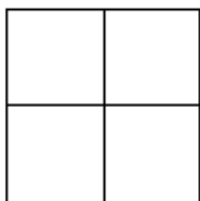# 3D Solids and Their Projections
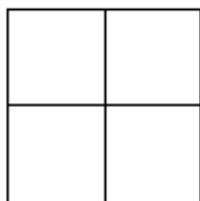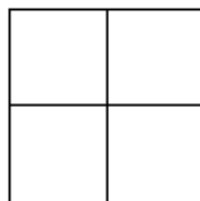## Early Elementary Group

Meeting 1, 9/30/12

1. Use the blocks you have brought for this question.

   (a) Build a 3d structure over a 2×2 square base so that it fits into a cube of size $2 \times 2 \times 2$. (This means that you will use no more than 8 blocks.)

   (b) Shade the grids below to indicate the top, front and **LEFT** side projections of the 3d shape you have built:

TOP   FRONT   SIDE
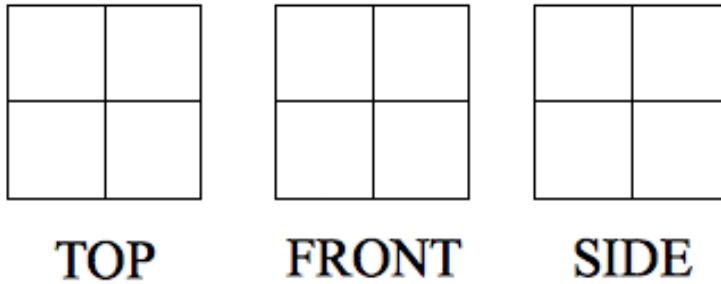
2. With the shape you built in problem 1, do the following:

   (a) Share the top, front, and side projections of your solid with a partner. Ask them to build a solid which has the same projections. (At the same time, you should build the solid which has the projection shown to you by your partner).

   (b) Are your shapes the same?

(c) Do you think it is possible to have 2 different solids over base of size 2×2 so that they have the same projections?

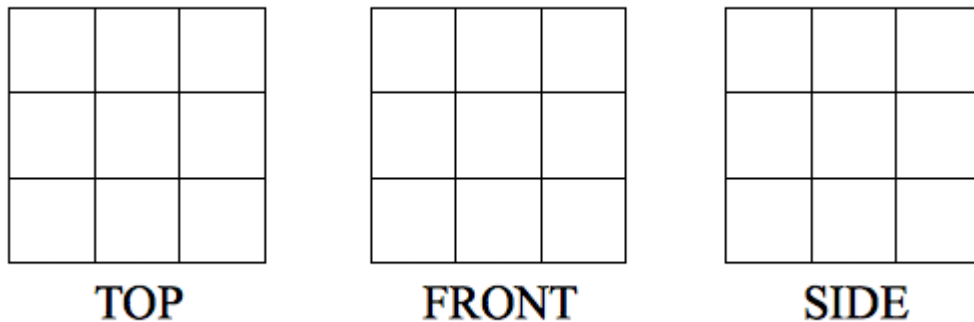i. If yes, build such a pair of solids and shade in their projections below.

TOP   FRONT   SIDE
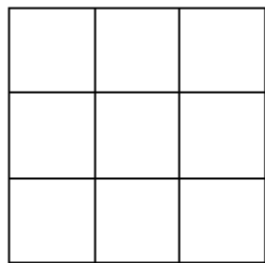
ii. If no, explain why not.

3. Use the blocks you have brought for this question:

(a) Build a 3d solid over a square of size 3×3 base so that it fits into a $3 \times 3 \times 3$ cube. (This means you will use no more than 27 blocks)

(b) Shade the grids below to indicate the top, front, and left side projections of the 3d solid you have built.
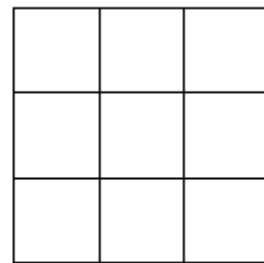
TOP   FRONT   SIDE

4. With the solid you built in question 2, do the following:

   (a) Share the top, front and side projections of your solid with a partner. Ask them to build a solid which has the same projections.

   (b) Are your solids the same?

   (c) Do you think it is possible to have 2 *different* solids over the base of size 3×3 that have the same projections?

      i. If yes, build such a pair of solids and shade in their projections below.
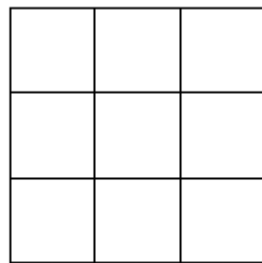
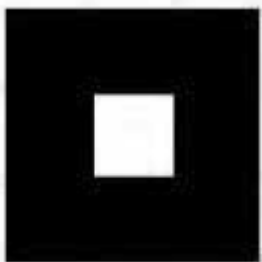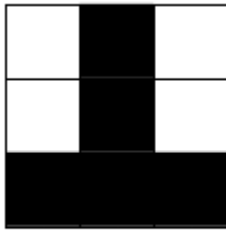TOP   FRONT   SIDE

      ii. If no, explain why not.

5. Melinda drew this projection:

Is it the top, front or side projection? How do you know?
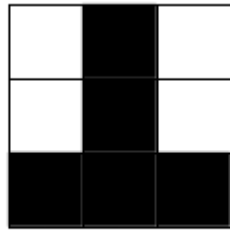
6. Make a 3d solid that has the following projections:

| TOP | FRONT | SIDE |

(a) Find all possible solids that have these projections.

(b) For each of these solids, count the number of cubes used and record in the table

Solid	# of cubes used
1	
2	
3	
4	
5	

(c) How many different solids have these three projections?

7. Make a 3d solid that has the following projections.

TOP   FRONT   SIDE

(a) Find all possible solids that have these projections.

(b) For each of these solids, count the number of cubes used and record in the table below:

Solid	# of cubes used
1	
2	
3	
4	
5	

(c) How many different solids have these three projections?

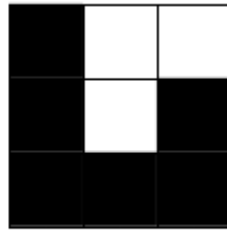8. Make a 3d solid that has the following projections.

TOP   FRONT   SIDE

(a) Find all possible solids that have these projections.

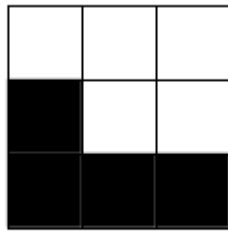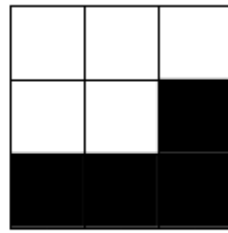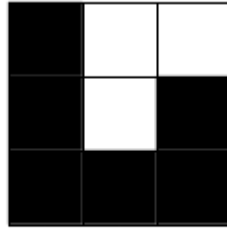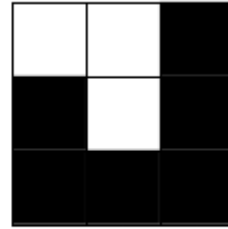(b) For each of these solids, count the number of cubes used and record in the table

Solid	# of cubes used
1	
2	
3	
4	
5	

(c) How many different solids have these three projections?

Substitution Ciphers

- In a **substitution cipher**, each letter is replaced by a symbol so that different symbols represent different letters.

- To encode a message with this kind of cipher, replace each letter with its encoded letter from the key below.

- To decode a message, do the opposite: replace each symbol by the original letter from the key below.

1. Consider one example of a key for a substiution cipher:

Letter:	A	B	C	D	E	F	G	H	I
Encoded Letter:	Z	Y	X	W	V	U	T	S	R

Letter:	J	K	L	M	N	O	P	Q	R
Encoded Letter:	Q	P	O	N	M	L	K	J	I

Letter:	S	T	U	V	W	X	Y	Z	
Encoded Letter:	H	G	F	E	D	C	B	A	

(a) Do you see a pattern in how this key is organized?

(b) Use the key on the previous page to decode the message below:

FXOZNZGSXRIXOV

(c) Create your own substitution cipher key below:
(Remember to only use each letter once in the second row.

Letter:	A	B	C	D	E	F	G	H	I
Encoded Letter:									

Letter:	J	K	L	M	N	O	P	Q	R
Encoded Letter:									

Letter:	S	T	U	V	W	X	Y	Z	
Encoded Letter:									

i. Use the key to encode a message:
(Your group leader will give you a piece of white paper for you to write your message on, then you can encode it on this page.)

Encoded Message:

ii. Now let your partner decode the message (Don't show them the piece of paper!):

Decoded Message:

Once they have done this, you can give them the piece of white paper to see if they were right.