9 Assume a dummy load of F = 1 kN (total force = 13 kN)

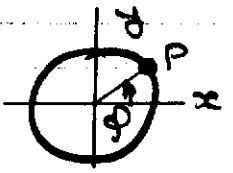
$F = [4 \;\; -3 \;\; -12]'$ kN

$M = r \times F = [0 \;\; 100 \;\; 500]' \times [4 \;\; -3 \;\; -12]' = [300 \;\; 2000 \;\; -400]'$

$m = M/R = [3 \;\; 20 \;\; -4]'$ kN.

i.e. using the results of Problem 7.

$$q = \frac{10^3}{200\pi}\begin{bmatrix} -4 & -4\sin\phi & -3\cos\phi \\ & -4\cos\phi & +3\sin\phi \\ 12 & -6\sin\phi & +40\cos\phi \end{bmatrix} \text{ N/mm}$$



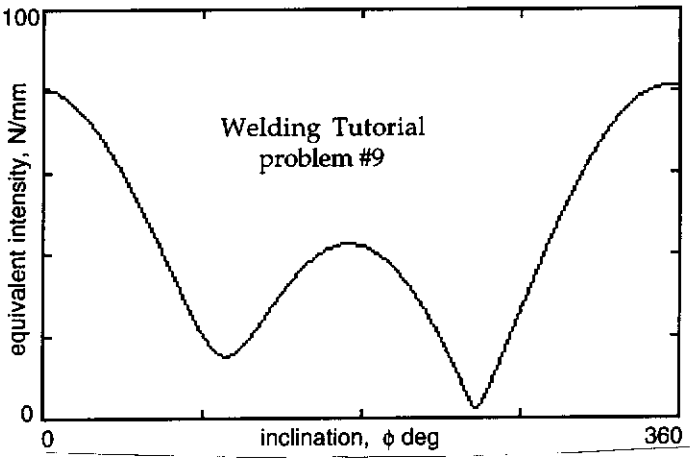
The maximum value of q_E must be found numerically so inserting the elements of q into plotting program (see below) for q_E from (1) we find:-

$\hat{q}_E = 81.2$ N/mm at $\phi = -6°$

$\hat{\tau}_E = 2 \times 81.2/10 = 16.2$ MPa for F = 1 kN.

But the design stress is $S/n = 480/1.5 = 320$ MPa.

So maximum F allowable is $1 \times 320/16.2 = 19.7$ kN.



10 **11** These problems should be worked out by hand. Only sufficient information is given here to enable checks to be carried out via the program "fillet welds" (intermediate steps are mechanical)

Input to the program:		#10	#11
Point coords:	1	50 0	0 0
	2	0 -120	-60 0
OK SEE ALMOST OVERLEAF.	3	-50 0	0 30
	4	—	60 30
No. of straight lines		0	2
& end indices		—	1 2
		—	3 4
Force components (kN)		0 -15 0	0 0 0
Moment comp's (Nm)		1125 0 -2175	990 0 -990
Hence $w\hat{\tau}_E$ (N/mm)		1018	1494
w ($\hat{\tau}_E$ = 250 MPa)		4.07 say 4	6 mm.

```
*************
FILLET  WELDS                                   version 1f
*************

title - tutorial problem #10 of Notes (N,mm)
line end point co-ordinates
   1 :  (50,0) (0,-120)
   2 :  (0,-120) (-50,0)
run centroid at (  0,-60)        run length = 260
   Ixx= 3.120e+5   Iyy= 2.167e+5   Ixy= 0.000e+0
force         :  0.000e+0   -1.500e+4    0.000e+0
moment, user :  1.125e+6    0.000e+0   -2.175e+6
   centroidal:  1.125e+6    0.000e+0   -2.175e+6
elements of the b-vector :-
   bx =-3.606e+0   by =-0.000e+0   bz = 4.114e+0
force intensity - components & equivalent
line 1   -1.48e+2  -3.29e+2  -2.16e+2    5.09e+2
         -1.48e+2   2.06e+2   2.16e+2    4.08e+2
line 2   -4.17e+1  -2.50e+2   2.16e+2    2.40e+2
         -4.17e+1   2.85e+2  -2.16e+2    2.62e+2
maximum equivalent force intensity is   5.092e+2


*************
FILLET  WELDS                                   version 1f
*************

title - tutorial problem #11 of Notes (N,mm)
line end point co-ordinates
   1 :  (0,-45) (-60,-45)
   2 :  (0,45) (60,45)
run centroid at (  0,  0)        run length = 120
   Ixx= 2.430e+5   Iyy= 1.440e+5   Ixy= 1.620e+5
force         :  0.000e+0    0.000e+0    0.000e+0
moment, user :  9.900e+5    0.000e+0   -9.900e+5
   centroidal:  9.900e+5    0.000e+0   -9.900e+5
elements of the b-vector :-
   bx =-1.630e+1   by =-1.833e+1   bz = 2.558e+0
force intensity - components & equivalent
line 1   -1.15e+2  -0.00e+0   7.33e+2    7.47e+2
         -1.15e+2   1.53e+2  -3.67e+2    3.49e+2
line 2   -1.15e+2   0.00e+0  -7.33e+2    7.47e+2
         -1.15e+2   1.53e+2   3.67e+2    4.84e+2
maximum equivalent force intensity is   7.468e+2
```