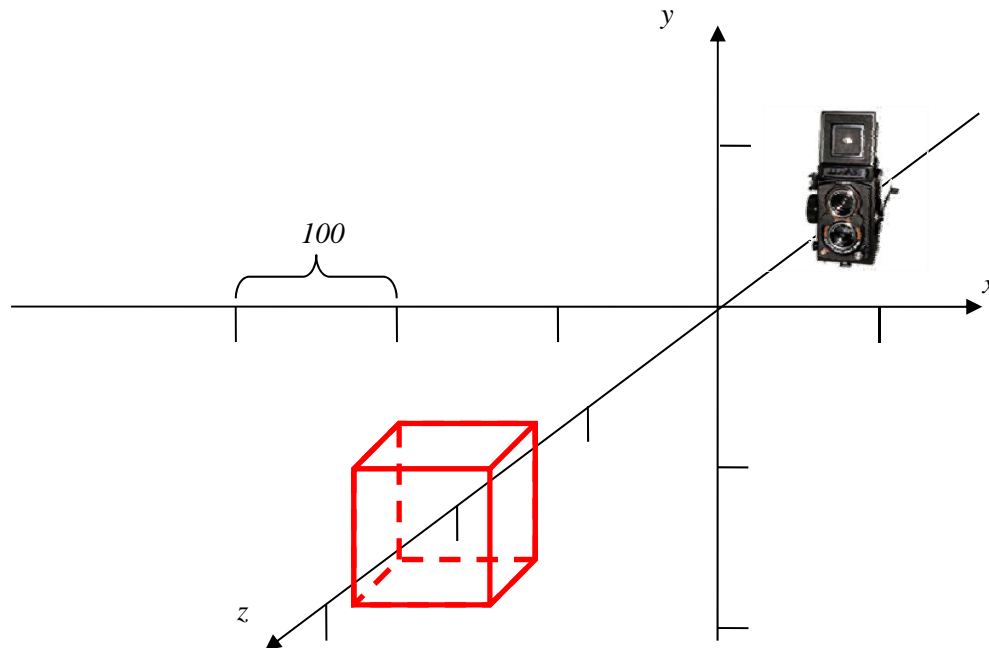# CS3241 Computer Graphics

Tutorial #3

# QUESTION 1

- A cube with vertices (± 50, ±50, 200±50) is viewed by a camera at (0,0,-100) with focal length 100, look-at direction (0,0,1) and up vector (0,1,0). The viewplane is the xy-plane.

# QUESTION 1A

- Compute $P_f$ and the x, y AND z positions of all vertices of the cube and draw the cube in the screen below.

$$P_f = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \frac{1}{f} & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \frac{1}{100} & 1 \end{pmatrix}$$

# QUESTION 1A

- Compute $P_f$ and the x, y AND z positions of all vertices of the cube and draw the cube in the screen below.
  - For (50,50,150)

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \dfrac{1}{100} & 1 \end{pmatrix} \begin{pmatrix} 50 \\ 50 \\ 150 \\ 1 \end{pmatrix} = \begin{pmatrix} 50 \\ 50 \\ 150 \\ \dfrac{250}{100} \end{pmatrix} \Rightarrow \begin{pmatrix} \dfrac{5000}{250} \\ \dfrac{5000}{250} \\ \dfrac{15000}{250} \end{pmatrix} \Rightarrow \begin{pmatrix} 20 \\ 20 \\ 60 \end{pmatrix}$$
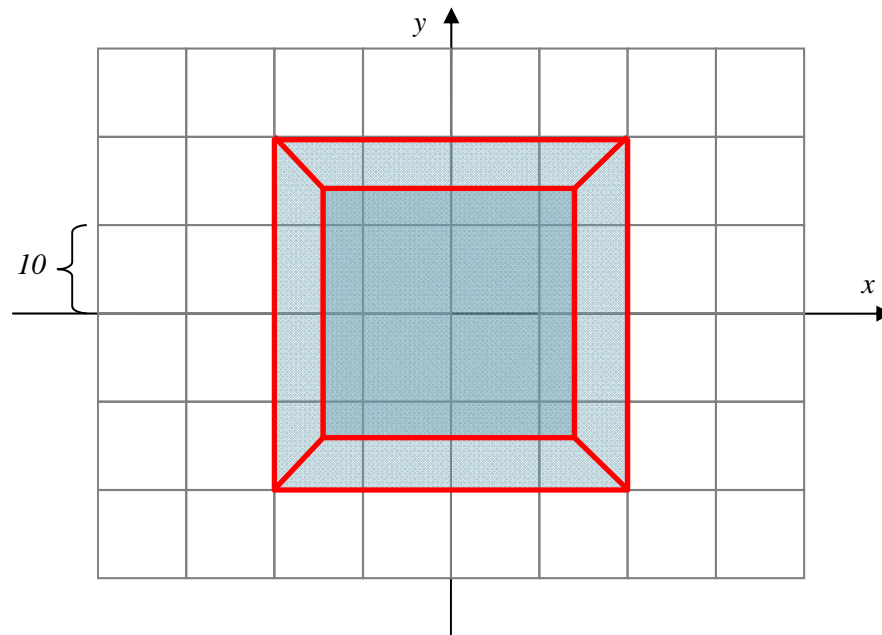
# QUESTION 1A

- Compute $P_f$ and the x, y AND z positions of all vertices of the cube and draw the cube in the screen below.
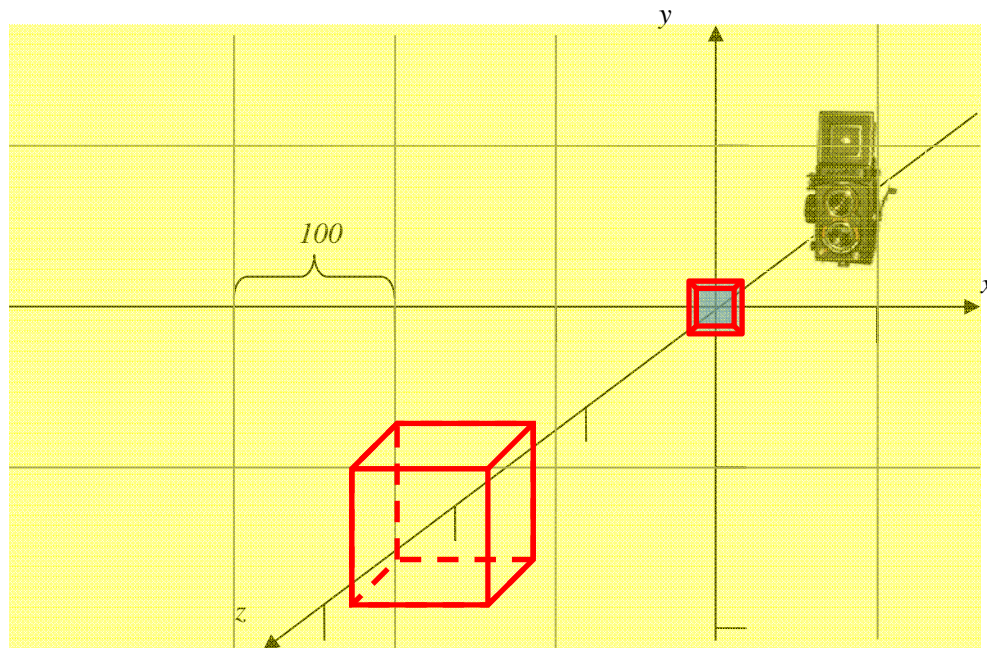  - For (50,50,250)

$$\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \frac{1}{100} & 1 \end{pmatrix} \begin{pmatrix} 50 \\ 50 \\ 250 \\ 1 \end{pmatrix} = \begin{pmatrix} 50 \\ 50 \\ 250 \\ \frac{350}{100} \end{pmatrix} \Rightarrow \begin{pmatrix} \frac{5000}{350} \\ \frac{5000}{350} \\ \frac{25000}{350} \end{pmatrix} \Rightarrow \begin{pmatrix} 14.29 \\ 14.29 \\ 71.43 \end{pmatrix}$$
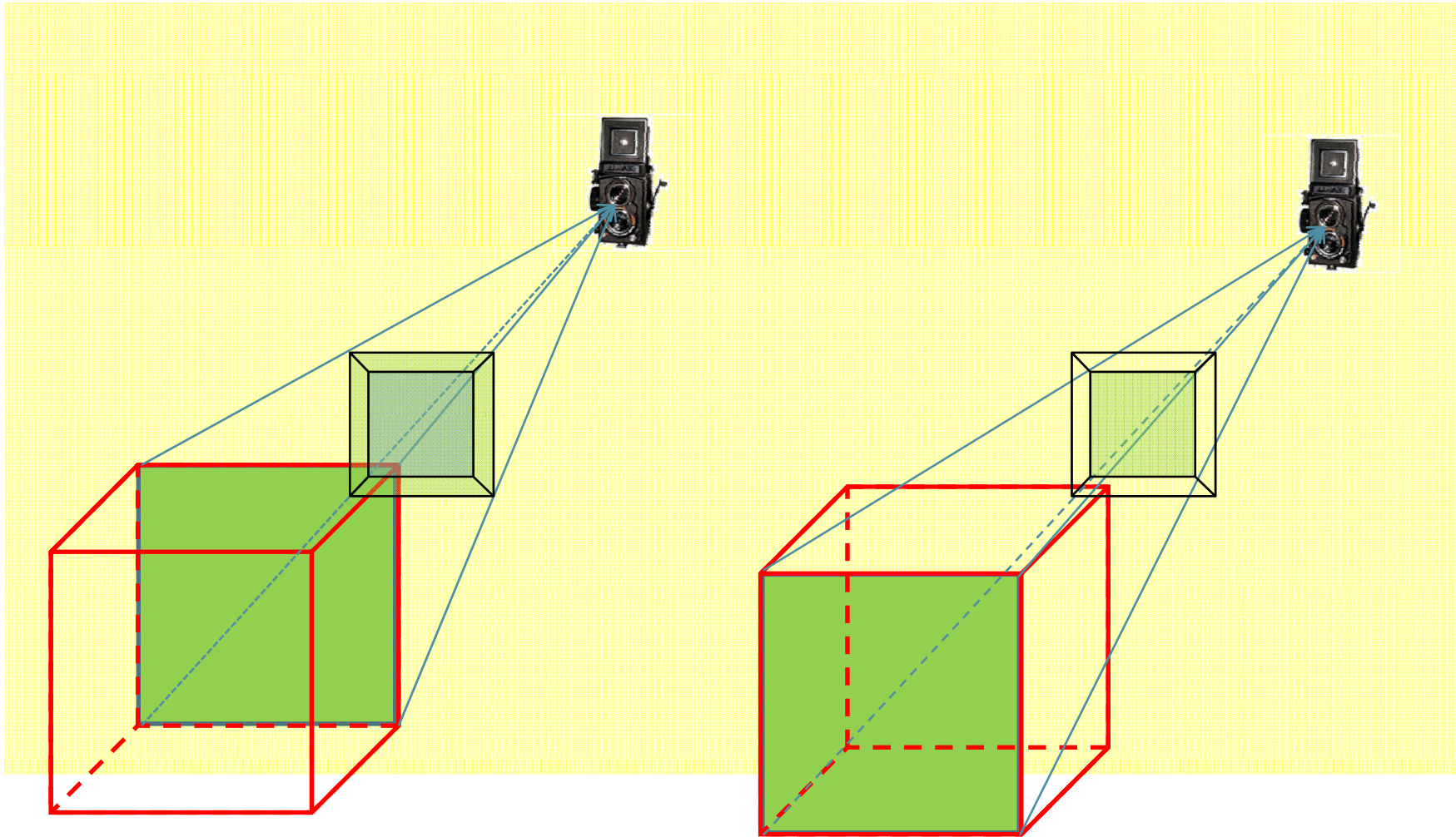
# QUESTION 1A

- Compute $P_f$ and the x, y AND z positions of all vertices of the cube and draw the cube in the screen below.
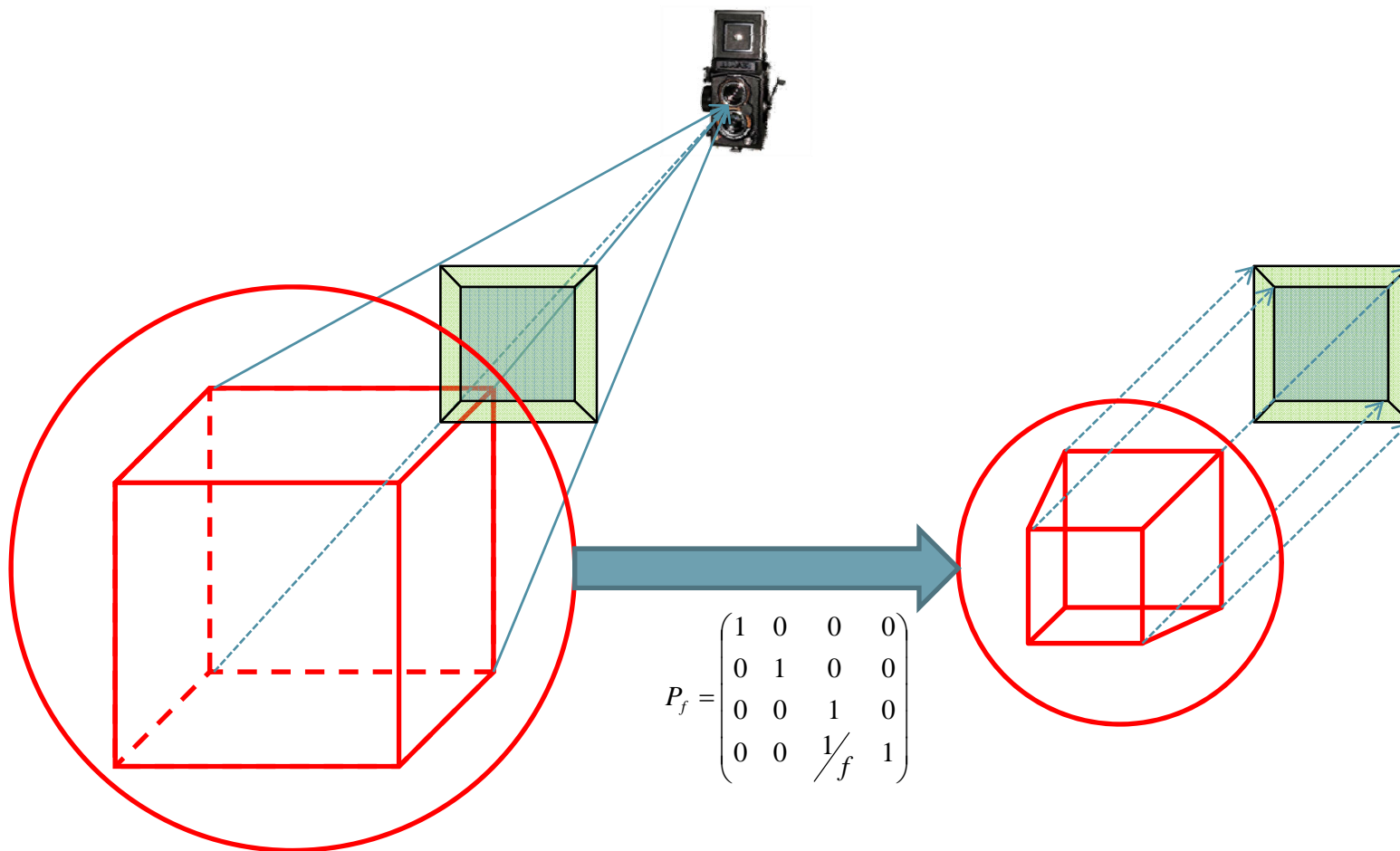
# PERSPECTIVE TRANSFORMATION ILLUSTRATED
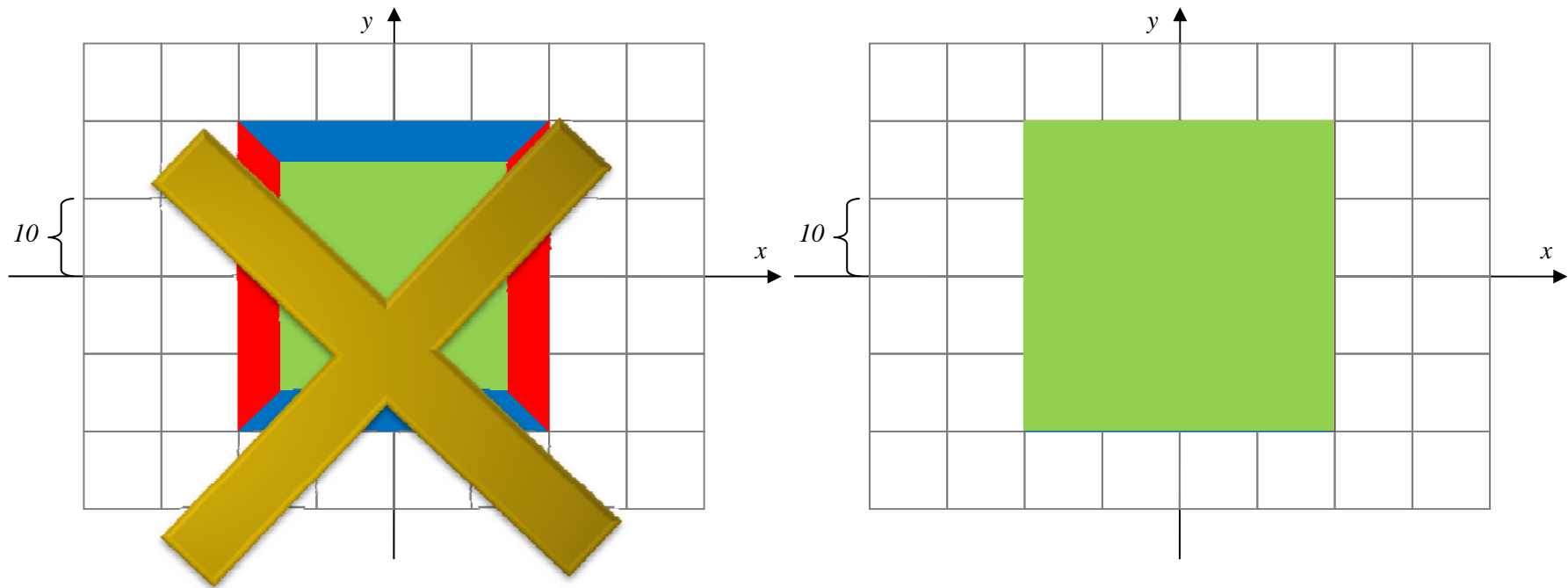
# PERSPECTIVE TRANSFORMATION ILLUSTRATED

# PERSPECTIVE TRANSFORMATION ILLUSTRATED



$$P_f = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & \dfrac{1}{f} & 1 \end{pmatrix}$$

# QUESTION 1B

- Let the faces that are perpendicular to the x, y and z-axis be red, blue and green respectively. Label the corresponding colors in your drawing.
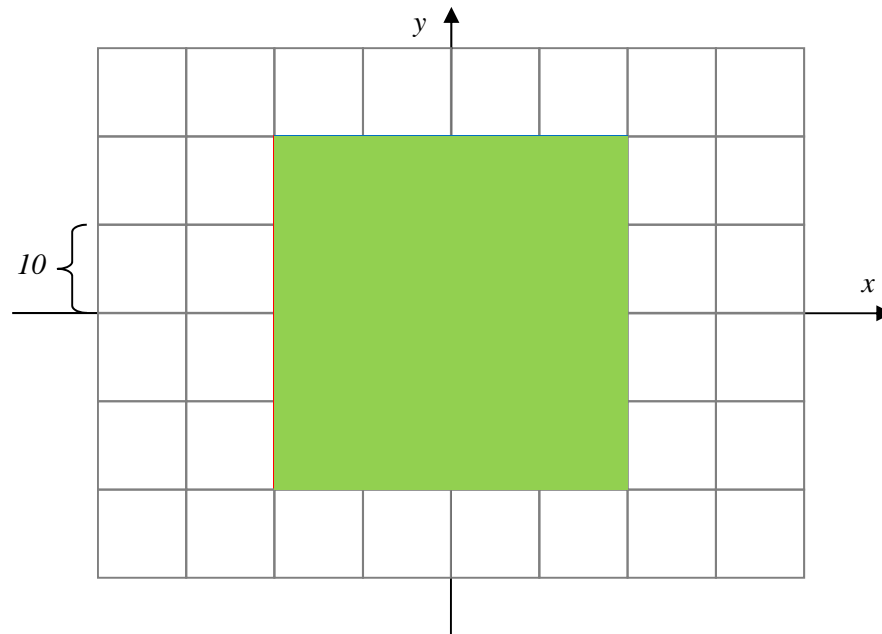
# QUESTION 1C

○ We use OpenGL and draw the six faces one by one. The FIRST faces to be drawn are the two blue faces (parallel to the xz-plane). Then we draw the green faces, and then finally draw the red ones afterwards. What will be the final result on the screen? Will it appear as what you predict in (b)?
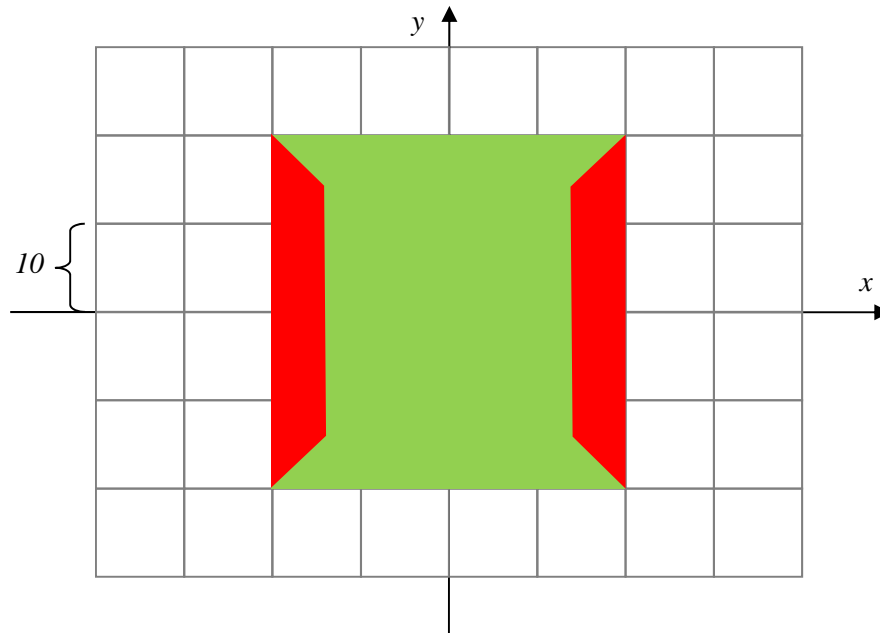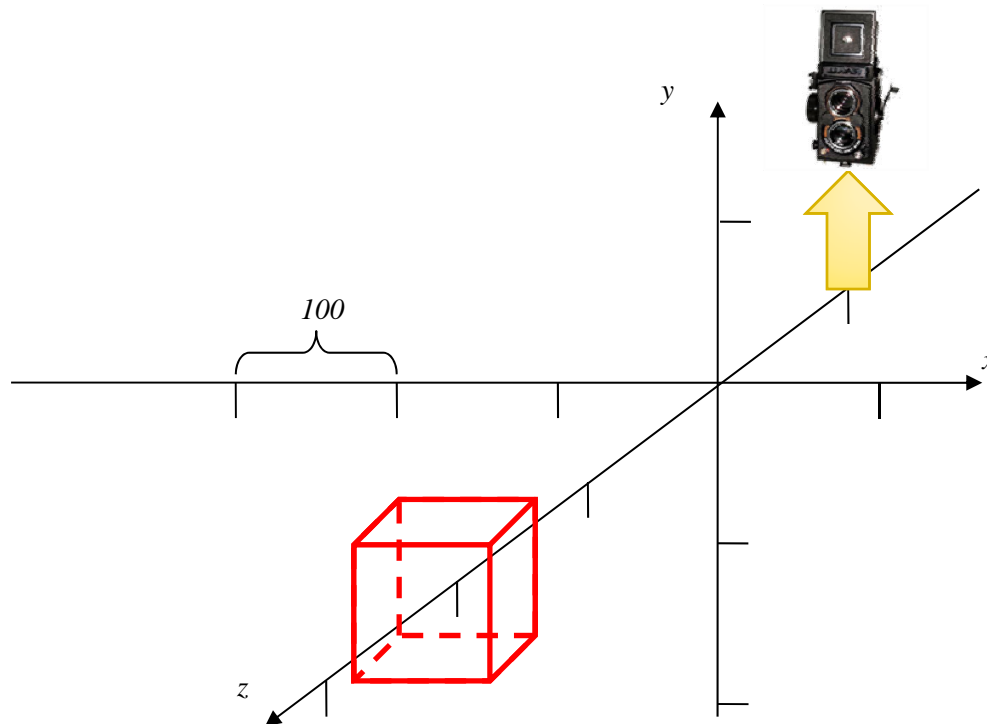
# QUESTION 1D

- What should be the drawing order?
  - First, the green face at z = 250
  - Then the four red and blue faces
  - Finally the green face at z = 150

# QUESTION 1E

- What do we have to do if the camera position is at (0,100,-100) instead of (0,0,-100)?

# QUESTION 1D

- What do we have to do if the camera position is at (0,100,-100) instead of (0,0,-100)?
  - We keep the camera at (0,0,-100), but move every object by (0,-100,0)
  - So the cube has vertices (± 50, ±50-100, 200±50)