# CSE-413

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Ans. to the ques. no.-

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So, 201X14ABC

X = 7

A = 0

B = 1

C = 8

Y = A+B = 0+1 = 1 So, Y = 1

Z = C+X = 8+7 = 15 So, Z = 15

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Ans. to the ques. no.- 01(a)

Vanishing Point:

Any set of parallel lines which are not parallel to the view plane, meet at some point. There are infinite number of these points. These points are called vanishing points.

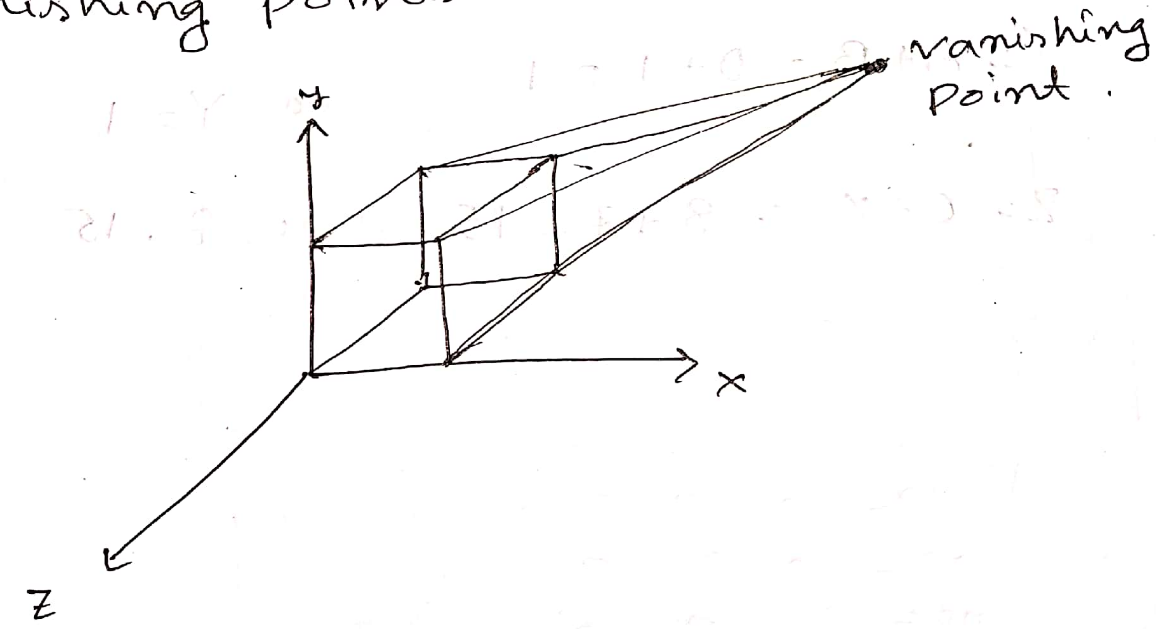


fig: vanishing point.

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Ans. to the ques. no.- 01(b)

Given,

Camera at (7, 1, 15)

and projection plane is given in point normal form :

where,

$R_0 = (0, 1, 8)$

$N = (3, 8, 9) = 3\hat{i} + 8\hat{j} + 9\hat{k}$.

we need to generate projection matrix for the projected point $P'(x', y', z')$ on the plane for the point $P(x, y, z)$.

So, we need:

① Translate the camera by (-7, -1, -15)

② Project the P

③ Translate back camera by (7, 1, 15)

Here,

$d_0 = R_0 \cdot N = (0\times3) + (1\times8) + (8\times9)$
$= 80$

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So, transformation matrix $= T P T_{back}$.

So, we can write:

$$\begin{bmatrix} x' \\ y' \\ z' \\ 1 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 15 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} d_0 & 0 & 0 & 0 \\ 0 & d_0 & 0 & 0 \\ 0 & 0 & d_0 & 0 \\ 3 & 8 & 9 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -7 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -15 \\ 0 & 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 15 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 80 & 0 & 0 & 0 \\ 0 & 80 & 0 & 0 \\ 0 & 0 & 80 & 0 \\ 3 & 8 & 9 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 & -7 \\ 0 & 1 & 0 & -1 \\ 0 & 0 & 1 & -15 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & 0 & 7 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 15 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 80 & 0 & 0 & -560 \\ 0 & 80 & 0 & -80 \\ 0 & 0 & 80 & -1200 \\ 3 & 8 & 9 & -164 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 101 & 56 & 63 & -1708 \\ 3 & 88 & 9 & -244 \\ 45 & 120 & 215 & -3660 \\ 3 & 8 & 9 & -164 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \\ 1 \end{bmatrix}$$

That is the Projection Matrix for $P'(x', y', z')$ (Ans)

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Ans. to the ques: no.- 02(b)

## Z-buffer Algorithm:

Initialize:

Each Z-buffer cell = max Z-value

Each frame-buffer cell = background color.

for each polygon:

compute $z(x, y)$ as polygon depth at pixel$(x,y)$

if $z(x, y)$ < Z-buffer value at $(x, y)$:

Z-buffer$(x, y)$ = $z(x, y)$

frame-buffer$(x,y)$ = color of polygon at $(x, y)$

end if

end for.

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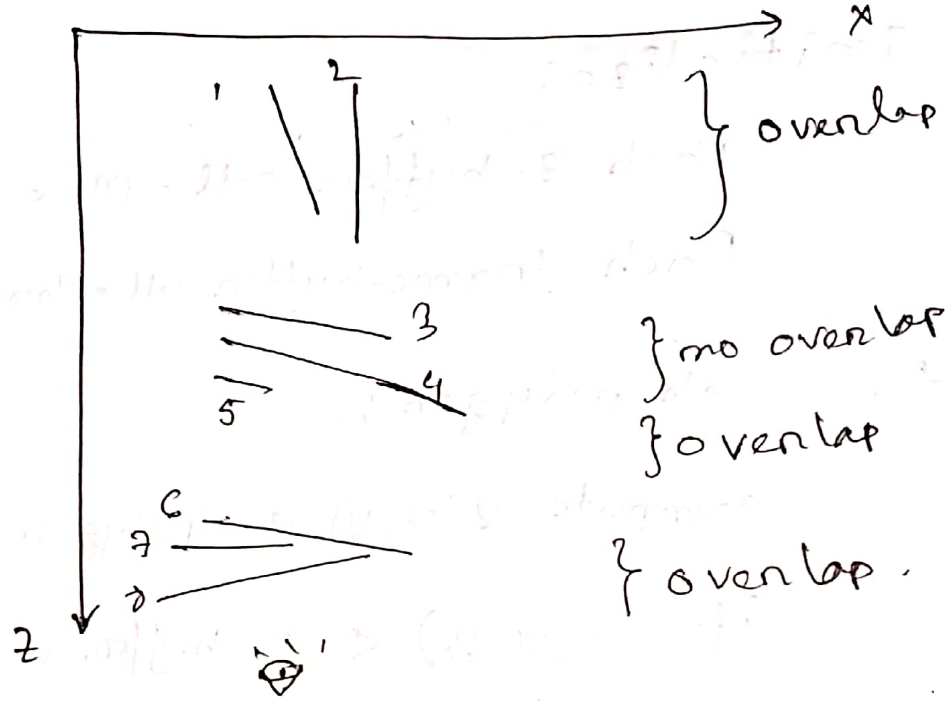
Ans. to the ques. no.- 02 (a)

Given:




we need to test:

① if x-extends of P and Q are disjoint

② is P entirely on the opposite side of Q' plane from the eye!

③ is Q entirely on the same sid of P's plane as the eye?

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~~for, P 2 1 and Q :~~

for, 1, 2 :

they overlap so, we need to consider.

test - 1 : ~~is extend~~ ~~No~~ Yes ✓

test - 2 : Let, P = 2, Q = 1 :

No

test - 3 : Yes ✓

So, P can be drawn before Q.

So, [2 > 1]

for, 3, 4 :

no overlap, so, any order.

Let, [3 > 4]

for, 4, 5 :

overlap, so, we need to consider.

test - 1 : ~~Yes~~ No

test - 2 : Let, P = 4, Q = 5 ; Yes ✓

test 3 : Yes ✓

So, 1, 4 > 5]

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for, 6, 7, 8 :

Overlap, we need to consider:

for, 6, 7 :

test-1 : ~~Yes~~ No

test-2 : Let P=6, Q=7 : Yes

test-3 : Yes ✓

So, [6 > 7]

for, 7, 8 :

test-1 : ~~Yes~~ No

test-2 : Let P=7, Q= 8 : No

test-3 : Yes ✓

So, [7 > 8]

for, 6, 8 :

test-1 : No

test-2 : Let, P=6, Q=8 : No

test-3 : Yes ✓

So, [6 > 8]

So, ultimately : [6 > 7 > 8]

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So, Order (Final) of drawing is :

[2 > 1 > 3 > 4 > 5 > 6 > 7 > 8]

(2, 1, 3, 4, 5, 6, 7, 8)

(Ans)