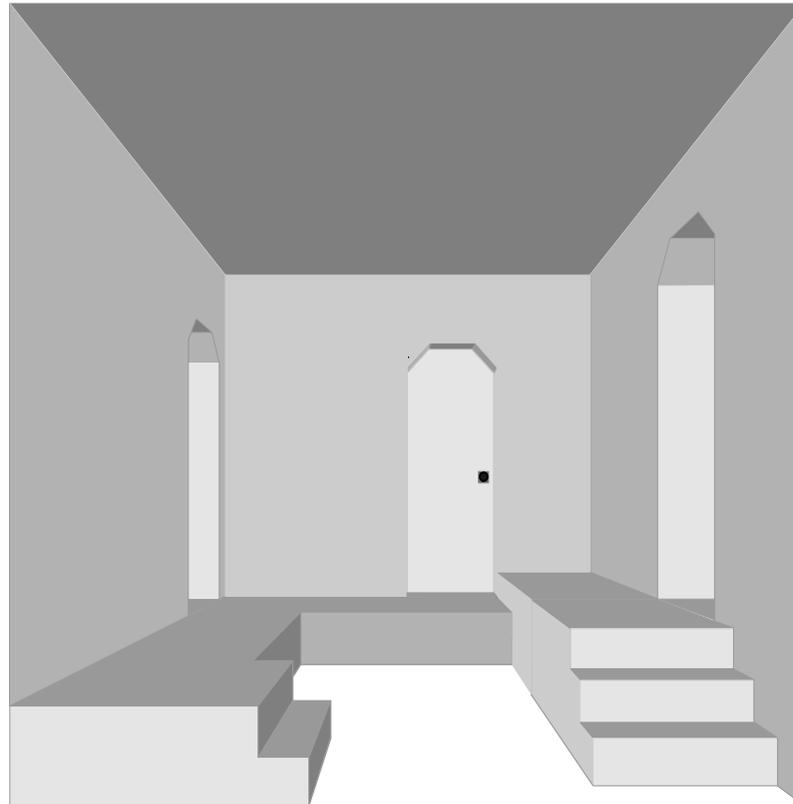


*The Art of Mathematics*  
*Get Everything Into Perspective*

*Steve Plummer and Pat Ashforth*



*Create drawings from your own 3 dimensional grids using ruler and pencil, computer drawing packages or 'dynamic geometry'*

*Easy, step by step instructions for everyone.*  
*Includes ready made grid sheet.*

# *Get Everything into Perspective*

*The Art of Mathematics*

Maths or Art?

You don't need to be able to draw in order to create fascinating pictures. Anyone can achieve artistic results using simple mathematical techniques.

This booklet is one of a series giving step-by-step instructions.

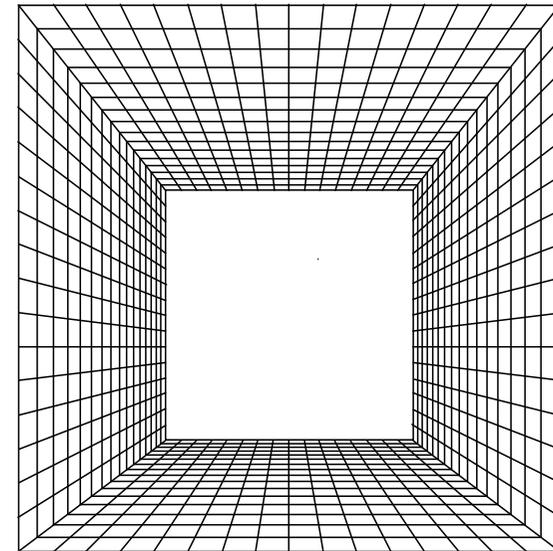
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A step by step guide for drawing a grid as the basis for perspective drawings, using ruler and pencil or computer software.



This booklet describes *Three Point Perspective*. This is one of several ways to create perspective drawings. It creates a large box which is stretching away from you. The box has a grid on all of its walls and this grid can be used to correctly position anything inside the box.

The box suggests a room but the box and grid can be used for drawing any objects or landscapes. Many famous painters have used this principle as the basis for their paintings. Your drawing can be as complex as you want it to be.

Requirements:

Plain paper, Ruler, Sharp pencil, Eraser, Patience

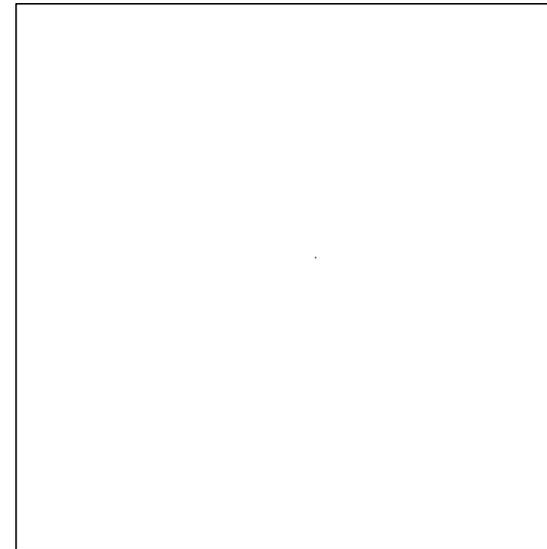
### Notes for computer users

These drawings can be done using computer software. They will still take a long time as there are a lot of lines to be drawn. Using a computer has the advantage that you can correct any errors more easily and construction lines are quickly removed. The drawings should be very accurate.

If the software you use has an arrangement of layers put each set of lines on a separate layer then you can remove and include layers whenever you want. In this way you can hide the construction lines to create the grid. When you are using the grid to make a drawing you can hide the entire grid at the end.

Using dynamic geometry software will give you a flexible grid so you will be able to change the positions of the vanishing points at any time. It is important that all lines are constructions not mere drawings or the grid will fall apart if you try to move any of the elements. For example the starting square must be a true square which remains fixed to the page when other points are made.

**DG** The abbreviation DG at the bottom of a page denotes a special note which only applies if you are using dynamic geometry.



Draw a square which will become the front wall of the room. Do not fill the paper with the square as space is needed at the sides to draw the vanishing points.

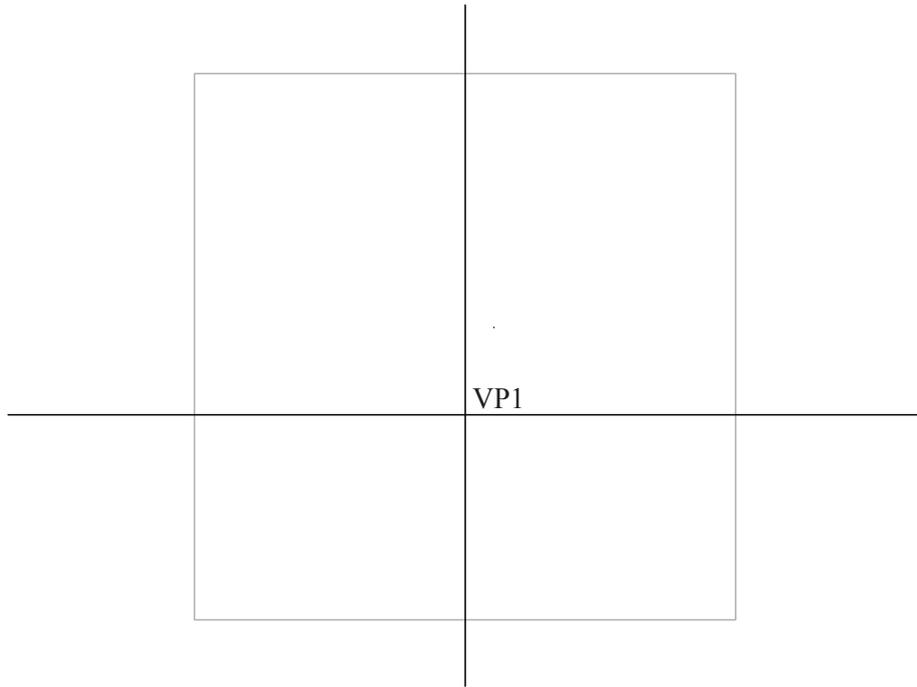
The sides of the square should be a length that can easily be divided into small sections later.

This square will form part of the finished grid so may be drawn in quite definitely. Most other lines are construction lines which will be removed later. They should be drawn as lightly as possible.

All lines need to be drawn very accurately, using a ruler and sharp pencil.

#### **Note:**

The instructions refer to the grid as a room, and the various parts as walls, floor, ceiling, etc. It does not have to be used for a room.



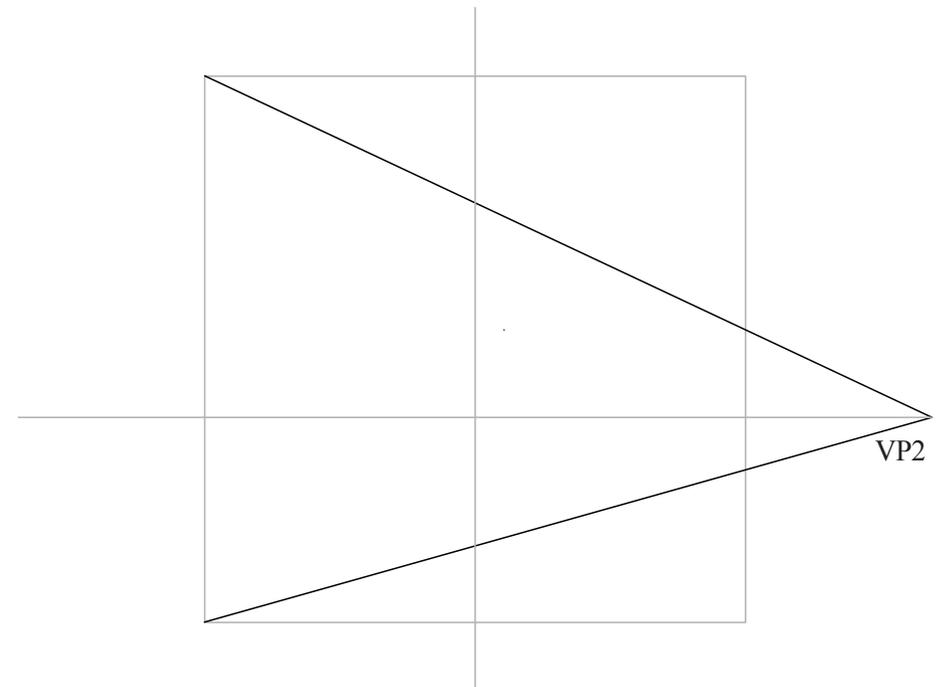
Draw in the horizon. This is a horizontal line which can be anywhere in the lower half of the square.

Draw a vertical line. This can be in the centre of the square but doesn't have to be. Changing the position of this line changes the angle from which you view the room

The point where these two lines cross is called *Vanishing Point 1* (VP1)

**Note:**

- Horizontal = across the page
- Vertical = up and down the page

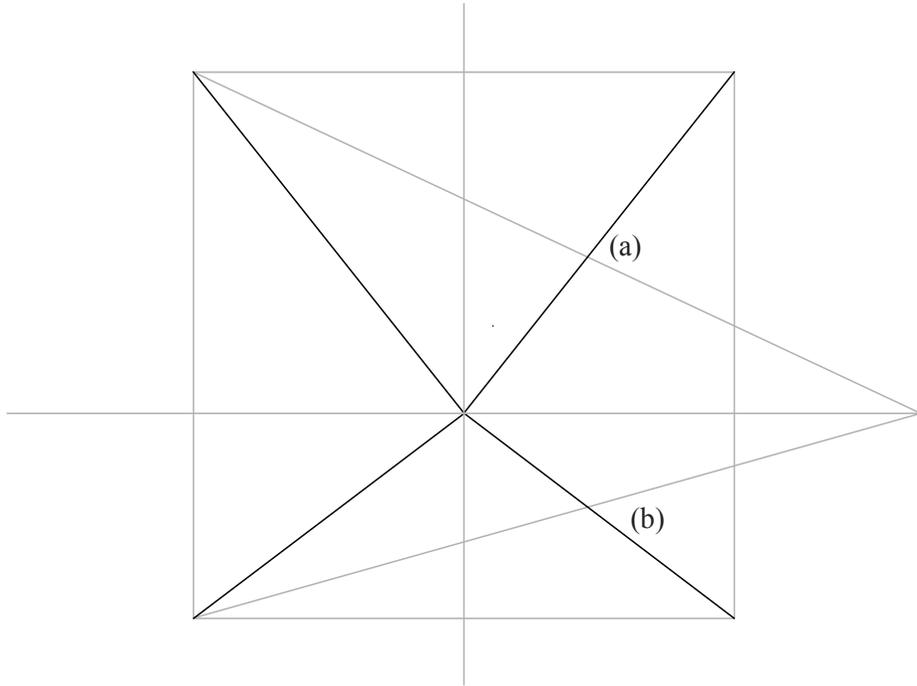


Choose a point on the horizon line, to the right of the square. This is *Vanishing Point 2* (VP2)

Join this point to both left hand corners of the square.

DG: The lines shown opposite are perpendicular to each other and parallel to the sides of the square. They must remain fixed to each other at VP1 and free from the square.

The lines shown above must be fixed together with the joining point able to slide along the horizontal line.



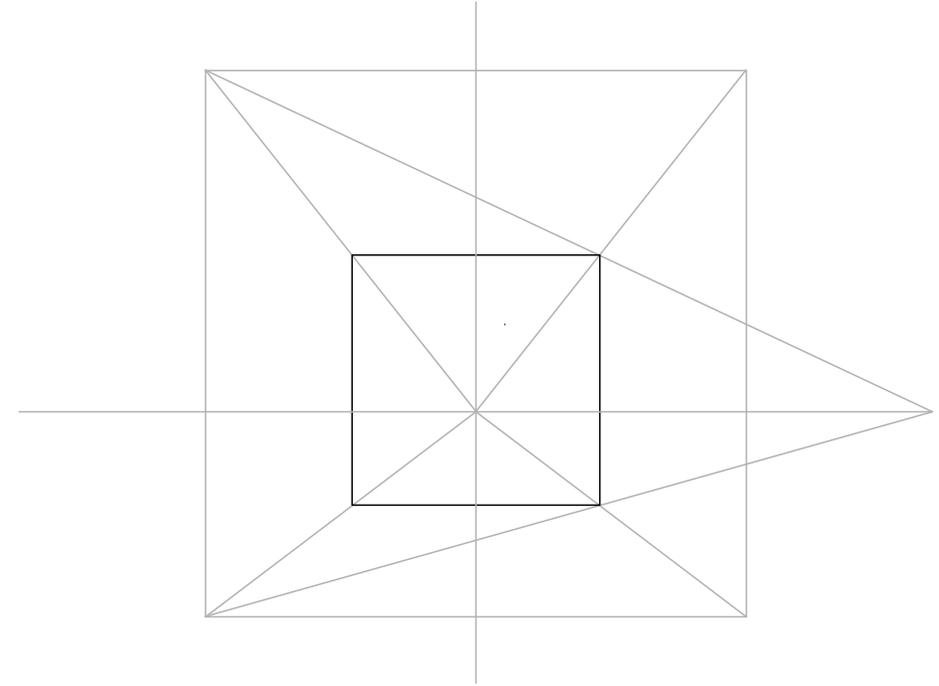
Join the corners of the square to Vanishing Point 1.

Find the points where

(a) the line from the top left hand corner of the square to Vanishing Point 2 crosses the line from the top right hand corner of the square to Vanishing Point 1.

(b) the line from the bottom left hand corner of the square to Vanishing Point 2 crosses the line from the bottom right hand corner of the square to Vanishing Point 1.

DG: These lines must remain fixed to the corners of the square and VP1.



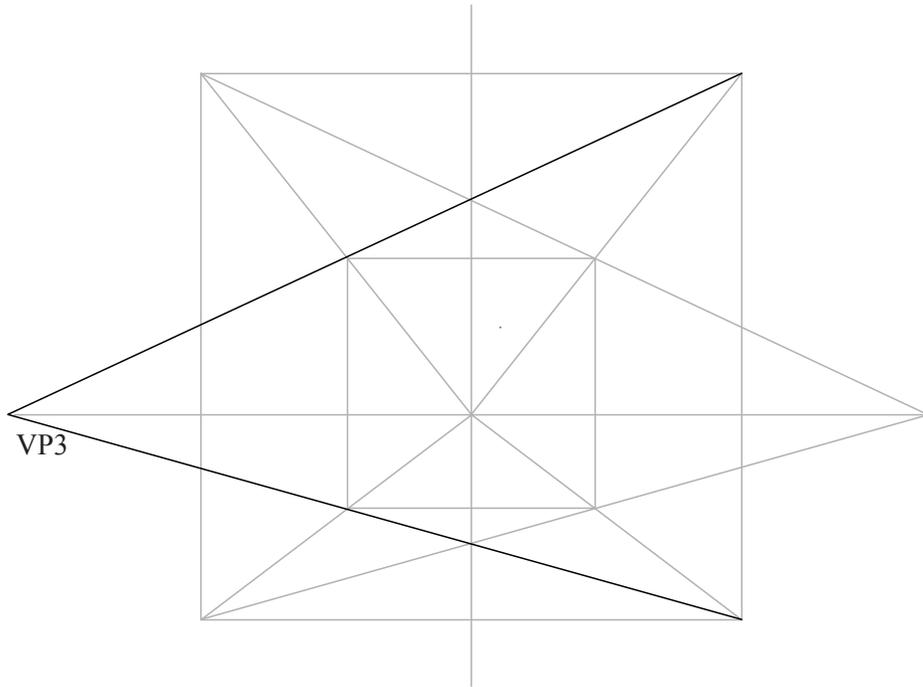
Points (a) and (b) are to be the corners of a smaller square.

To construct the square :

- (1) Join points (a) and (b)
- (2) Draw a horizontal line from (a), to meet the line from the top left hand corner of the square to Vanishing Point 1.
- (3) Draw a horizontal line from (b), to meet the line from the bottom left hand corner of the square to Vanishing Point 1.
- (4) Draw in the fourth side of the square (A vertical line).

This square forms a part of the finished grid.

DG: Two of the corners of the square should be fixed to points of intersection, the others constructed to meet the other lines.

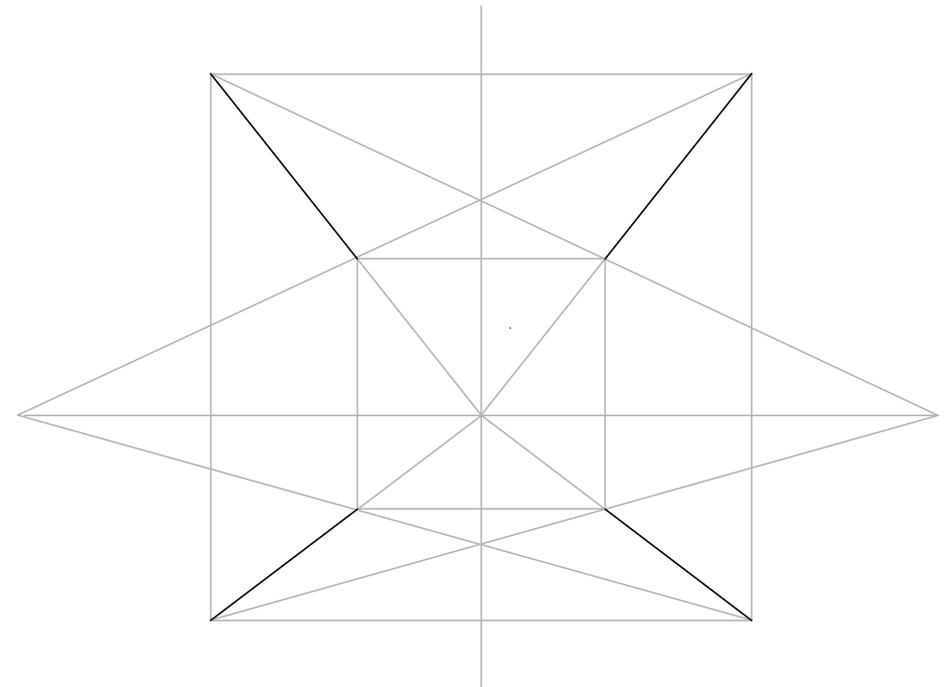


Draw a line from the top right corner of the large square to the horizon line, passing through the top left corner of the small square.

Draw a line from the bottom right corner of the large square to the horizon line, passing through the bottom left corner of the small square.

These lines should meet on the horizon line. This is Vanishing Point 3 (VP3).

DG: These lines must be joined together and be free to move along the horizontal when they are 'pushed' by the movement of VP1 or VP2.

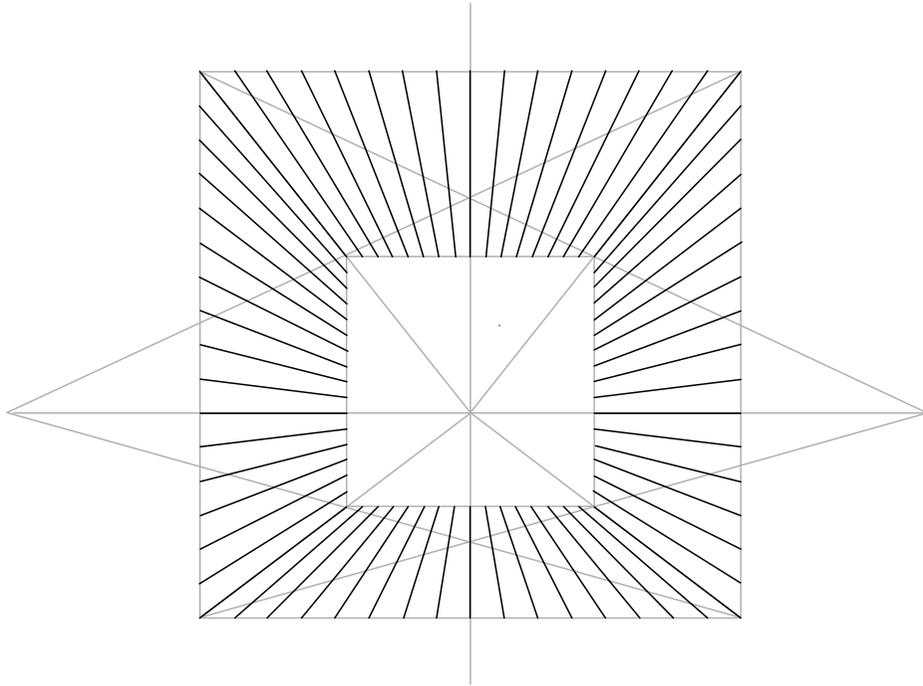


Join the two squares:

- (1) top left to top left
- (2) top right to top right
- (3) bottom right to bottom right
- (4) bottom left to bottom left

These lines go over part of the existing construction lines. They form the corners between the walls and the floor and ceiling. They are part of the finished grid.

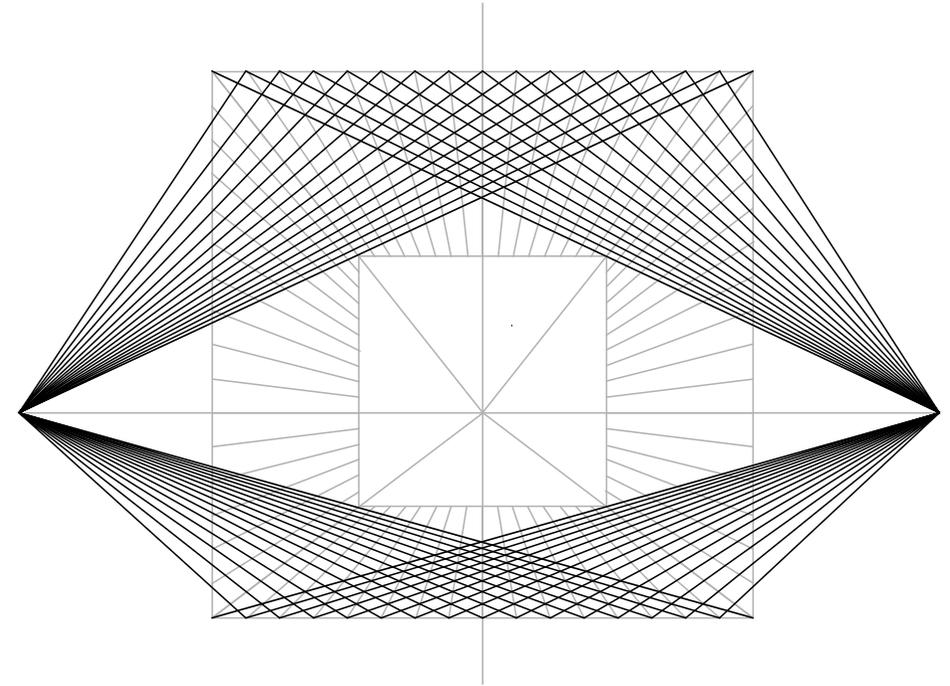
DG: These lines must remain fixed to the corners of both squares.



Divide the edges of the large square into a convenient number of equal parts. Mark the points. The number of divisions will depend on the size of your drawing. The more divisions you have the more detailed your drawing on the grid can be. Too many lines make it difficult to pick out the one you want to use.

Use your ruler to join each of the marked points to Vanishing Point 1. Draw in the lines, stopping at the small square instead of going to the point.

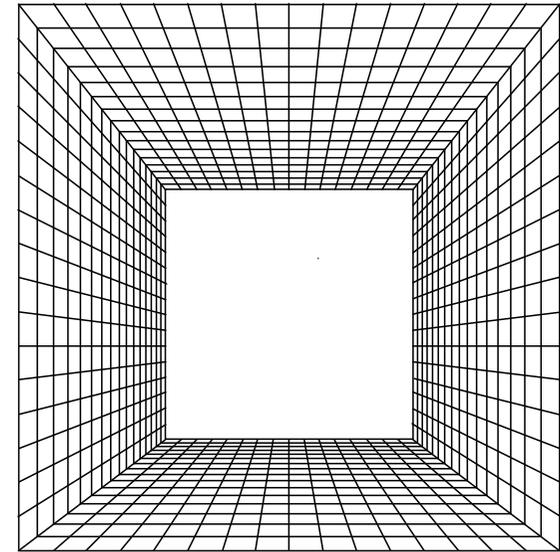
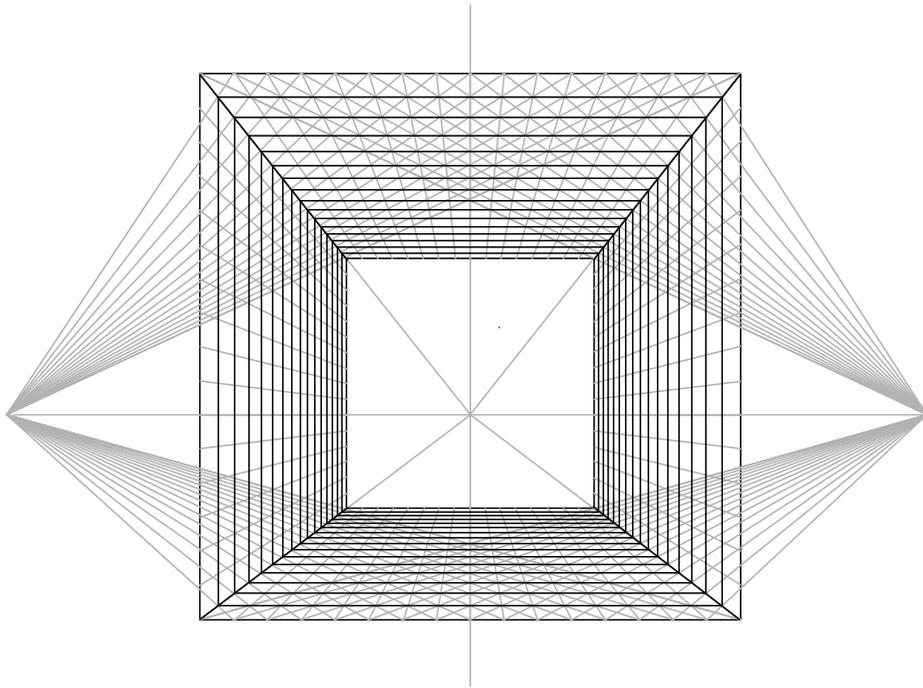
These lines are part of the finished grid.



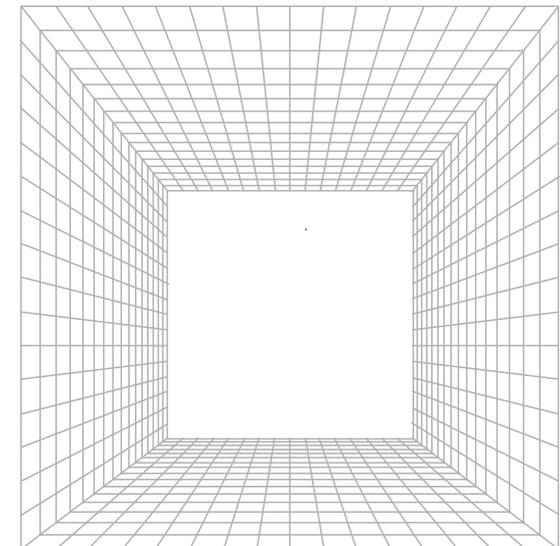
Join all the marked points along the top and bottom edges of the large square to Vanishing Points 2 and 3.

DG: The lines shown opposite have to remain attached to the outer square and to the places where they cut the inner square. To achieve this first construct lines to VP1 then replace them with lines to the points where these intersect with the inner square.

The lines shown above must remain attached to the square and the vanishing points but free to move along the horizontal.



Make your drawing on another piece of paper to preserve the original grid. Place it over the grid and securely fasten the two pieces together.



Look for the points where the lines you have just drawn cross

- (a) the lines which form the corners between the floor and the walls
- (b) the lines which form the corners between the ceiling and walls

Join these points with horizontal and vertical lines to form a series of squares.

Remove any construction lines which are no longer needed. Make sure all the gridlines you need are very clear, in preparation for making your perspective drawing.

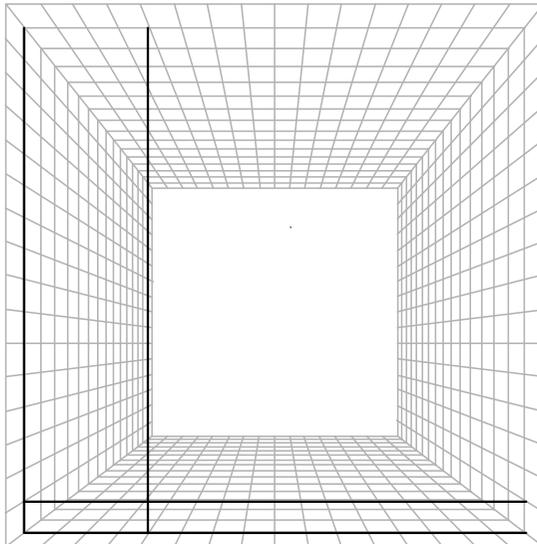
DG: Construct the squares between the points of intersection at each corner.

The following instructions are for drawing a flight of three steps and a landing against the left hand wall of the room. Points are plotted on the grid, joined with faint lines using a ruler, then made clearer later.

LH and RH refer to the left hand side and right hand side of the room. The points to be joined are given by how far back or up from the front of the room.

### Stage 1

1. Join 1 back on join between floor and LH wall to 1 back on join between floor and RH wall.  
*(Part of this will form the bottom edge of the riser of the first step.)*
2. Join 1 back 1 up LH wall to 1 back 1 up RH wall.  
*(Part of this will form the top edge of the riser of the first step.)*
3. Draw a vertical line following the line 1 back on LH wall.  
*(Part of this will form the left hand edge of the riser of the first step.)*
4. Draw a vertical line joining 4 across 1 back from LH wall, on the floor, to 4 across 1 back from LH wall, on the ceiling.  
*(Part of this will form the right hand edge of the riser of the first step.)*

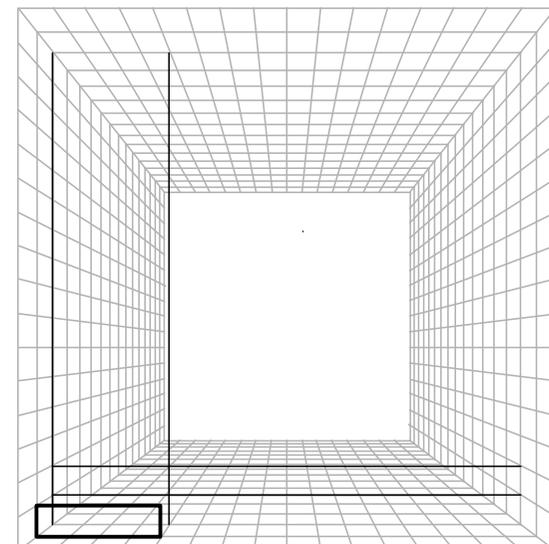


### Stage 2

A rectangle has been formed where the lines cross. This is the first riser of the steps and can now be drawn in more clearly. Alternatively, rub out the parts of the lines which are no longer needed.

### Stage 3

1. Join 1 up 2 back LH wall to 1 up 2 back RH wall.  
*(Part of this will form the bottom of the riser of the second step.)*
2. Join 2 up 2 back LH wall to 2 back 2 up RH wall.  
*(Part of this will form the top of the riser of the second step.)*
3. Join 2 back on join between floor and LH wall to 2 back on join between ceiling and LH wall.  
*(Part of this will form the left hand edge of the riser of the second step.)*
4. Join 2 back 4 across floor from LH wall to 2 back 4 across ceiling from LH wall.  
*(Part of this will form the right hand edge of the riser of the second step.)*

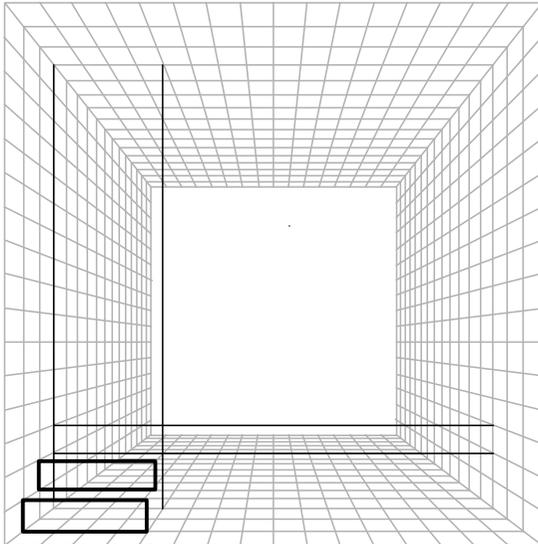


#### Stage 4

Draw in the riser of the second step.

#### Stage 5

1. Join 3 back 2 up LH wall to 3 back 2 up RH wall.
2. Join 3 back 3 up LH wall to 3 back 3 up RH wall.
3. Join 3 back LH floor to 3 back LH ceiling.
4. Join 3 back 4 across floor to 3 back 4 across ceiling.

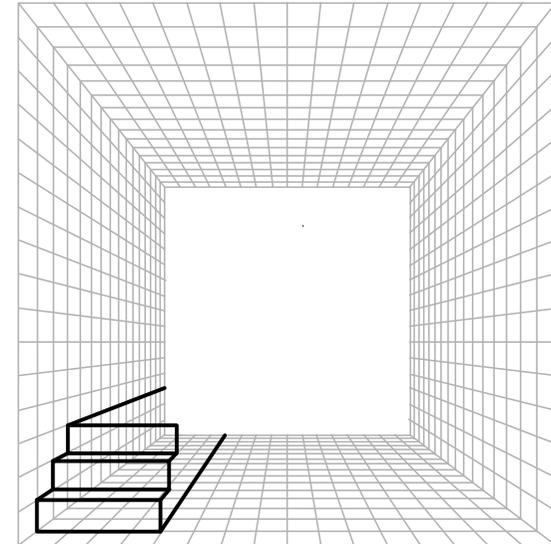


#### Stage 6

Draw in the riser of the third step.

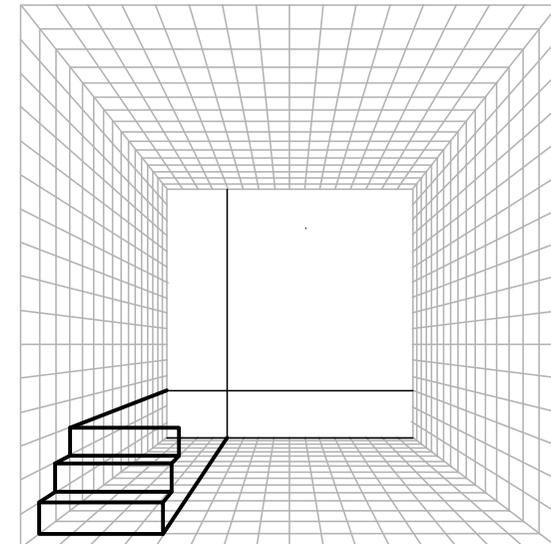
#### Stage 7

1. Join (a) top corners of first riser to bottom corners of second riser  
(b) top corners of second riser to bottom corners of third.
2. Join top left hand corner of third riser to 3 up at back of LH wall.
3. Join bottom right hand corner of first riser to 4 across from LH wall at back of floor.



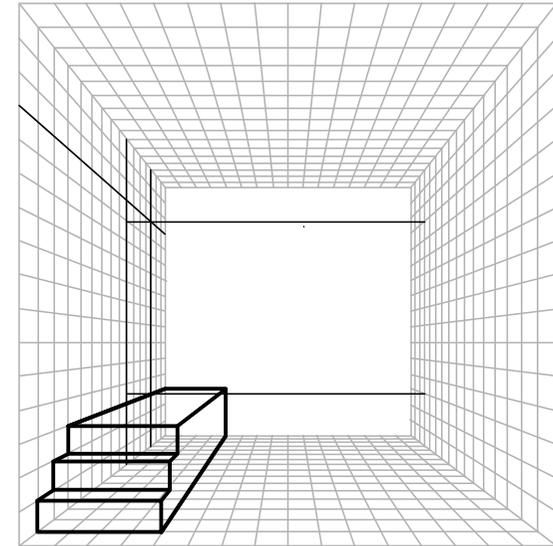
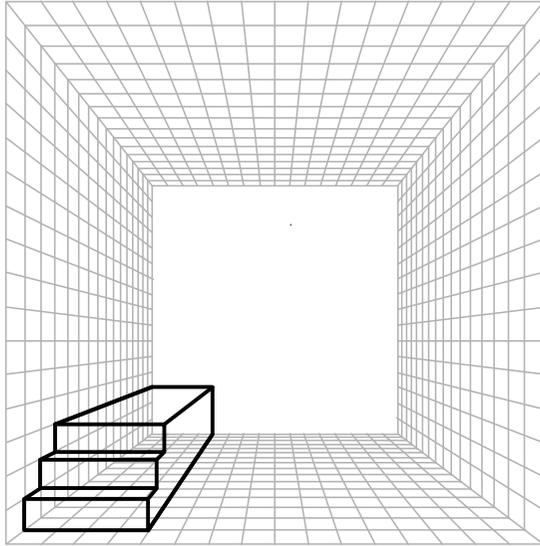
#### Stage 8

1. Join 4 across from LH wall on the back of the floor to 4 across from LH wall on the ceiling.
2. Join 3 up on LH wall at back to 3 up on RH wall at back.



### Stage 9

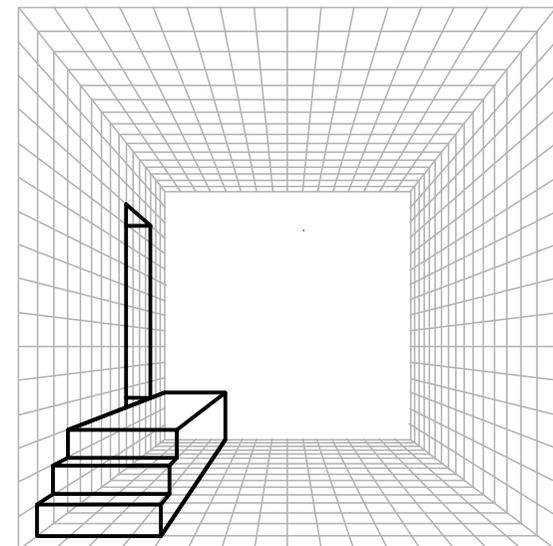
1. Join 3 up at back of LH wall to 3 up 4 across from back LH corner of floor.
2. Join top right hand corner of third riser to 4 across 3 up back wall.
3. Join 4 across the back wall on the floor to 4 across 3 up the back wall.



The steps are now complete. Rub out any construction lines.  
These principles can be used to draw any other features.

The diagrams opposite show the addition of a doorway in the wall on the landing

Note: Two of the lines extend beyond the wall to create the inside top and bottom of a corridor beyond the doorway.



Add details until the scene is complete.

