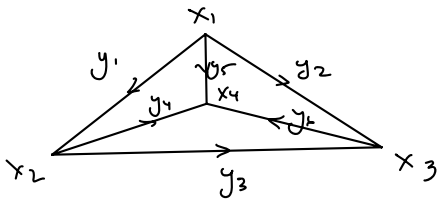
# Math 5435 HW #6

Section 2.5 #6

Section 2.6 #6abc, 14, 30

## 2.5 #6




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

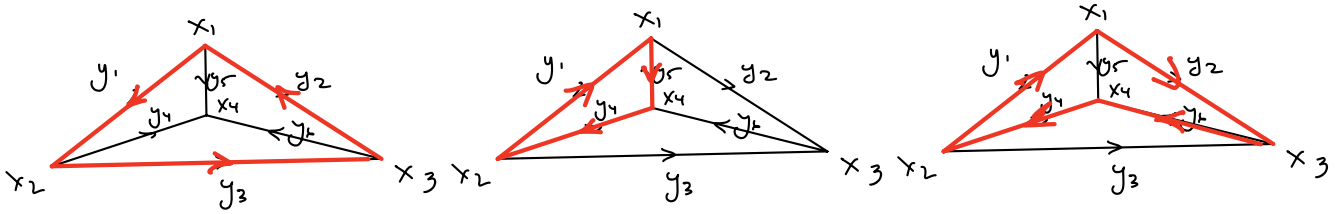
$x_1 \quad x_2 \quad x_3 \quad x_4$

$$A^T\vec{y} = \vec{0} \qquad \begin{bmatrix} -1 & -1 & 0 & 0 & -1 & 0 \\ 1 & 0 & -1 & -1 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & -1 \\ 0 & 0 & 0 & 1 & 1 & 1 \end{bmatrix} \begin{vmatrix} 0 \\ 0 \\ 0 \\ 0 \end{vmatrix} \rightarrow \cdots \begin{bmatrix} 1 & 0 & -1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 0 & 0 & -1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \begin{vmatrix} 0 \\ 0 \\ 0 \\ 0 \end{vmatrix}$$

(pivot columns: 1, 2, 4)

$$\vec{y} = y_3 \begin{bmatrix} 1 \\ -1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} + y_5 \begin{bmatrix} -1 \\ 0 \\ 0 \\ -1 \\ 1 \\ 0 \end{bmatrix} + y_6 \begin{bmatrix} -1 \\ 1 \\ 0 \\ -1 \\ 0 \\ 1 \end{bmatrix}$$

These basis vectors for $N(A^T)$ represent the loops:



## 2.6 # 6 a, b, c

a: project into xy-plane (make $z = 0$)

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

b: reflect thru xy-plane (negate z)

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

c: rotate xy plane 90°, leave z

$(1,0,0) \to (0,1,0)$
$(0,1,0) \to (-1,0,0)$
$(0,0,1) \to (0,0,1)$

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

## 2.6 # 14

preserves +

$$T^2(\vec{u}+\vec{v}) = T\big(T(\vec{u}+\vec{v})\big) = T\big(T(\vec{u}) + T(\vec{v})\big)$$

$$= T(T(\vec{u})) + T(T(\vec{v})) = T^2(\vec{u}) + T^2(\vec{v}) \quad \checkmark$$

scalar mult

$$T^2(c\vec{u}) = T\big(T(c\vec{u})\big) = T\big(cT(\vec{u})\big)$$

$$= cT(T(\vec{u})) = cT^2(\vec{u}) \quad \checkmark$$

2.6 #30 $T(1,1) = (2,2)$
$T(2,0) = (0,0)$

a $T(2,2) = T(2\cdot(1,1)) = 2T(1,1) = 2\cdot(2,2) = (4,4)$

b $T(3,1) = T((1,1)+(2,0)) = T(1,1) + T(2,0) = (2,2) + (0,0) = (2,2)$

c $T(-1,1) = T((1,1)-(2,0)) = T(1,1) - T(2,0) = (2,2) - (0,0) = (2,2).$

d $T(a,b) = T(b(1,1) + \frac{a-b}{2}(2,0))$

$= bT(1,1) + \frac{a-b}{2}T(2,0) = b(2,2) + \vec{0}$

$= (2b,2b).$