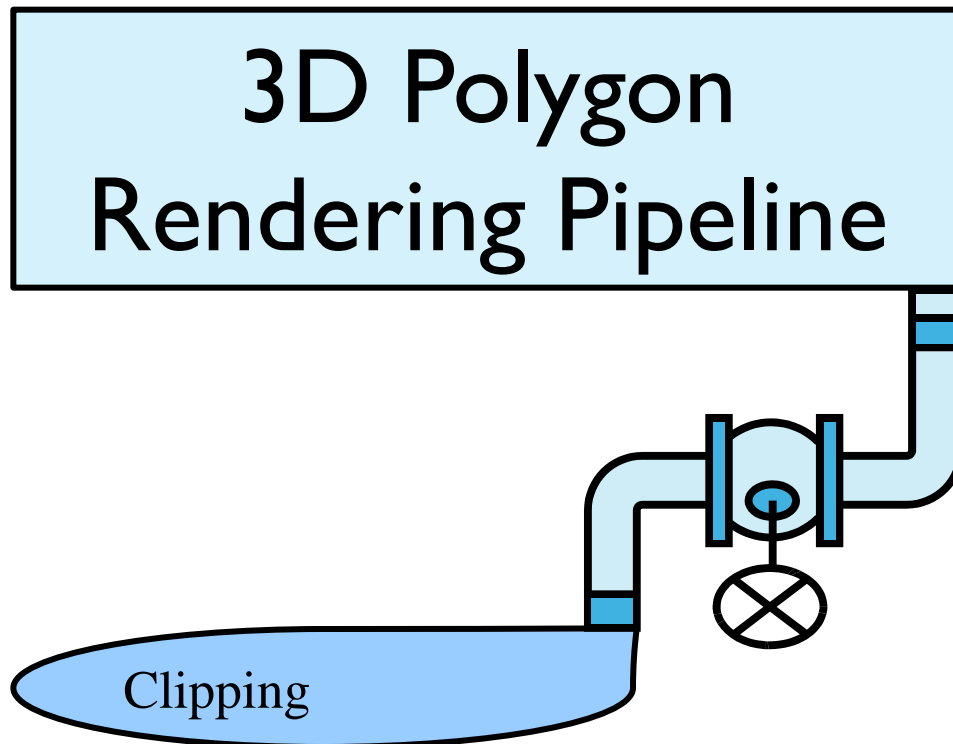


2009 סמסטר ב'

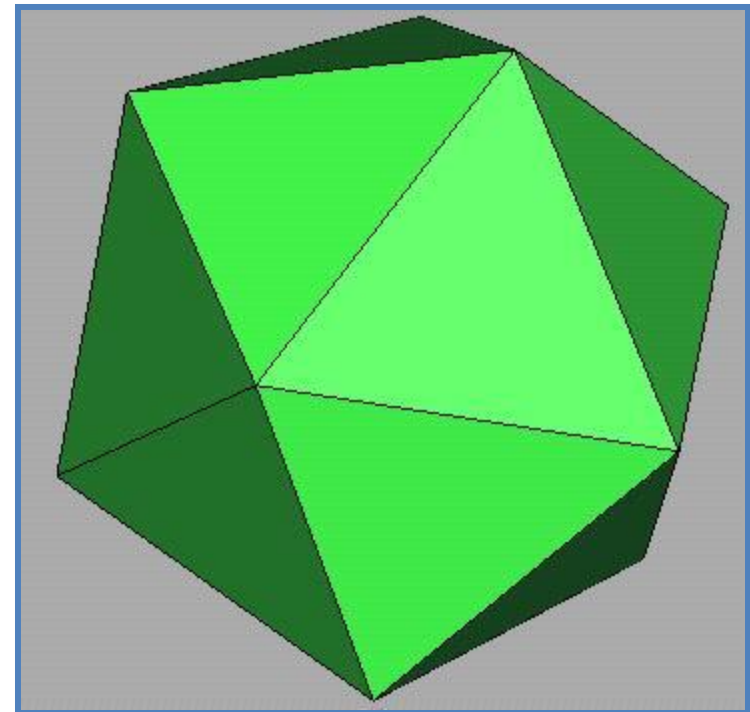
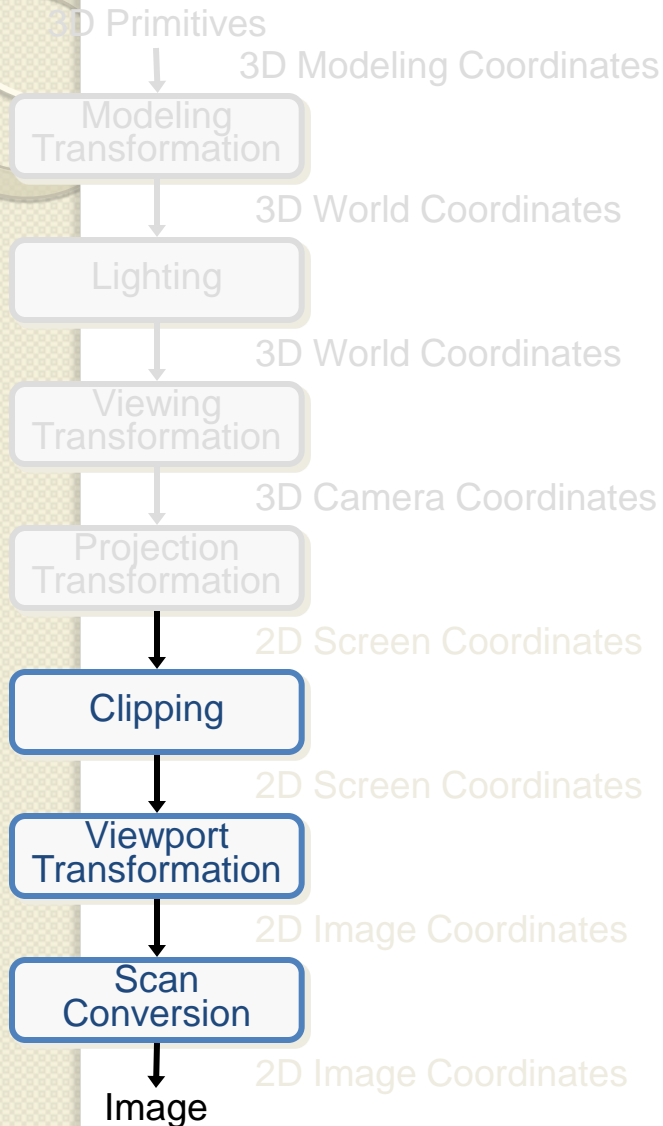
ליאור שפירא

קורס גרפיקה ממוחשבת

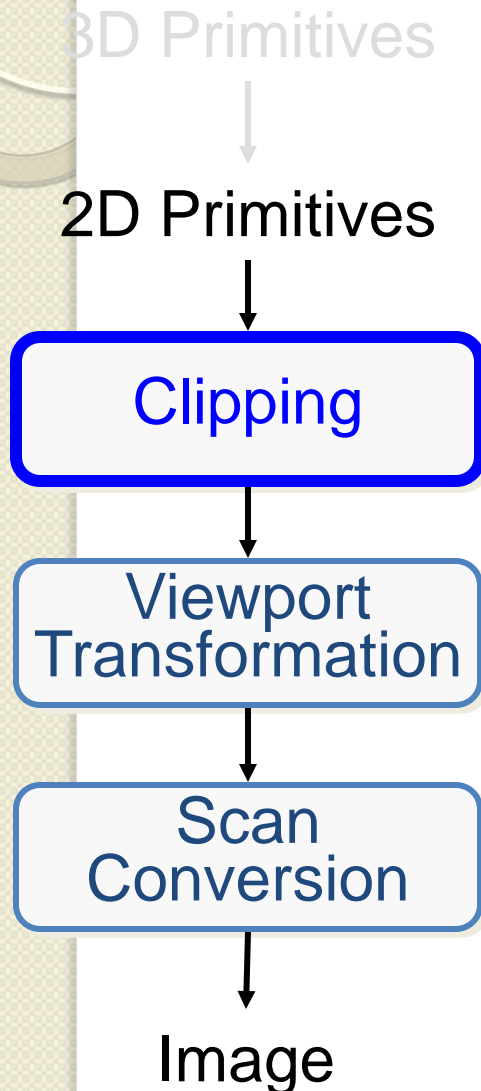
שיעור 6 חלק שני



3D Rendering Pipeline (for direct illumination)



2D Rendering Pipeline



Clip portions of geometric primitives residing outside the window

Transform the clipped primitives from screen to image coordinates

Fill pixels representing primitives in screen coordinates

Clipping

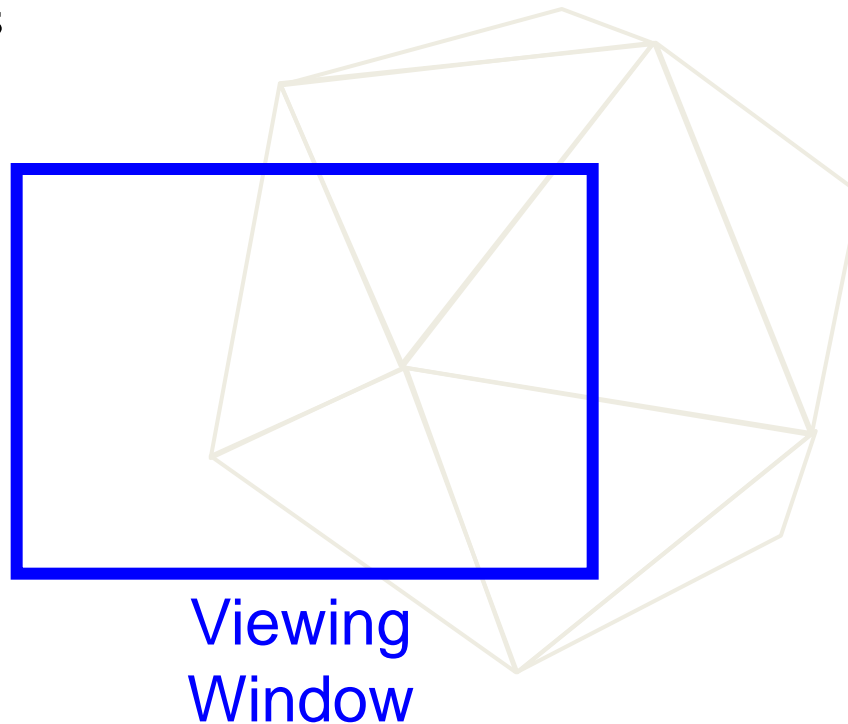
- Avoid drawing parts of primitives outside window
 - Window defines part of scene being viewed
 - Must draw geometric primitives only inside window



Screen Coordinates

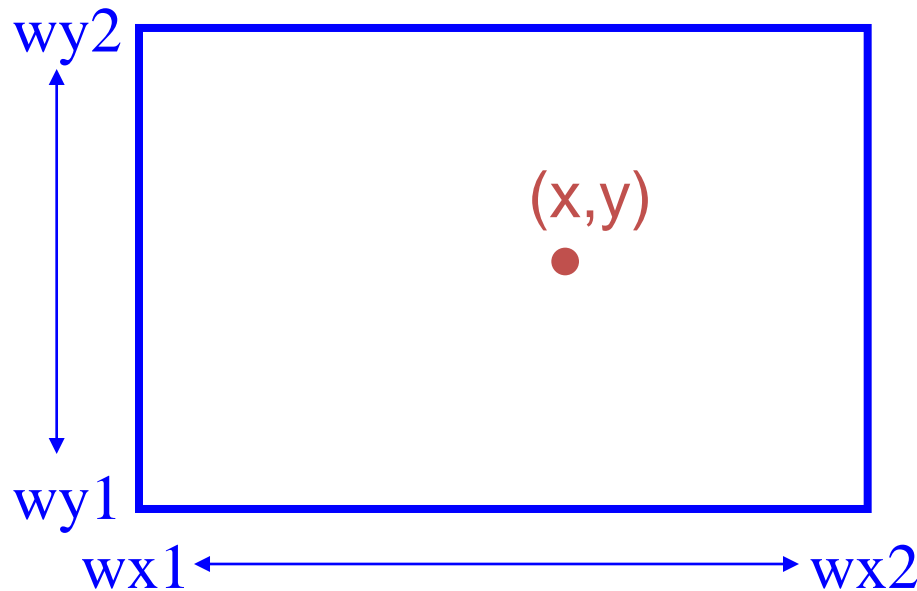
Clipping

- Avoid drawing parts of primitives outside window
 - Points
 - Lines
 - Polygons
 - Circles
 - etc.



Point Clipping

- Is point (x,y) inside the clip window?

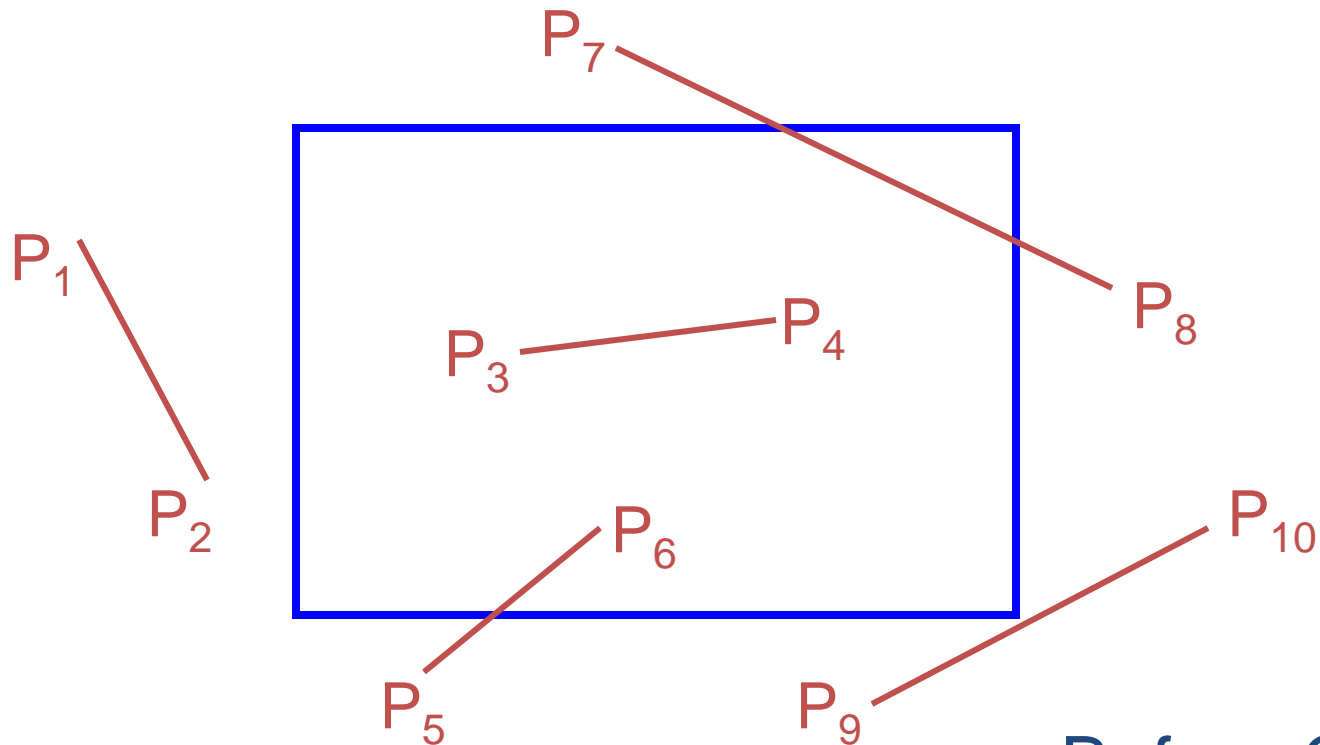


```
inside =  
  (x >= wx1) &&  
  (x <= wx2) &&  
  (y >= wy1) &&  
  (y <= wy2) ;
```

Window

Line Clipping

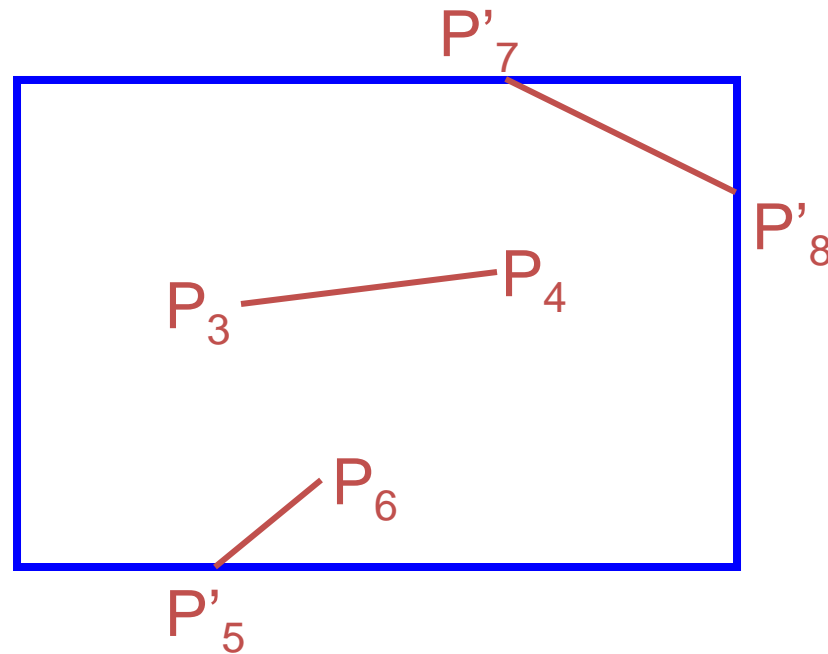
- Find the part of a line inside the clip window



Before Clipping

Line Clipping

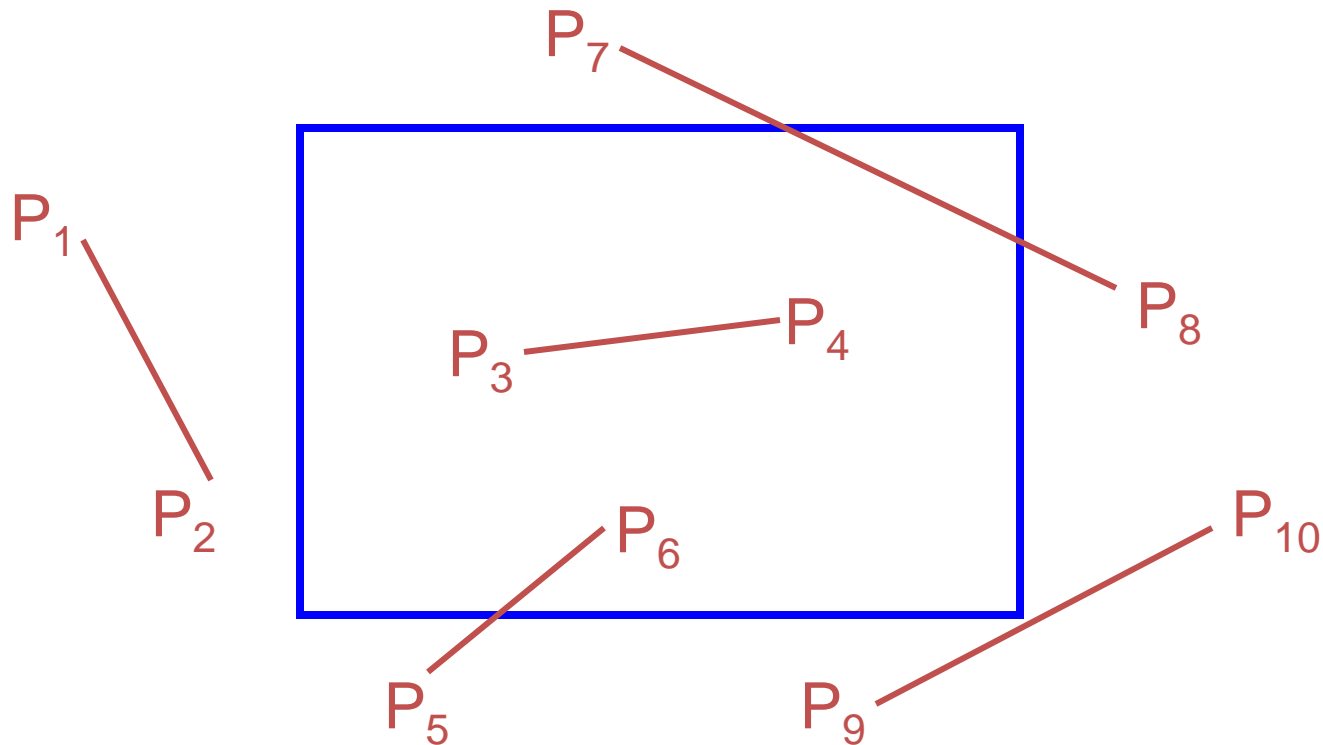
- Find the part of a line inside the clip window



After Clipping

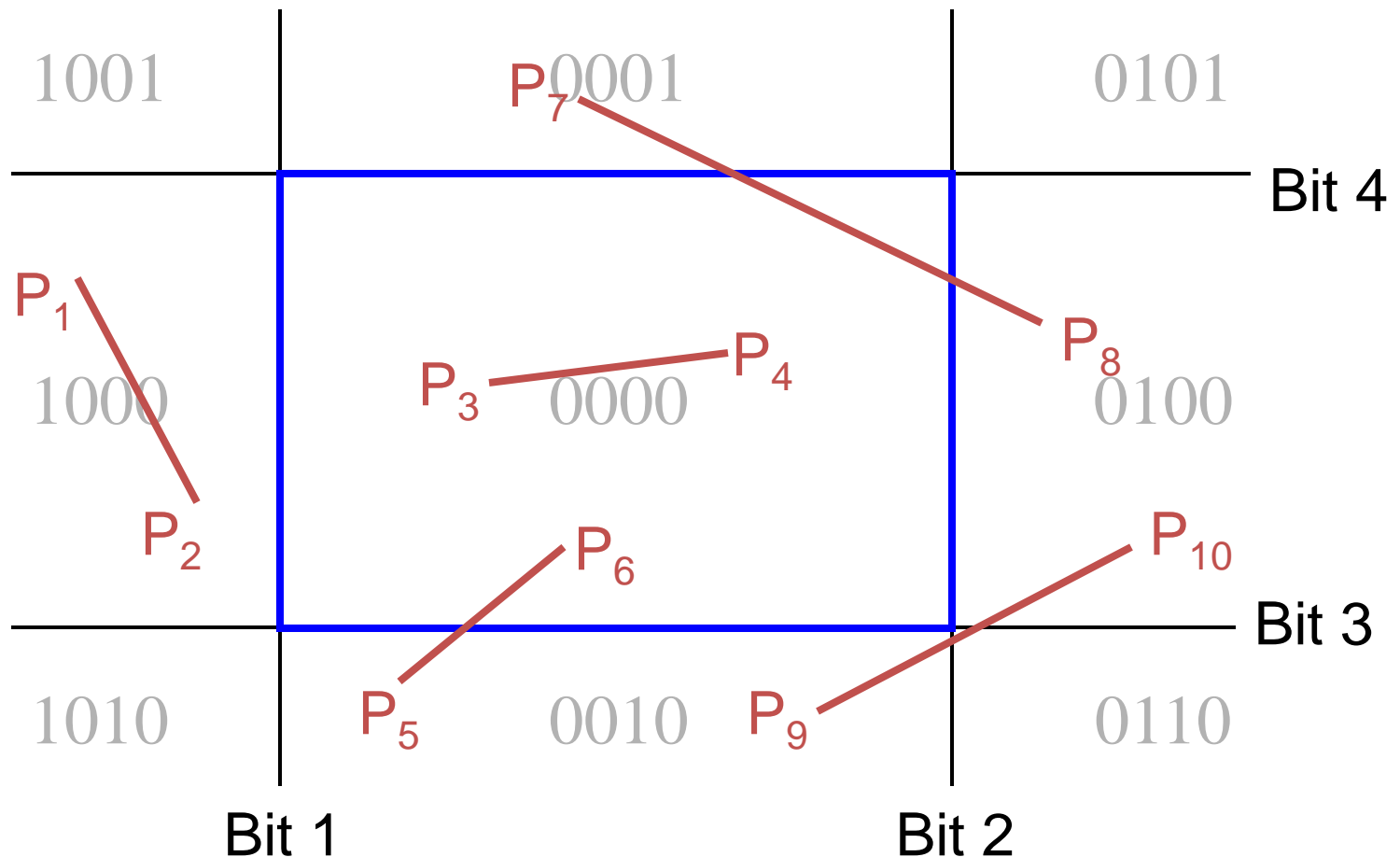
Cohen Sutherland Line Clipping

- Use simple tests to classify easy cases first



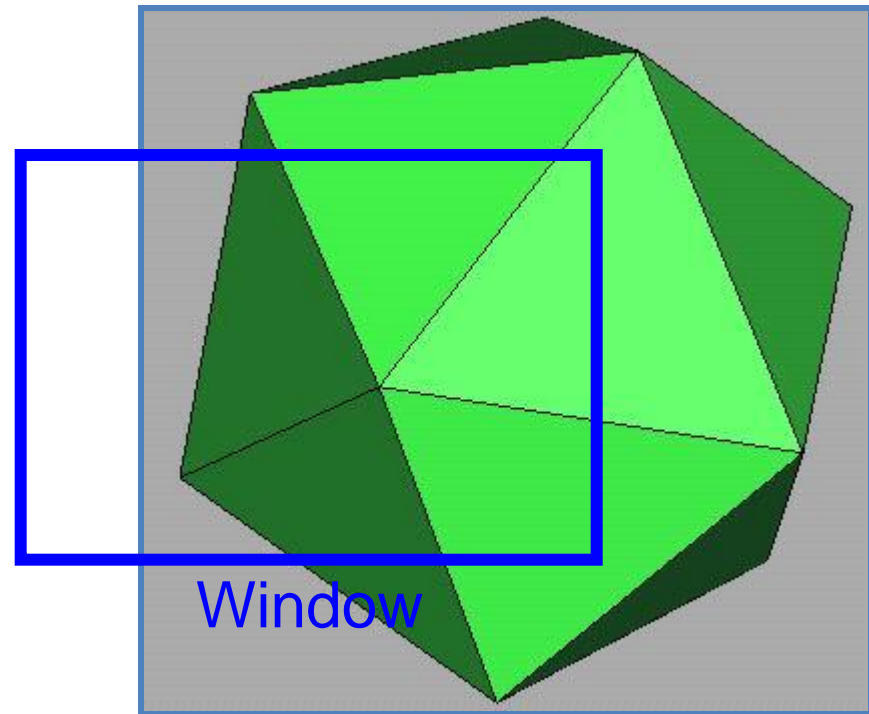
Cohen Sutherland Line Clipping

- Classify some lines quickly by AND of bit codes representing regions of two endpoints (must be 0)



Clipping

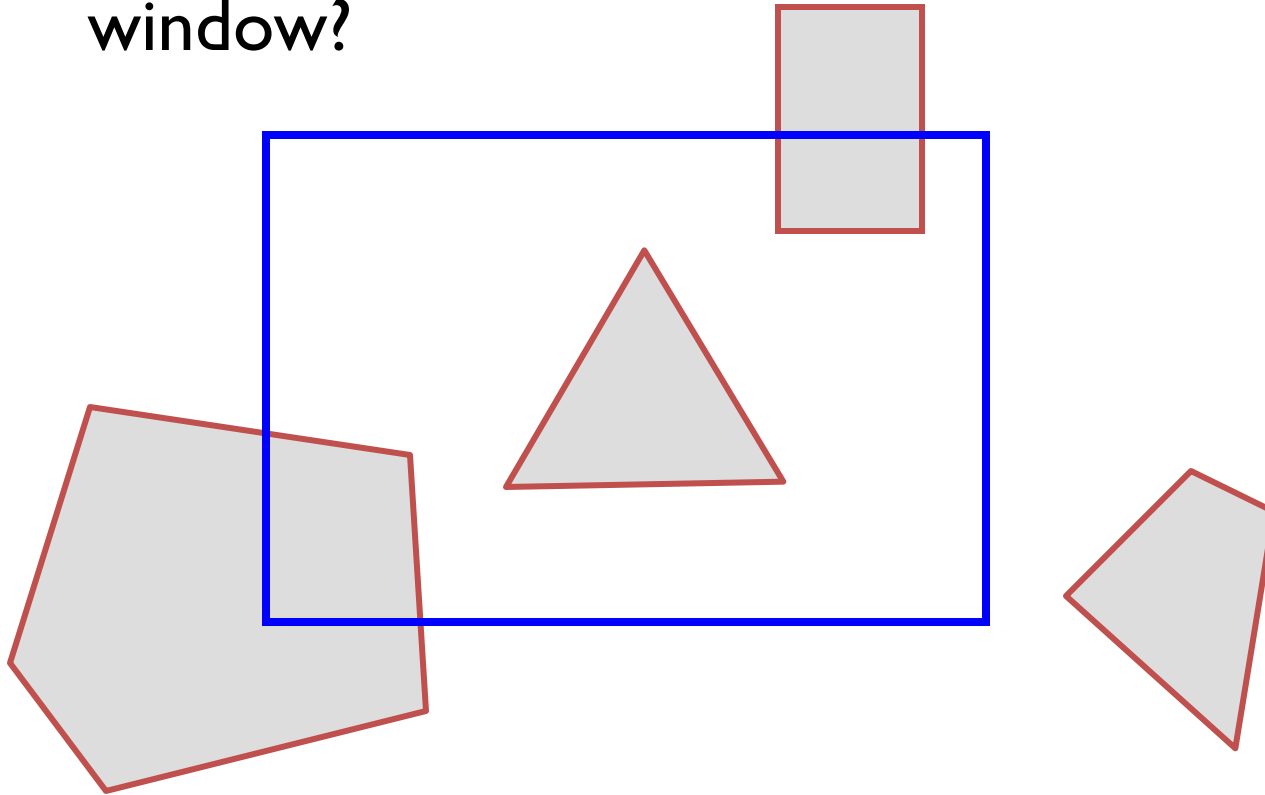
- Avoid drawing parts of primitives outside window
 - Points
 - Lines
 - **Polygons**
 - Circles
 - etc.



2D Screen Coordinates

Polygon Clipping

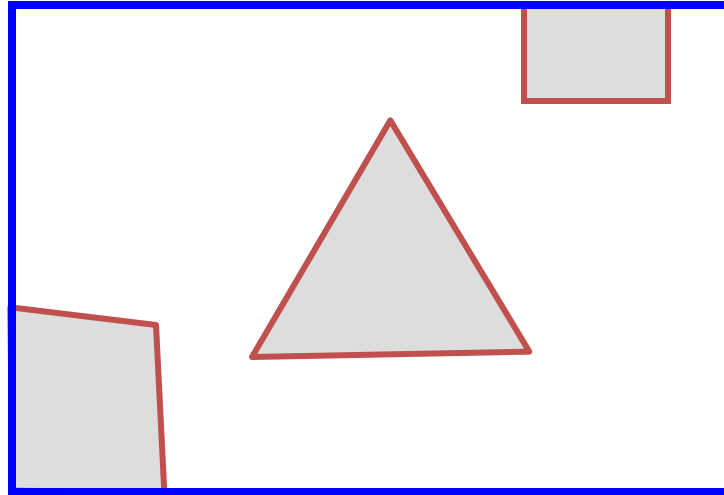
- Find the part of a polygon inside the clip window?



Before Clipping

Polygon Clipping

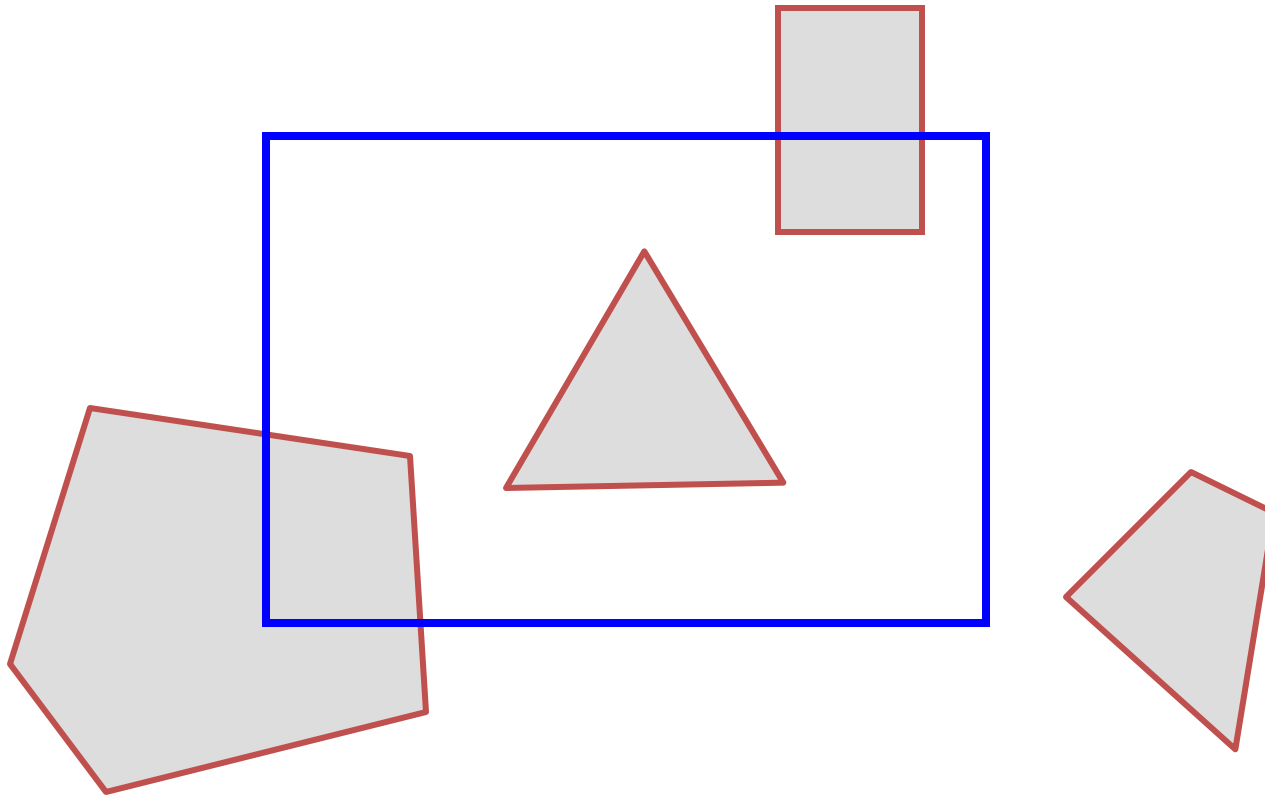
- Find the part of a polygon inside the clip window?



After Clipping

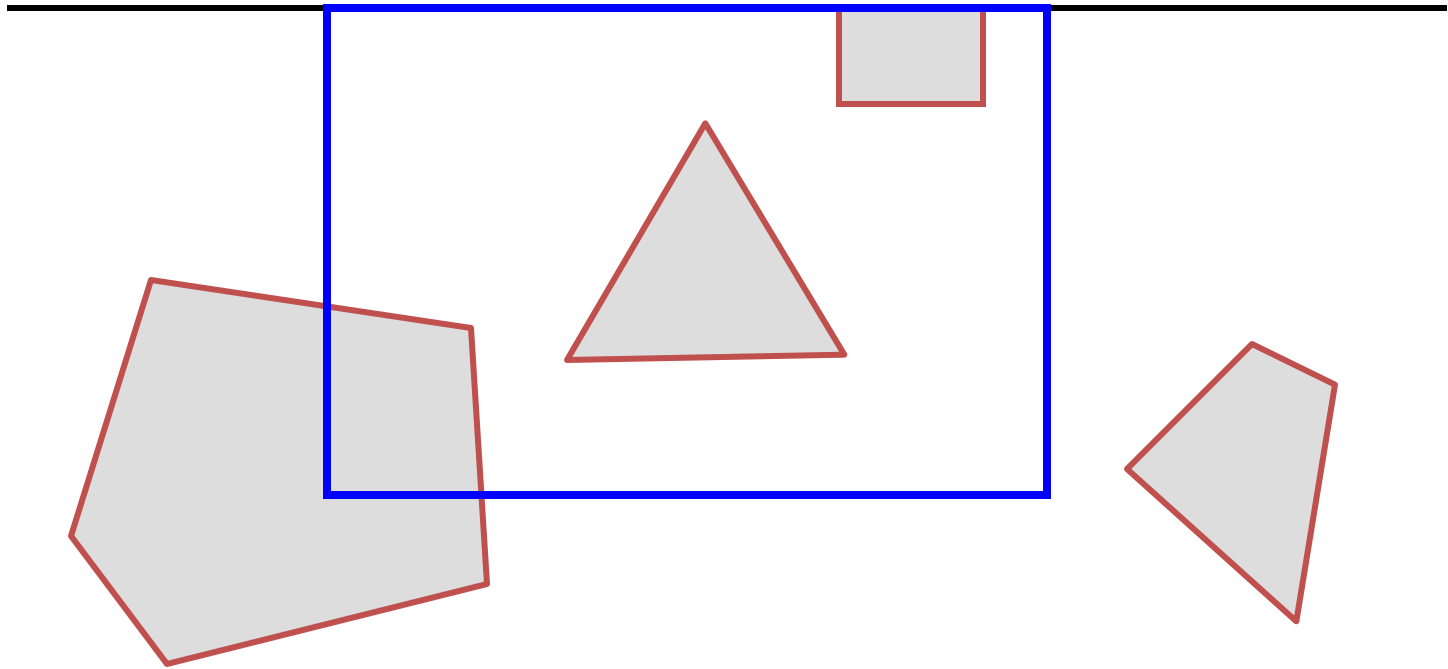
Sutherland Hodgeman Clipping

- Clip to each window boundary one at a time



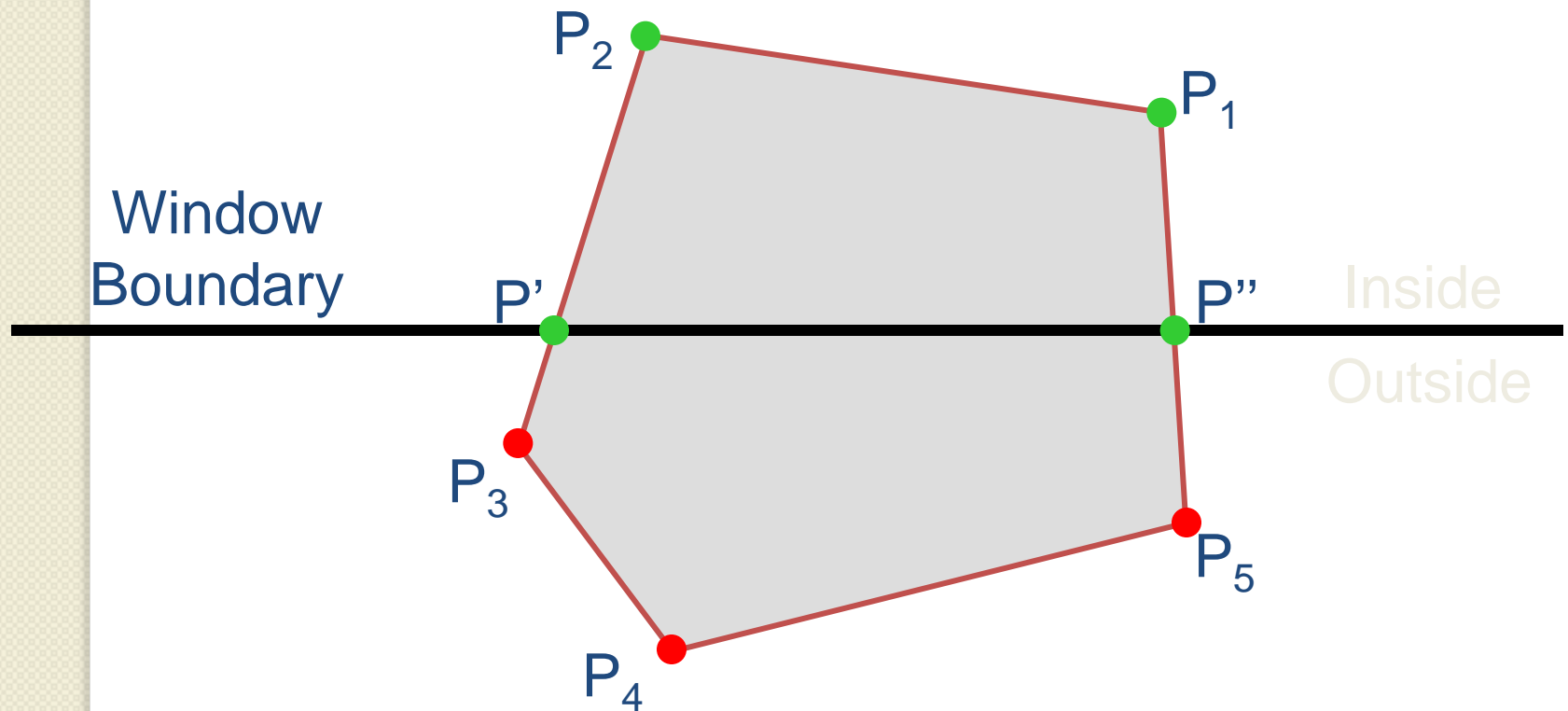
Sutherland Hodgeman Clipping

- Clip to each window boundary one at a time



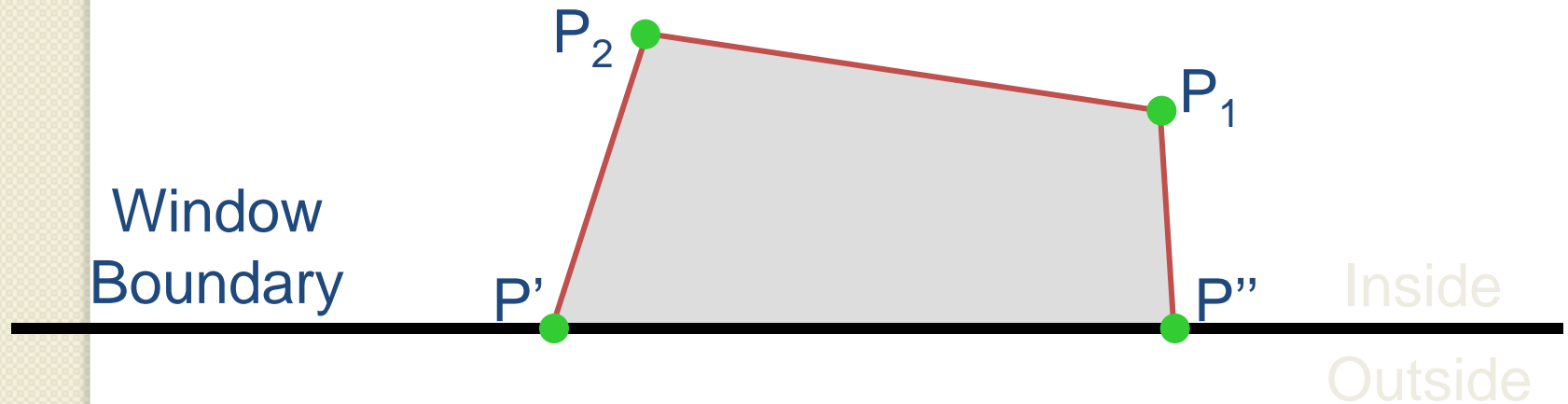
Clipping to a Boundary

- Do inside test for each point in sequence,
Insert new points when cross window boundary,
Remove points outside window boundary

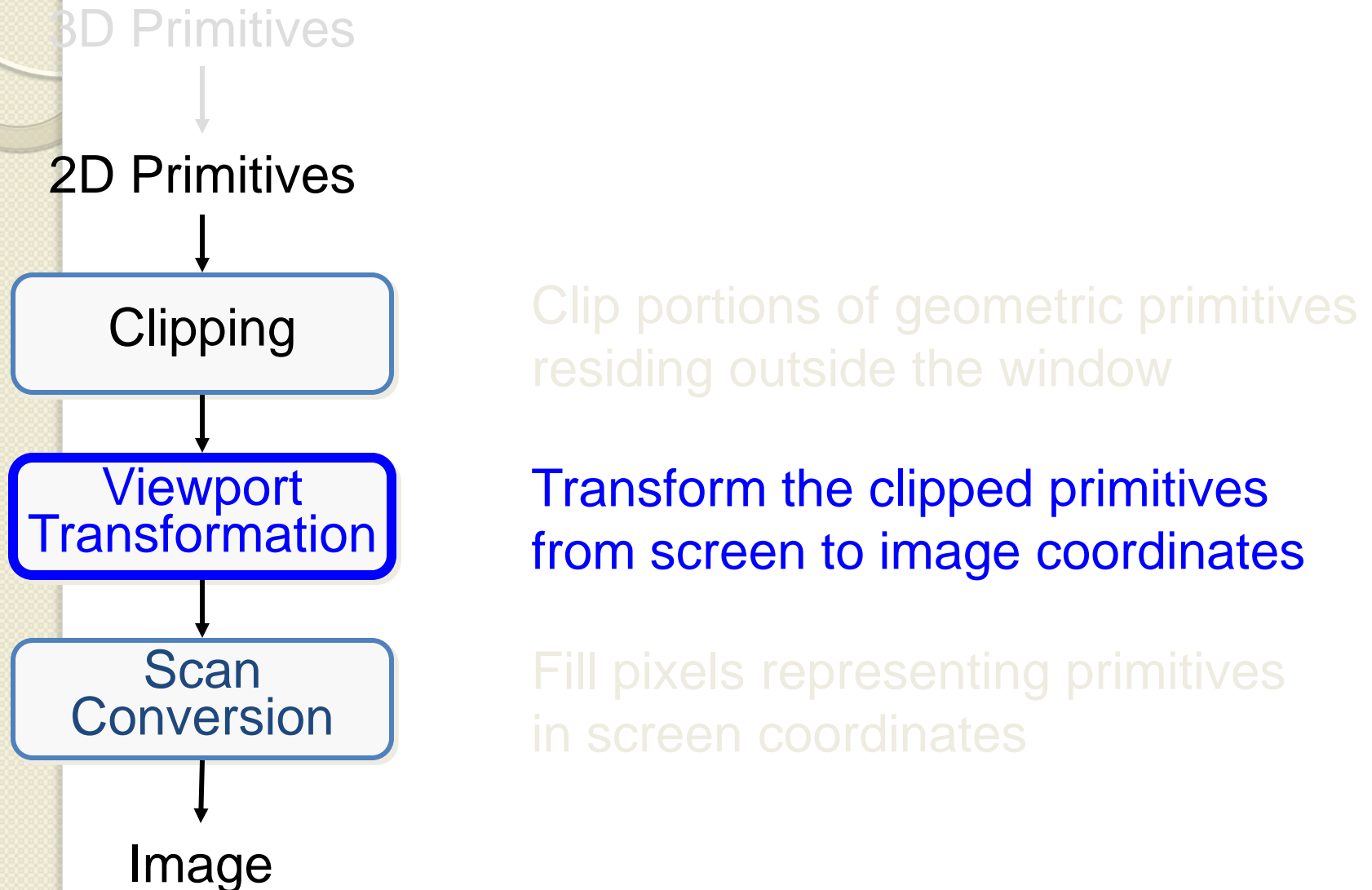


Clipping to a Boundary

- Do inside test for each point in sequence,
Insert new points when cross window boundary,
Remove points outside window boundary

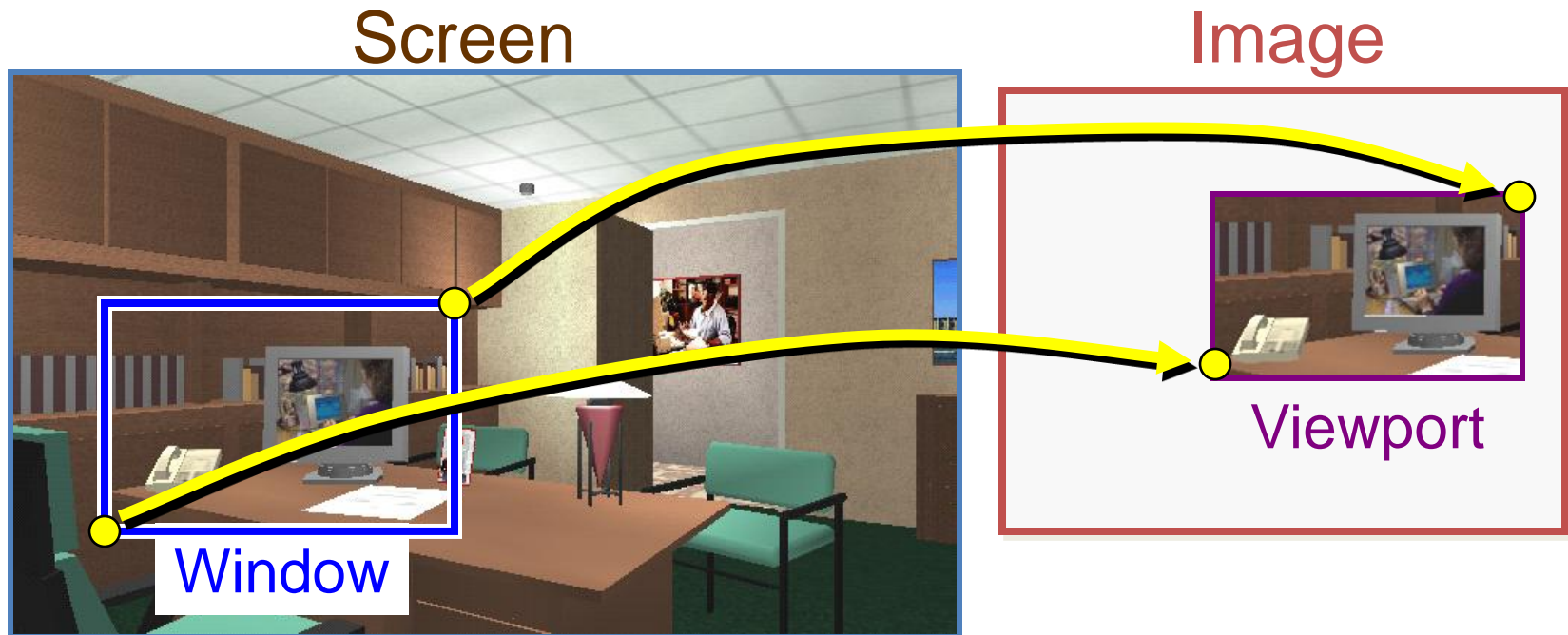


2D Rendering Pipeline



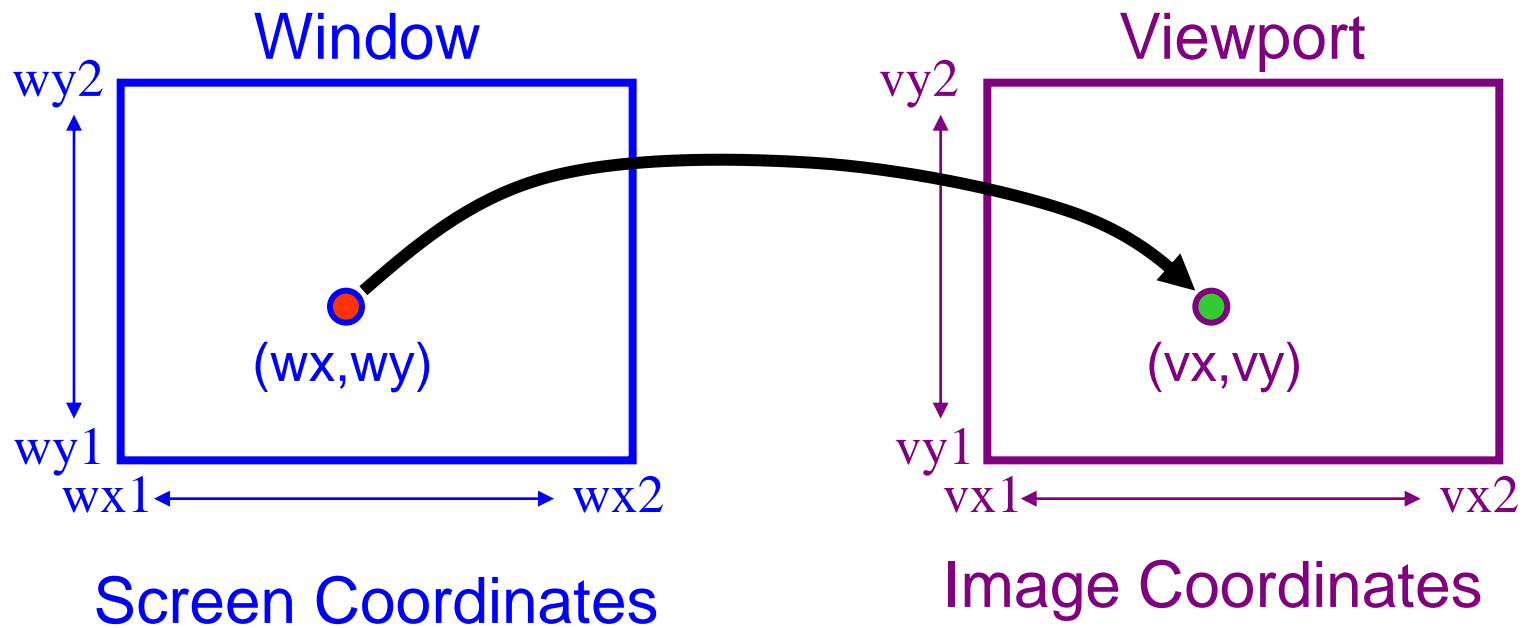
Viewport Transformation

- Transform 2D geometric primitives from screen coordinate system (normalized device coordinates) to image coordinate system (pixels)



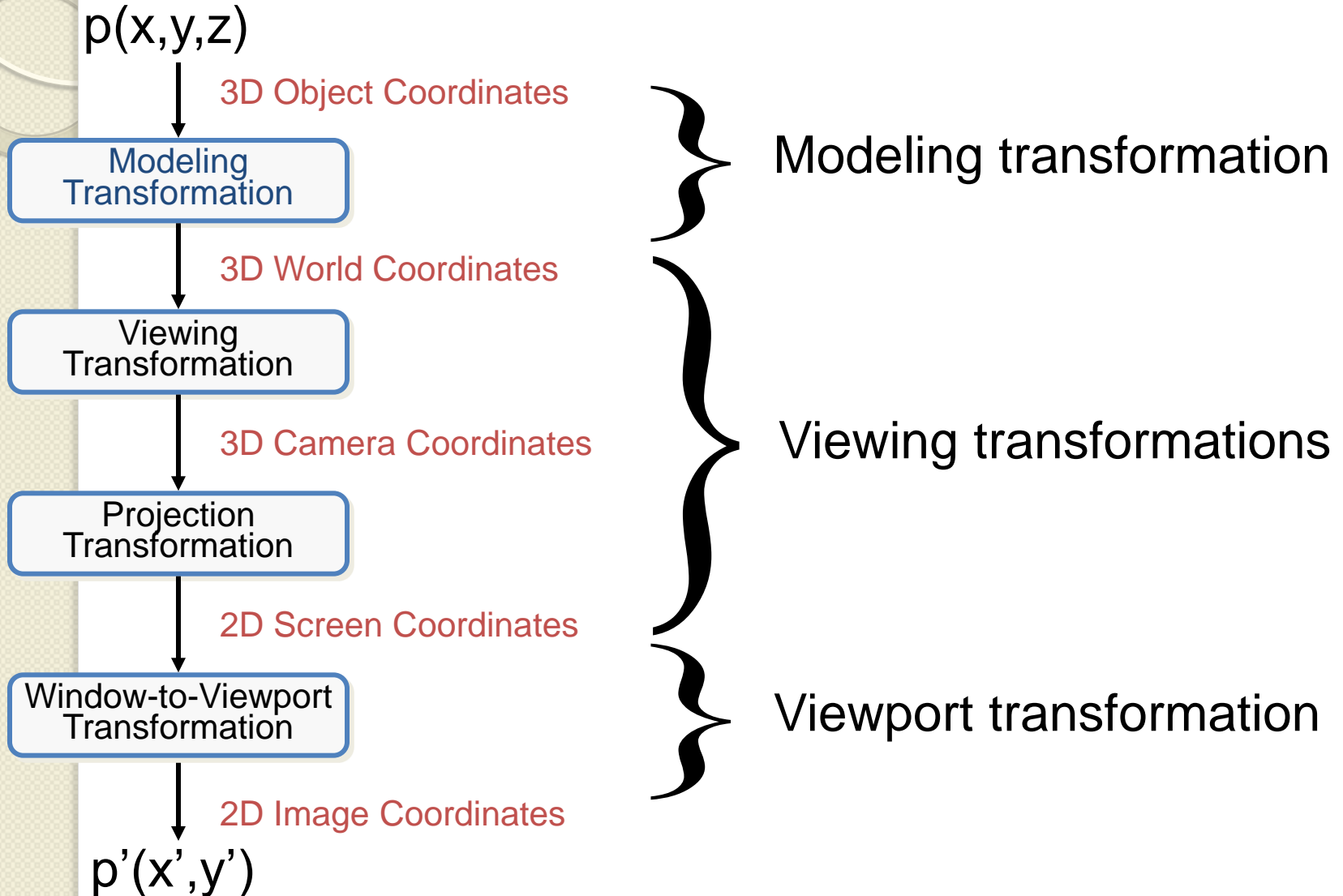
Viewport Transformation

- Window-to-viewport mapping



$$\begin{aligned} vx &= vx1 + (wx - wx1) * (vx2 - vx1) / (wx2 - wx1); \\ vy &= vy1 + (wy - wy1) * (vy2 - vy1) / (wy2 - wy1); \end{aligned}$$

Summary of Transformations



Summary

3D Primitives



2D Primitives



Clipping



Viewport
Transformation



Scan
Conversion



Image

Clip portions of geometric primitives residing outside the window

Transform the clipped primitives from screen to image coordinates

Fill pixels representing primitives in screen coordinates

Summary

