Part III: Problem Solving **Time: 40 Minutes**

1. Write the matrices of the following transformation in the correct order and find the composite matrix.
Reflection about the origin and then rotation by 90° (Note: cos 90 = 0 and sin 90 = 1)
[CLO 2.1] (2 Marks)

Trace the **DDA line drawing algorithm** to draw a line segment that starts at point **(2, 4)** and ends at point **(6, 9)** . [CLO 2.2] (3 Mark)

Notes:
- Clearly write parameters values in your solution.
- Fill up a table showing your calculations step by step.

Part III:

(2)

$dx = 6 - 2 = 4$

$dy = 9 - 4 = 5$

$steps = dy = 5$

$x_{inc} = \frac{4}{5} = 0.8$

$y_{inc} = dy/steps = 1$

X_{old}	Y_{old}	X_{new}	Y_{new}	R(x)	R(y)
2	4	2.8	5	3	5
2.8	5	3.6	6	4	6
3.6	6	4.4	7	4	7
4.4	7	5.2	8	5	8
5.2	8	6	9	6	9

Write the homogeneous coordinate matrix for the rectangle with endpoints (0,0), (1,0), (1,1), (0,1). [CLO 2.1] (1 Marks)

What are the **three major types** of curves? How each of these curves are specified? Write the blending function for **one** of these types. [CLO 2.1] (4 Marks)

Homogeneous matsix is

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

4. What are the algorithmic steps required to successfully draw a circle using **Bresenham's *midpoint* circle drawing** algorithm? [CLO 2.2] (3 Mark)

2.
Major types of curves:
oHermit
odefined by two endpoints and two tangent vectors
oBezier
odefined by two endpoints and two other
points
Splines
oseveral kinds, each defined by four points

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Forwarded

1. Input radius r and circle centre (xc , yc) -> (x0,y0)=(0,r).
2. Calculate the initial value of the decision parameter p0=1-r
3. If pk < 0,

the next point along the circle centred on (0, 0) is (xk+1, yk) and

pk+1=pk+2Xk+3.

else

next point along the circle is (xk+1, yk -1) and:

pk+1=pk+2(xk-yk)+5

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Given Xwmin = 0, Ywmin=0, Xwmax=2, and Ywmax=2 and a line with start point P1(1,4) and end point P2(5,2). Using the Liang Barsky line clipping algorithm, find the visible part of line within the window. Draw your picture. Show your steps and calculations. The following tables are given for your convenience.

[CLO 2.3] (3 Marks)

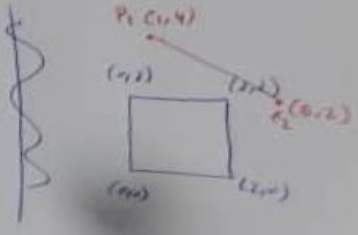
$x = x1 + u\Delta x$	$\Delta x = x2 - x1$
$y = y1 + u\Delta y$	$\Delta y = y2 - y1$
$p1 = -\Delta x = x1-x2$	$q1 = x1 - x_{min}$
$p2 = \Delta x = x2-x1$	$q2 = x_{max} - x1$
$p3 = -\Delta y = y1-y2$	$q3 = y1 - y_{min}$
$p4 = \Delta y = y2-y1$	$q4 = y_{max} - y1$

$u1 = \max\{0, qk/pk\}$ for all $pk < 0$
$u2 = \min\{1, qk/pk\}$ for all $pk > 0$

$x_{min} = 0$, $y_{min} = 0$, $x_{max} = 2$, $y_{max} = 2$

$P_1 = (1, 4)$ & $P_2 = (5, 2)$.

$$\text{slope} = \frac{2-4}{5-1} = \frac{-2}{4} = -0.5$$



$p_1 = -\Delta x = -4$, $q_1 = 1 - 0 = 1$

$p_2 = \Delta x = 4$, $q_2 = 2 - 1 = 1$

$p_3 = -\Delta y = 2$, $q_3 = 4 - 0 = 4$

$p_4 = \Delta y = -2$, $q_4 = 2 - 4 = -2$

$\Rightarrow$

For $p_k < 0$

$$u = \max\left(0, \frac{1}{-4}, \frac{-3}{-2}\right) = 1$$