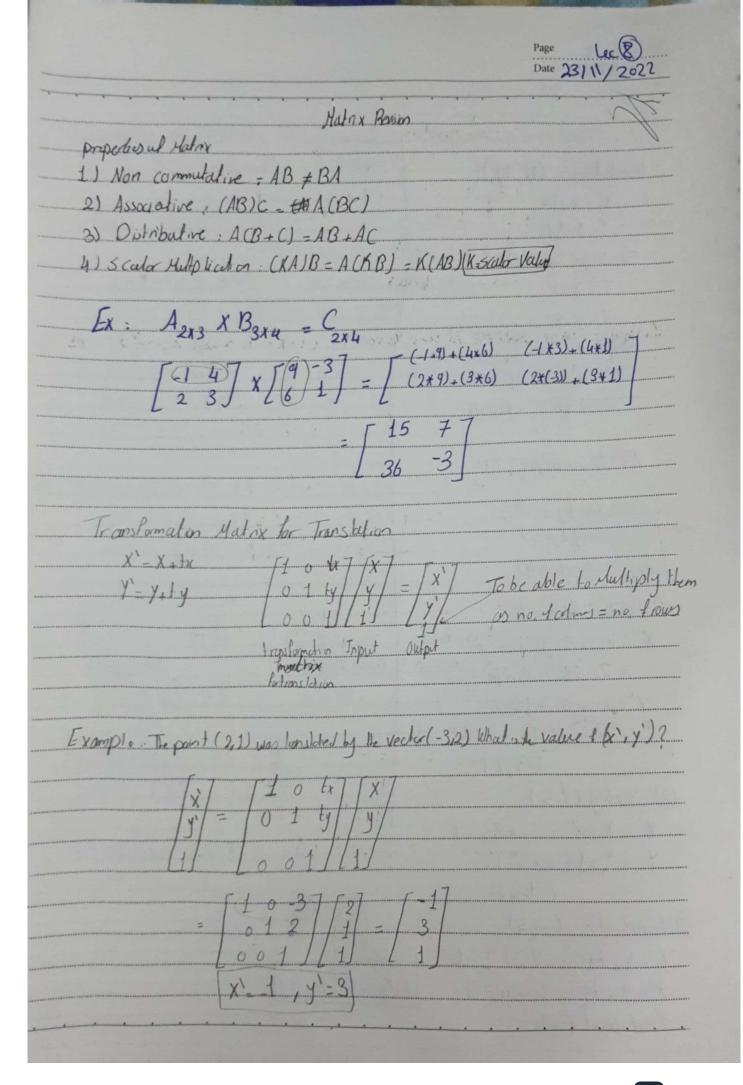
lec 67 ch4 Date Two Dimensional Geometric Transformation 20 Geometro Transformation: 1) Translation 2) Rotation 3) Scaling 4) Reflecting 5) shearing 1) Translation Translation vector. (tx, 14) ox'=x+tx = oxylise $E_{V}: \rho(\hat{2}, \hat{3})$ $(5, \hat{3})$ p'(7,0) 2) Potation depends on 2 factors 1) Robution Angle 8 -dockwise (-ve) Mckekwise (+e) 2) Rotation axis (2/4, 4/2) xxxcos a usin o · y=x>in0+4 coso >CCW & +ve Ex = p(2, 3) rotalin cow by o go had p' x'= x (0) 0 - y sin 0 = 2(0) 3 sin 6) - 3 4'=xsin0 + 4cos0 - 2sin(90) + 3cos(90) - 2

Scaling	depends on 2 houton
O(X/4)	1) scaling fuetor (810,84)
D(x,y) Sally > p'(x', y')	· IP sx, sy >1 (Amplification
Vigor P	· IPsy, sy (1 (Attenuation
(3x, usy) scaling	of factor o Its x - sy, unform sally
	Different point (see 14)
• X\=\\\	, , , , , , , , , , , , , , , , , , , ,
·y'=454	
Ex p(2,3)	*
Scaling by Co. S. L	9
o' / t)	
p=(1, 12)	
find Exam: Don't	of hypotense x=r.cose in p'(x), y)
	y=rsing / 10
)c\ = r cos	$\frac{(O+\varnothing) = x\cos\theta\cos\theta - y\sin\theta}{\sin\theta}$
	+ x) - reaxising + rsing cose / 8 - 19
	- x Sin & + 4 COD & 0
	Z-X-X

Page Date
Sequence of Geometric Transformation: Sequence is important Ex: 1: Scale (0.3, 0.3) 2. Rotate (-90°) 3-Translate (5,1)
Ex: $p = (2,6)$ $p' = ??$
Ex : $p = (2, 6)$ $p' = ??$ 1 Scale (0.3, 0.3) = $x' = x \Rightarrow x = y' = y \Rightarrow y$ $p' = (0.6, 1.8)$
2. Robote (-90°) & - x cos θ - ysin θ , y=x sin θ + y cos θ p=(0.6, 1.8) = 0 - (-1.8) y: - a.6 + 0 p'= (1.8, -0.6)
3) Translate (5,1) x'=x+tx, y'=y+tx p"= (1.8,-0.6) p"= (6.8,0.4)
$P(2,6)$ 1. Rotule (-90) $x' - x \cos \theta - y \sin \theta$, $y' = x \sin \theta + y \cos \theta$ $= 2\cos(-90) - 6\sin(-90)$ $= 2\sin(-90) + 6\cos(-90)$ $= 2\cos(-90) - 6\sin(-90)$ $= 2\sin(-90) + \cos(-90)$
2-Tronslute (S, 1) p"= (11, -1)
3) Scale (0.3,0.3) p" = (3.3,-0.3) /: Final p (3.3,-0.3)

brandaling: (le, ly) X'=X,lX Y=Y+ly Scaling (Sx, Sy) X'=XSX Y-ySX Robat in a conve X'= x costo -y sin to y'= t sin to +y costo Ex Assume p (2,3) O Robating (3,5) O Robating (3,5) O Robating (3,5) Y'= x sin to +y costo = 2 costo -y sin to	ge lec. 8	
X = X + 1 x Y = Y + 1 y Scaling (5x, 5y) X' = X 5x Y = y 5X Rolat in a scar ve X' = x costa - y sinto y' = x sone + y costa Ex Assume p(2,3) (a) Robulon by 0 = 9° (b) Robulon by 0 = 9° (c) Xating (3,5) (b) Robulon by 0 = 9° (c) Xating (3,5) (c) Robulon by 0 = 9° X' = x cos 0 = y sin o = 2 = 2 cos 90° 3 sn 90 = = 3 Y' = x sn 0 + y cos 0 = 2 sin (9°) + 3 cos (9°) - 2 (c) 3,2) (c) Scaling (3,5) x' - x 5x = -3 x 3 = 9 y' = y 3y = 2 x 5 = 10 (-9,10) (a) Robulotin (-1,4) 1' = x + x - 9 - 1 = -10	25/11/2022	
X = X + 1 x Y = Y + 1 y Scaling (5x, 5y) X' = X 5x Y = y 5X Rolat in a scar ve X' = x costa - y sinto y' = x sone + y costa Ex Assume p(2,3) (a) Robulon by 0 = 9° (b) Robulon by 0 = 9° (c) Xating (3,5) (b) Robulon by 0 = 9° (c) Xating (3,5) (c) Robulon by 0 = 9° X' = x cos 0 = y sin o = 2 = 2 cos 90° 3 sn 90 = = 3 Y' = x sn 0 + y cos 0 = 2 sin (9°) + 3 cos (9°) - 2 (c) 3,2) (c) Scaling (3,5) x' - x 5x = -3 x 3 = 9 y' = y 3y = 2 x 5 = 10 (-9,10) (a) Robulotin (-1,4) 1' = x + x - 9 - 1 = -10	1	
X = X + 1 x Y = Y + 1 y Scaling 1 5x, 5y) X' = X 5x Y = y 5X Rold in a scale X' = X costo - y sinto y' = x sno + y costo Ex Assume p (2,3) (0) Robulon by 0 = 9° (3) Hoostol on (-1,4) (1) Robulon by 0 = 9° X' = X costo - y sinto (3) Hoostol on (-1,4) (1) Robulon by 0 = 9° X' = X costo - y sinto 2		
Scaling (Sx, Sy) X'= X SX Y = y SX Rotal in a scw ve X'= X costo = y sinto y'= * * sne + y costo Ex Asime p (2,3) (3) Provide (-1,4) (1) Rotalin by 0 = 95 X'= X costo = 9 sinto = 9 - 2 ces 90 3sn 90 = 3 Y'= X sne + y ces 0 = 2sin (96) + 3 cos(90) = 2 (3,2) (2) Scaling (3,5) X'= X SX = -3 x 3 = 9 Y'= y 3y = 2x5 = 10 (-9,10) (3) banslatin (-1,4) A'= x + x - 9 - 1 = -10		
Scaling (5x, 5y) X' = X 5X Y = y 5X Rotal as a cow we X' = x costo -y sino y' = x sine +y case Ex Assume p (2,3) (3) Hoolder (-1,4) (1) Rotalin by 0 = 46 X' = x cos 0 - y sin 0 = 2 - 2 cas 40 - 3s n 40 - 3 Y' = x sin 0 +y cas 0 = 2 sin (40) + 3 cos (40) - 2 (-3,2) (2) Scaling (3,5) X' - x 5x = -3 x 3 = 9 Y' = y 3y = 2 x 5 = 10 (-9,10) (3) Houstahn (-1,4) A' = x + x - 9 - 1 = -10		
X'= X SX Y = y SX Rolat in ω S CW - ve X'= X cost - y sin to y'= X sn θ + y cosθ Ex Assume ρ (2,3) (0) Rolation by θ = 9° (3) Frostation (-1,4) (1) Rolation by θ = 9° (3) X'= X cos θ - y sin θ - θ (-1,4) (1) Rolation by θ - 9° (2) X cos θ - y sin θ - θ (-3,2) (2) Scaling (3,5) X'= X SX = -3 × 3 = 9 Y'= y Sy = 2 × 5 = 10 (-9,10) (3) Hanstation (-1,4) (1) (1) (3) Hanstation (-1,4) (4) (4) (5) (6) (7) (6) (7) (7) (8) (8) (8) (8) (9) (9) (9) (9		
Sold in 0 2 cw we X' = x cost - y sin to y' = x sn to + y cos to Ex Assume ρ (2,3) (0) Roboton by θ = 9° (3) Horstell or (-1,4) (1) Roboton by θ = 98 X' = x cos θ = y sin to = 2 = 2 cos y to = 3 y' = x sn to + y cos to = 2 sin (4 o' 1 + 3 cos (9 o') - 2 (-3,2) (2) Scaling (3,5) x' = x 8x = -3 x 3 = 9 y' = x 3x = 2 x 5 = 10 (-9,10) (3) Houst what (-1,4) (1) A' = x + tx = 9 - 1 = - to		
X'= x cost -y sin 6 y'= t sin e +y cost Ex Assume p (2,3) O Robuson by e = 90 O Scaling (3,5) O Robuson by e = 90 X'= x cost e = y sin e = 9 - 2 cos 90 3 sin g e = 3 Y'= x sin e +y cost e = 2 sin (90) + 3 cos (90) - 2 (-3,2) O scaling (3,5) x'= x sx = -3 x s = 9 y'= y sy = 2 x 5 = 10 (-9,10) O Blanstulin (-1,4) A'= x + x = 9 - 1 - 10		
X'= x cost -y sin 6 y'= t sin e +y cost Ex Assume p (2,3) O Robuson by e = 90 O Scaling (3,5) O Robuson by e = 90 X'= x cost e = y sin e = 9 - 2 cos 90 3 sin g e = 3 Y'= x sin e +y cost e = 2 sin (90) + 3 cos (90) - 2 (-3,2) O scaling (3,5) x'= x sx = -3 x s = 9 y'= y sy = 2 x 5 = 10 (-9,10) O Blanstulin (-1,4) A'= x + x = 9 - 1 - 10	Political CCW+Ve	
y'= x sn θ +ycosθ Ex Assume ρ (2,3) O Rowon by θ = 90 on O Sad ng (3,5) O Roboton by θ = 90 X'= x cos θ - y sin θ = 2 = 2 cos 90° 3 sn 90 = 3 Y'= x sn θ +ycosθ = 2 sin (901 + 3 cos (90°) - 2 (-3,2) O Sadny (3,5) X'- x sx = -3 x 3 = 9 Y'= y 3y = 2 x 5 = 10 (-9,10) O Roboton by θ = 90° x' x sx = -3 x 3 = 9 Y'= y 3y = 2 x 5 = 10 (-9,10) O Roboton by θ = 90° on O Roboton by θ = 90° on O Roboton by θ = 90° on O Roboton by θ = 90° x' x x x x x x x x x x x x x x x x x x		
Ex Assume p (2,3) (a) Robbin by 0 = 90° (b) Sading (3,5) (c) Robbin by 0 = 45° X': X000 0 - 4 sin 0 - 2 - 2 cos 40° 3 sn 90 = 3 Y'= X sn 0 + 4 cos 0 - 2 sin (40°) - 2 (-3,2) (2) Sading (3,5) X'= X 5X = -3 × 3 = 9 Y'= 43 + 2 = 4 = -10 (-9,10) (3) Lacustatin (-1,4) (-1,4) (4) - 4 = -10		
(3) Frosted in (-1,4) (1) Rotation by 8 - 98 (2) X = X(0) 8 - 98 (3) X = X(0) 8 - 98 (3) X = 260 40 3 sn 90 = 3 (3) Y = X sn 8 + 4 con 8 (3) X = 2 sn (96) + 3 con (90) - 2 (3) X = X sx = -3 * 3 = 9 (4) X = 3 * 3 = 9 (9) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (2) X = 3 * 3 = 9 (3) X = 3 * 3 = 9 (4) X = 3 * 3 = 9 (5) X = 3 * 3 = 9 (6) X = 3 * 3 = 9 (7) X = 3 * 3 = 9 (8) X = 3 * 3 = 9 (9) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (2) X = 3 * 3 = 9 (3) X = 3 * 3 = 9 (4) X = 3 * 3 = 9 (5) X = 3 * 3 = 9 (6) X = 3 * 3 = 9 (7) X = 3 * 3 = 9 (8) X = 3 * 3 = 9 (9) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (2) X = 3 * 3 = 9 (3) X = 3 * 3 = 9 (4) X = 3 * 3 = 9 (5) X = 3 * 3 = 9 (6) X = 3 * 3 = 9 (7) X = 3 * 3 = 9 (8) X = 3 * 3 = 9 (9) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (2) X = 3 * 3 = 9 (3) X = 3 * 3 = 9 (4) X = 3 * 3 = 9 (5) X = 3 * 3 = 9 (6) X = 3 * 3 = 9 (7) X = 3 * 3 = 9 (8) X = 3 * 3 = 9 (9) X = 3 * 3 = 9 (1) X = 3 * 3 = 9 (2) X = 3 * 3 = 9 (3) X = 3 * 3 = 9 (4) X = 3 * 3 = 9 (5) X = 3 * 3 = 9 (6) X = 3 * 3 = 9 (7) X = 3 * 3 = 9 (8) X = 3 * 3 = 9 (8) X = 3 * 3 = 9 (9) X = 3 * 3 =	y = 7 501 B + 3 CO3 G	
(-3, 2) (Boldon by 0 = 90 (Tables (-1,4) (D Roberton by 0 = 90 X = x00 0 = ysin 0 = 3 - 260 40 23 n 40 = 3 Y'= x sin 0 + y con 0 - 2sin (40) + 3 con (40) - 2 (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2) (-3, 2)	Ex Assume 003)	
(3) Frosted on (-1,4) (1) Rotation by 8 = 45 X = x (0) 0 - 4 sin 0 = 3 - 2 (0) 40 - 3 sin 9 = 3 Y'= x sin 0 + 4 (0) 0 = 2 sin (90) + 3 (0) (90) - 2 (-3,2)	A y	
(3) Frosted on (-1,4) (1) Rotation by 8 = 45 X = x (0) 0 - 4 sin 0 = 3 - 2 (0) 40 - 3 sin 9 = 3 Y'= x sin 0 + 4 (0) 0 = 2 sin (90) + 3 (0) (90) - 2 (-3,2)	(O Rotwon by 0 = 90°	
① Roboton by $\theta = 48^{t}$ X'= $x\cos\theta - y\sin\theta = 3$ = $2\cos 4\theta$	(D. Saling (3,5)	
$x'=x\cos\theta-y\sin\theta$ $=2\cos\theta0^{\circ}-3\sin\theta0=3$ $y'=x\sin\theta+y\cos\theta$ $=2\sin(90^{\circ})+3\cos(90^{\circ})-2$ $(-3,2)$ (2) Saling (3,5) $x'=x\sin\theta+3\cos\theta$ $(-9,10)$ (3) Lanstatin (-1,4) $(-9,10)$	3) Frontal in (-1,4)	
$X'=XOSO-YSINO=9$ $=2cos90^{\circ}-3sn90=3$ $Y'=Xsn0+Ycos0$ $=2sin(90)+3cos(90)-2$ $(-3,2)$	1) Rotalin by 0 = 400	
$= 2 \cos 90^{\circ} \cdot 3 \sin 90 = 3$ $Y' = X \sin 9 + 9 \cos 9$ $= 2 \sin (90) + 3 \cos (90) - 2$ $(-3, 2)$ $(-3, 2)$ $(-3, 2)$ $X' = X \times -3 \times 9 = 9$ $Y' = y \times -2 \times 5 = 10$ $(-9, 10)$ $3) \cos 2 \sin 9 = 3$ $(-9, 10)$ $(-1, 10)$ $3) \cos 2 \sin 9 = 3$ $(-3, 2)$ $(-3, $		
$y'=x \sin \theta + y \cos \theta$ $= 2 \sin (9 \circ 1 + 3 \cos (9 \circ) - 2$ $(-3,2)$ (2) $x = x + 2 = 3 + 3 = 9$ $x'=x + 3 = 2 + 5 = 10$ $(-9,10)$ (3) $x = x + 2 = 9 + 1 = -10$ $x'=x + 2 = 9 + 1 = -10$		
$= 2\sin (90^{\circ}) + 3\cos(90^{\circ}) - 2$ $(-3,2)$ $2) \text{Salry (3,5)}$ $x' - x \leq x = -3 \times 3 = -9$ $y' = \sqrt{3}y = 2 \times 5 = 10$ $(-9,10)$ $3) \text{Loss Laber (-1,4)}$ $x' = x + x = -9 + 1 = -10$		
(-3,2) 2) scalog (3,5) x'= x 8x = -3 x 3 = 9 y'= y 5y = 2x 5 = 10 (-9,10) 3) Landula (-1,4) x'= x + x = 9 = 1 = -10		
2) scaling (3,5) x'- x 8x3 * 3 = 9 y' = \frac{1}{3} = 2 * 5 = 10 (-9,10) 3) Landaha (-1,4) x'= x + x - 9 - 1 10		
$x' = x \leq x = -3 \times 3 = -9$ $y' = y \leq y = 2 \times 5 = 10$ $(-9, _{0})$ 3) Landulin $(-1, 4)$ x' = x + x = -9 + 1 = -10		
3) Lanslaha (-1,4) A=X+1x=9-110		
(-9, 10) 3) translation (-1,4) N=X+X=-9-110	······A	
B) translation (-1,4) 1 - x + x - 9 - 1 10		
1 2 x + x = q - 1 to		
y=y+ty=10+4=14 [ind pont=(-10,14)]	1= y + ty = 10+4=14 [ind par	1/=(-10,14)
· final-point (st.	final-point (st	



Tra	ns farmation Hutax for Rotation
	ns formascus Mutax for Motation y free (x) 7 (cost sine of fx)
	/ y' = / sina cos a 0 / y
	1111001111
	X'= X cos a ysin a
	y'= X sint + ycost
Exam	ple: Apoint (2,2) was rataled godegrees counter clack use about the original
Whal	Le Value 1 (x', y')?
	Try Touse sine of Ixi

,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	111001111

	[cos 90 -5m90 0] 2]
***************************************	311/0 (05/0 1 1 1)
***************************************	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	$\begin{bmatrix} -2 \\ 2 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \end{bmatrix} \begin{bmatrix} 2 \\ 0 \end{bmatrix} \begin{bmatrix} 2 \\ 2 \end{bmatrix} $ $y'=2$

From	standon Abria la Scoling
4=	X SX / V+ 9 P O O T F X T
y' - !	Sy Sx Sx Sy
ample.	Scaling by the factor (2,0.5) to the paint (1,4) find (x'y')?
	2001111 121 10 2
	$\begin{bmatrix} 2 & 1 & 1 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix} = \begin{bmatrix} 2 & 1 \\ 2 & 1 \end{bmatrix} \begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix} $
	0 0 1 1 1 1 1
1	

PageDate
Sequence of Transformation by Halax:
Ty = 13/2/E/Ty July - Taplomet in Tapet
E: What he Value ! (x) y') ofter applying the sequence on the point (Lybs)?
D Scaling (0.5,0.5) 2) Clock use rotation 90 degrees
3) Translator W.A. He Vector (41)
$\begin{bmatrix} x \\ y \\ y \\ y \\ z \\ z \\ z \\ z \\ z \\ z \\ z$
Successive Transformation
1) Two and successive for 14 ins are additive
$\begin{bmatrix} y' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 1 & 5 \\ 0 & 1 & 5 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} y \\ 1 \end{bmatrix}$

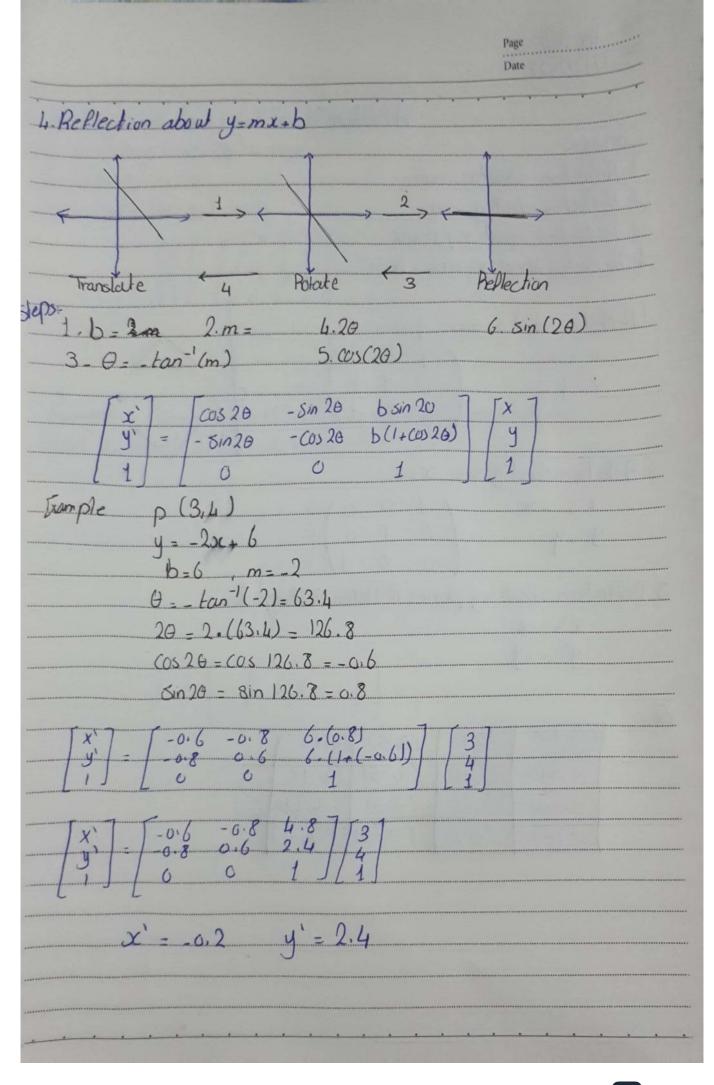
Vators (3,2) and	Successive Translation and applied to the part (1,5) with translation. (-2,1) Prod(x', y')?
3-2=1	[x17] [1] 1 1 1 1 1 1 2 2 2 2 2 2 2
2+1-3	
	x'-2 , y'-8
	le geometre transform d'on matrix la r 2 successive translations Will
	14) To (+x2,14)
Prod i=	$\begin{array}{c c} x \\ y \\ 1 \end{array} = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 \end{bmatrix} \begin{array}{c} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{array} \begin{array}{c} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{array} \begin{array}{c} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{array}$
	1 100 1 600 1111
	x 7 f1 6 tx + tx 7 fx 7
	y = 0 1 ty, ty / y
<u></u>	1 100 1 1111
Two ormore S	uccessive rotations are additive
Tx'1	
=	[cos (ze) - sin (ze) 0] [x] [sin (ze) cos (ze) 0] [y]
- 1 2 4	
by 4 Soldwees	aint(2,2) Hen of he applying 90 degrees ratalin clackwise, tallo relation Counter clack wise, What is he value of (x', y')?
,	1 [cus (-90+hs) -sin(-90+45) 07 (x7
y'	= \sin(90+45) cos(-90+45) 0 \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \
	601111
1721	Ja. 70 0.70 0 1 5 2 7
151	$= \left \begin{array}{cccccccccccccccccccccccccccccccccccc$

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Successive Transformation
3) Two or more successive scaling are multiplicative:
$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 5x, *5x, *5x \\ 0 & 5y, *y, *5y, \\ 0 & 6 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$
by saling with boto (6.5, 0.6) What is he value of (x', y')?
by saving with factor (0.3,0.0) What is be valle at (x,y)?
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
Frample prove that three successive scaling with factors s, (sx, sy), so(sx, sy), so(sx, sy), so(sx, sy)
are multiplicative. \[\begin{align*} \begin{align*} \text{x} & \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \
- Sx, Sx, Sx, O O T (x) - O Sy, Sy, Sy, O O J (y)
Invene Transformation
1) Invose Translation:
T-(tx, ty) = T(-tx, ty)
E_{X} , $P(2,3)$
T(1,4) 4p (3,7) T(1,4) 4(2,3)
2) Inverse Botation
$R^{-1}(\Theta) = R(-\Theta)$
3) Inverse Scaling 1S(5x,5y)=S(1,1) Ex:S(2,4) = S(1,1)

Date Date
Potation around afixed (pivot) point (xp. x).
a) orginal position of object & pivot point
b) Franclation of about so that post point (x, y) is at any in
C) Rolatin about origin
d) Translation Jobbed so that 4 pivot point is Returned to position (x, y)
Botation Hatrix about purt (xp.y)
$R((x_p, y_p), \theta) = T(-x_p, y_p) * R(\theta) * T^{-1}(x_p, y_p)$ (i) translation $(-x_p)^2$
TX 7 1 2 3 1 (cost -sint) of [0 -xe X 6 4 cost of x 1
()] = 0 1 y sino coso 0 0 1 - y y 3) + cos do (xe y)
[] [0 1 1 0 1 1 1 1 1
7 () 7
$-\frac{\cos\theta}{\sin\theta} - \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} + \cos$
$\int \frac{\sin\theta}{0} \frac{\cos\theta}{0} \frac{d\theta}{d\theta} \left(1-\cos\theta\right) \frac{1}{2} \frac{\sin\theta}{\theta} \left(\frac{1}{2}\right) \frac{1}{2} $
Example: we upit to rotate the paint (4, 1)90° ounterclack wise about the
point (2,1) find the value of (x1, y1)?
P(-4, -1) [x'7 [cogo singo 2(1/2)go'] + 5ingo 7 [-47]
0 = 90° / y' - [singo cusqo () cas a) - 2 singo -1
$(2,1) \qquad [1] \qquad [6] \qquad [4] \qquad [4]$
7 34
4 - 1 - x' - 4 x' - 5
17/60/15/1

	Page Date
Scaling around alived (pivot) point (xp. yp):- (D) Translation (-xpyp) to origin	
2) Saling (Sx, Sy)	
(S) Translation (Ye ye) back	
[x1] [10xp] [5x00] [19) -X] [X]
1 1 1 1 0 3 y 0 1 0	30 9
$ \begin{array}{c c} & 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ \hline & & & & & & & & & & & & & & & & & & $	
$= \begin{bmatrix} s_x & s_y & (1 & s_y) & [x] \\ s_y & (1 & s_y) & [y] \end{bmatrix}$	
1001111	
Example: Given the point (3,4), ofter applying scaling bout the point (2,2) what ste Value P(x, y)?	juin factor (1,2)
Would the point (2,2) what the Value P(xr, yr)?	,
P(3,4) (x) 7 (4x 4x (1-x)) (x)	
$\frac{5(1-2)}{(2-3)} \left \frac{y'}{y'} \right = \left \frac{3y}{y} \left(\frac{1-5y}{y'} \right) \right \frac{y}{y'}$	
[2,2] LI Loo 1 [1]	
-/o 2 2(12) /= lul	
[00]	
<u> </u>	x'=3, y'=6
6 - 1 0 2 -2 4	

	Pellection
Cooes:	
1 Reflection abou	dx oxis
2 Reflection about	y-oxix
	Ixy plane
4 Be Pedian about	y=mx+b
	O
Reflection about s	x-axis y-o
x`=x	
<u>y_4</u>	0-10
	\ 0 0 1/
2-Reflection about	y-000 x-0
x' = -x	<u>/100</u>
y = 4	[0 1 0]
	(0 0 1)
~ ^ 1	1 (D) 01 1 -1 1 1 1
Reflection abou	t scy plane (Reflection about origin)
Reflection about	I szy plane (Kettetrán about origin)
Beflection about Y'=-X Y'=-Y	I szy plane (Ketterrán about ongin)
S. Reflection about X' = -X	I sy plane (Keterran about ongin)
x'x y'y	
X- X- X Reflection Assistance Assistanc	(2,1) (3,5) (4,1)
Xi = -X Yi = -Y Xi Reflection X-oxis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1) (-2,1) (-3,5) (-4,1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1) (-2,1) (-3,5) (-4,1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1) (-2,1) (-3,5) (-4,1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1) (-2,1) (-3,5) (-4,1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1) (-2,1) (-3,5) (-4,1)
X: Reflection X-axis Y-axis	(2,1) (3,5) (4,1) (2,-1) (3,-5) (4,-1) (-2,1) (-3,5) (-4,1)



Example $\rho(2,3)$ 1. Scaling (5,4) 2. Reflect on about x-axis $y=0$ $x'=x,y'=-y$ 3. Rotation (x,y)	Page Date
1. Scaling (5,4) 2. Reflect on absorbing -axis $y=0$ $x=x,y=y=0$ 3. Robation ac w by 0.90° $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $	
1. Scaling (5,4) 2. Reflect on absorbing -axis $y=0$ $x=x,y=y=0$ 3. Robation ac w by 0.90° $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $ $ \begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 1 \end{bmatrix} $	sample $\rho(2,3)$
$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 5 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 5 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 5 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$	1. Scaling (5,4)
$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 5 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 5 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$ $\begin{bmatrix} x \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 0 \\ 5 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \end{bmatrix}$	2 Reflection about x-axis y-0 x'=x,y'y
$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 07 & \begin{bmatrix} 2 \\ 3 & 0 & 0 \end{bmatrix} \begin{bmatrix} 2 \\ 3 & 1 \end{bmatrix}$	B-Rotation CCW by A-90°
	$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & -1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 2 \\ 3 \\ 0 & 0 \end{bmatrix}$
	$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 0 & 4 & 07 & \begin{bmatrix} 2 \\ 3 & 0 & 1 \end{bmatrix} \begin{bmatrix} 3 \\ 3 \end{bmatrix} $

Transformation that clistoch the shape of an	
expert conect as square to aprivallelayro	
Sherr	
5180	
An X direction Show relative to the X axis Corgin). Any duector show relative to the
in_X'= x+3hx = y	1
y '= y	\\ \(\infty \) = \(\infty \)
1 8hx 0	lorgingy '= y+shy.x
0 1 0	1 1 0 0 7
001	Shy 1 0
y reference _ x' = x . Shx . (y - Y rel) _	1001
	x-xreference -> X = X
Exp (2,3) 0 1 0	y'= y+ Shy . (x-x
Xdirection shx = 05 Lo 0 1	Ex: p(2,3)
Pad p'(x'y')	yelirection stry =0.5 10
x'= x, sh, y = 2, 6,5x3)=3.5	findp'(x)y') shy 1.
y'-y-3 p'(3,5,3)	X'-X-2
Ex. p(2,3)	y'=y+shyx=3+(2,5+2)=
Shaving (X) with shr = 0.5 relative to yrep=2	P(2,4)
$X = x + Sh_x (y - y_{ref}) = 2 + (0.5 \times 3) = 2.5$	
y'-y-3 p'(2.5,3)	Shearing (4) with shy -0.5 chil in to)
	(X = X = 2
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	1 4-4 + Shy (x * Knel) - 3 + (05 x (2)
	1 p(2,3.5)

