Applying (d):

$\beta' \mathfrak{I}_o = [1.91\ \ 10.83\ \ -10][0.222\ \ 1.432\ \ 1.704] = -1.100$

$\therefore \nu' = -0.1209$

From (n):

$(\alpha \mathfrak{I}_o)' = \alpha' \mathfrak{I}_o + \nu' \alpha \mathfrak{I}_c = [12.37\ \ 0\ \ -10][0.222\ \ 1.432\ \ 1.704]$

$-0.1209\ [3.71\ \ 12.37\ \ -3][0.833\ \ 0.236\ \ 0.590] = -14.81$ in.

$\alpha \mathfrak{I}_o = [3.71\ \ 12.37\ \ -3][0.222\ \ 1.432\ \ 1.704] = 13.43$ in

and (m):

$(\mathfrak{I}_o(3))' = \nu' \mathfrak{I}_c(3) = -0.1209 \times 0.590 = -0.071$

So from (h):

$S = 1 + 0.3\left(\frac{-0.071}{1.704} - \frac{-14.81}{13.43}\right) = 1.318.$

Turning now to other parameters:

with $P_o = 400$ lbf and $\lambda = 4$, $P = \lambda P_o = 1600$ lbf,

and $M = Pe = 1600 \times 28 = 44800$ lbf-in,

So from (g) $N_s = 44800/13.43 = 3336$ lbf.

which, inserted into (e) and (f) gives:

$$\begin{bmatrix} F_x \\ F_y \end{bmatrix} = 3336 \begin{bmatrix} 1 & -0.3 \\ 0.3 & 1 \end{bmatrix} \begin{bmatrix} 0.222 \\ 1.432 \end{bmatrix} = \begin{bmatrix} -693 \\ 5000 \end{bmatrix} \text{ lbf.}$$

$T = 3336 \times 0.3 \times 10 \times 1.704 = 17.1 \times 10^3$ lbf-in.

Hinge reaction components from eq (6) of notes:

$$\begin{bmatrix} R_{H1x} \\ R_{H1y} \end{bmatrix} = 1 \times 1600 \begin{bmatrix} \cos 76° \\ \sin 76° \end{bmatrix} - \begin{bmatrix} -693 \\ 5000 \end{bmatrix} = \begin{bmatrix} 1080 \\ -3448 \end{bmatrix} \text{ lbf.}$$

The RH shoe follows in a similar manner ($\beta = -0.3$). Full results are shown below, no testing is necessary. Note that drum reaction equilibration calculations are exactly the same as for a rigid shoe brake. The forces on the shoe/post pivot, G, are simply F_x, F_y.

Note that there is little difference here between rigid and pivoted shoes, as ν is so small. $\nu = 0$ corresponds to a rigid shoe.

```
**************************
BRAKES - TWIN PIVOTED SHOES
**************************

Enter
    title  :  Problem 12 ( lbf,in )
    are shoes external ?      ( y/n ) :  y
    drum radius                       :  10
    distance from centre to post hinge :  12.37
    lining limits             ( deg ) :  6 136
    distance from centre to shoe pivot :  11
    inclination of pivot axis ( deg ) :  80
    friction coefficient ?            :  0.3
Enter, for shoe number 1
    is the shoe trailing ?                    ( y/n ) :  y
    ratio of shoe:brake actuating forces              :  4
    moment arm of actuating force about post hinge    :  28
    actuating force inclination to hinge axis ( deg ) :  76
Enter, for shoe number 2
    is the shoe trailing ?                    ( y/n ) :  n
    ratio of shoe:brake actuating forces              :  4.123
    moment arm of actuating force about post hinge    :  22.8
    actuating force inclination to hinge axis ( deg ) :  90
    inclination of hinge axis w.r.t. shoe 1   ( deg ) : -28
Enter duty specification
    brake torque*1E-3     :  0
    brake actuating force :  400
    lining mean pressure  :  150

Lining width              :  1.67
        sensi-  torque  press   contact x,y     hinge reaction     drum reaction
        tivity  *1E-3   -ure    components      x,y components     contribution
shoe 1  1.318   17.1    150.0   -693  5000      1080 -3448  3613   -693  5000
shoe 2  0.823    9.9     78.6   1233  2318     -1233  -669  1403      1 -2625
brake   1.148   26.0                                               2474
```