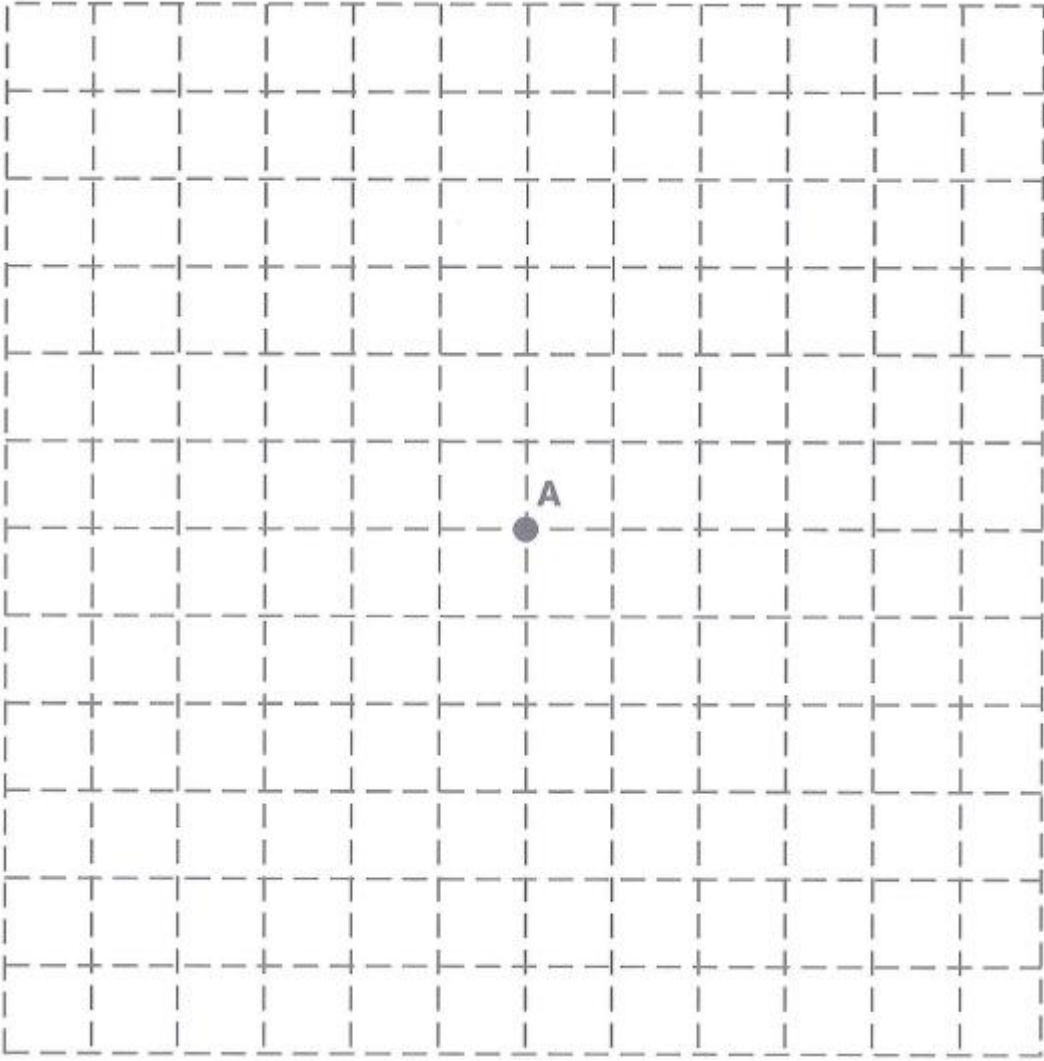
You turn so that east is in front of you and to your right.

B-126 Which way are you facing? Answer: _____

DEPICTING DIRECTIONS (QUESTIONS 38 – 39)

Question 38:

Ms. Rodriguez owns a rectangular piece of land. The northwest corner is shown below as point A. The land extends three miles to the south of point A and five miles to the east of point A. Draw a sketch of Ms. Rodriguez's land on your own scratch paper. Each unit on the grid represents one mile.



Mr. Shultz owns some land next to Ms. Rodriguez's land. Mr. Shultz's land is a square – four miles on each side. Point A is the northeast corner of Mr. Shultz's land. Sketch Mr. Shultz's land on your own scratch paper.

B-162 How much of Mr. Shultz's fence is shared by the two neighbors? Answer: _____(miles)

B-163 How much fence is required to enclose Ms. Rodriguez's land? Answer: _____

B-164 How much fence is required to enclose Mr. Shultz's land? Answer: _____

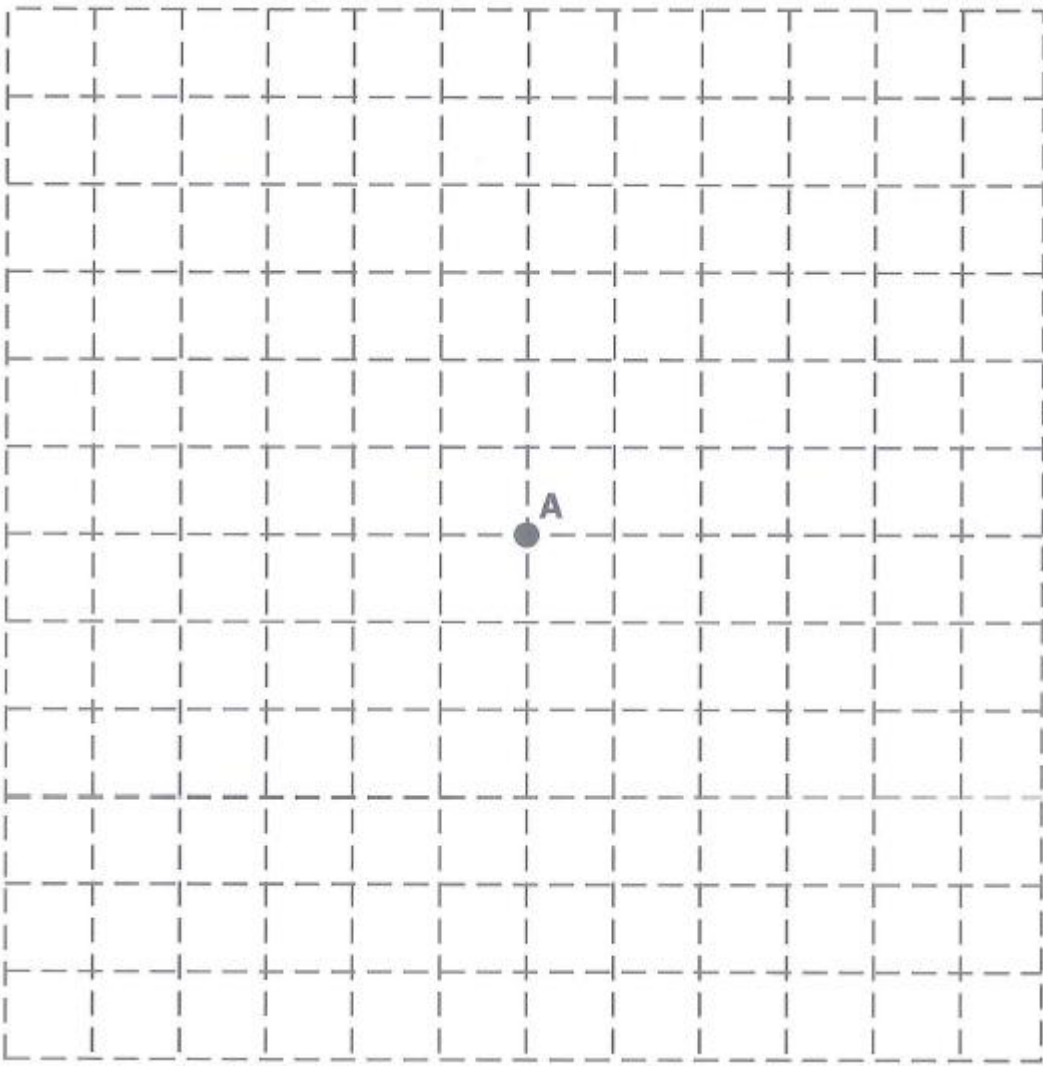
B-165 Each small square on the grid represents a square mile. How many square miles does Ms. Rodriguez own? Answer: _____

B-166 How many square miles does Mr. Shultz own? Answer: _____

Question 39:

While on vacation, the Itamura family had to detour. They had to go south two miles, east three miles, south one mile, east two miles, and north three miles.

Starting at point A, draw the route of their detour on your own scratch paper. Mark the end of the detour as point B.



B-168 How long is the detour? Answer: _____ miles

B-169 How far is it (in a straight line) from point A to point B? Answer: _____

B-170 How much longer than the planned route is the detour? Answer: _____

DEDUCTIVE REASONING (QUESTIONS 40 – 42)

Instructions:

A *Mind Bender*® is a problem in matching lists. Making a chart helps you work the problem. Here is a *Mind Bender*® involving three people and their pets.

EXAMPLE:

Michael, Sarah, and Tina own a cat, a goldfish, or a parakeet.

From the clues below, match each pet with the proper owner.

- a. Tina is allergic to animal fur.
- b. Michael's pet does not use kitty litter or live in a cage.

Step 1: From the clue "Tina is allergic to animal fur," you can figure out that Tina does not own the cat. Find the row marked "T" for Tina and write NO in the column marked "C" for cat.

	C	G	P
M			
S			
T	NO		

Step 2: The second clue, "Michael's pet does not use kitty litter or live in a cage," tells you that Michael does not own a cat or bird. Find the row marked "M" for Michael and write NO in both the "C" (for cat) column and the "P" (for parakeet) column.

	C	G	P
M	NO		NO
S			
T	NO		

Step 3: You know that each person owns a pet. Since neither Michael nor Tina owns the cat, Sarah must be the cat owner. Write a YES in the "S" row and the "C" column.

	C	G	P
M	NO		
S	YES		
T	NO		

Step 4: Since Sarah owns the cat, Sarah does not own the goldfish or the parakeet. Write NO in the "S" row in both the "G" column and the "P" column.

	C	G	P
M	NO		NO
S	YES	NO	NO
T	NO		

Step 5: By the same kind of reasoning, you see that the only vacancy in the "M" row is in the "G" column. From this, you figure out (**deduce**) that Michael is the goldfish owner. Write a YES in this position.

	C	G	P
M	NO	YES	NO
S	YES	NO	NO
T	NO		

Step 6: Since Michael owns the goldfish, then neither Sarah nor Tina owns the goldfish. You have already figured out (deduced) that Sarah doesn't own the goldfish. Now you know that Tina doesn't either. Mark NO in the "T" row and the "G" column.

	C	G	P
M	NO	YES	NO
S	YES	NO	NO
T	NO	NO	

Step 7: The only vacancy on the chart is in the "T" row and the "P" column. You now know that Tina is the parakeet owner.

Question 40:

Bob, Joe, Freddy, and Christy are all in grade school (1st, 2nd, 4th, and 6th grades). From the clues below, match each child with his or her grade.

- a. No student has been held back or skipped a grade.
- b. Joe is about three years younger than Bob.
- c. Christy is about four years older than Freddy.

	B	C	F	J
1				
2				
4				
6				

Question 41:

Four World War II tanks have the following gun sizes: 49mm, 75mm, 88mm, and 100mm. The larger the gun, the more powerful it is. From the clues below, match each tank with its gun.

- a. The Tiger tank has a larger gun than either the American or British tank.
- b. The Sherman tank is American.
- c. The SU-100 has the most powerful gun.
- d. The Crusader, a British tank, has the least powerful gun.

	C	Sh	SU	T
49				
75				
88				
100				

Question 42:

Use the following clues to determine the running speeds of a cheetah, deer, elephant, and fox.

- a. The largest animal is the slowest.
- b. The fastest weighs less than half as much as a deer.
- c. A fox can't catch a deer or a cheetah.

	Running Speed km/hr			
	38	64	79	112
Cheetah				
Deer				
Elephant				
Fox				

END OF CONTEST