```
> restart:with(linalg):

Warning, the protected names norm and trace have been redefined and
unprotected
```

Rotating the rectangular duct opening in GC2 through a clockwise angle of arctan(3/4) about and axis on M and with direction numbers {3:0:4}to get the required new coordinates, with respect to M(14,6,4.5), of the duct corner point coordinates
Am(15.04,-2.4,3.7),Bm(7.84,9.6,9.12),Cm(12.96,14.4,5.28),Dm(20.16,2.4, -0.12)
from the unrotated one Ap(6,-4,-4.5),Bp(-6,-4,4.5),Cp(-6,4,4.5),Dp(6,4,-4.5)
and then adding those of M to get actual locations A,B,C,Dd.
GC2RRD02i.mws, 10-02-09.

```
> rm:=matrix(4,4,[c0^2+c1^2+c2^2+c3^2,0,0,0,0,c0^2+c1^2-c2^2-c3^2,2*(c1
> *c2-c0*c3),2*(c1*c3+c0*c2),0,2*(c2*c1+c0*c3),c0^2-c1^2+c2^2-c3^2,2*(c2
> *c3-c0*c1),0,2*(c3*c1-c0*c2),2*(c3*c2+c0*c1),c0^2-c1^2-c2^2+c3^2]);
```

$$rm := \begin{bmatrix} c0^2 + c1^2 + c2^2 + c3^2 & 0 & 0 & 0 \\ 0 & c0^2 + c1^2 - c2^2 - c3^2 & 2\,c1\,c2 - 2\,c0\,c3 & 2\,c1\,c3 + 2\,c0\,c2 \\ 0 & 2\,c1\,c2 + 2\,c0\,c3 & c0^2 - c1^2 + c2^2 - c3^2 & 2\,c2\,c3 - 2\,c0\,c1 \\ 0 & 2\,c1\,c3 - 2\,c0\,c2 & 2\,c2\,c3 + 2\,c0\,c1 & c0^2 - c1^2 - c2^2 + c3^2 \end{bmatrix}$$

```
> c0:=sqrt(.8):c1:=-.6*sqrt(.2):c2:=0:c3:=-.8*sqrt(.2):rm:=minor(matrix
> (4,4,[c0^2+c1^2+c2^2+c3^2,0,0,0,0,c0^2+c1^2-c2^2-c3^2,2*(c1*c2-c0*c3),
> 2*(c1*c3+c0*c2),0,2*(c2*c1+c0*c3),c0^2-c1^2+c2^2-c3^2,2*(c2*c3-c0*c1),
> 0,2*(c3*c1-c0*c2),2*(c3*c2+c0*c1),c0^2-c1^2-c2^2+c3^2]),1,1);
```

$$rm := \begin{bmatrix} 0.7440000000 & 0.6400000000 & 0.1920000000 \\ -0.6400000000 & 0.6000000000 & 0.4800000000 \\ 0.1920000000 & -0.4800000000 & 0.8560000000 \end{bmatrix}$$

```
> Ap:=matrix(3,1,[6,-4,-4.5]);Bp:=matrix(3,1,[-6,-4,4.5]);Cp:=matrix(3,
> 1,[-6,4,4.5]);Dp:=matrix(3,1,[6,4,-4.5]);M:=matrix(3,1,[14,6,4.5]);
```

$$Ap := \begin{bmatrix} 6 \\ -4 \\ -4.5 \end{bmatrix}$$

$$Bp := \begin{bmatrix} -6 \\ -4 \\ 4.5 \end{bmatrix}$$

$$Cp := \begin{bmatrix} -6 \\ 4 \\ 4.5 \end{bmatrix}$$

$$Dp := \begin{bmatrix} 6 \\ 4 \\ -4.5 \end{bmatrix}$$

$$M := \begin{bmatrix} 14 \\ 6 \\ 4.5 \end{bmatrix}$$

```
> A:=evalm(multiply(rm,Ap)+M);B:=evalm(multiply(rm,Bp)+M);C:=evalm(mult
> iply(rm,Cp)+M);Dd:=evalm(multiply(rm,Dp)+M);
```

$$A := \begin{bmatrix} 15.04000000 \\ -2.400000000 \\ 3.720000000 \end{bmatrix}$$

$$B := \begin{bmatrix} 7.840000000 \\ 9.600000000 \\ 9.120000000 \end{bmatrix}$$

$$C := \begin{bmatrix} 12.96000000 \\ 14.40000000 \\ 5.280000000 \end{bmatrix}$$

$$Dd := \begin{bmatrix} 20.16000000 \\ 2.400000000 \\ -0.120000000 \end{bmatrix}$$

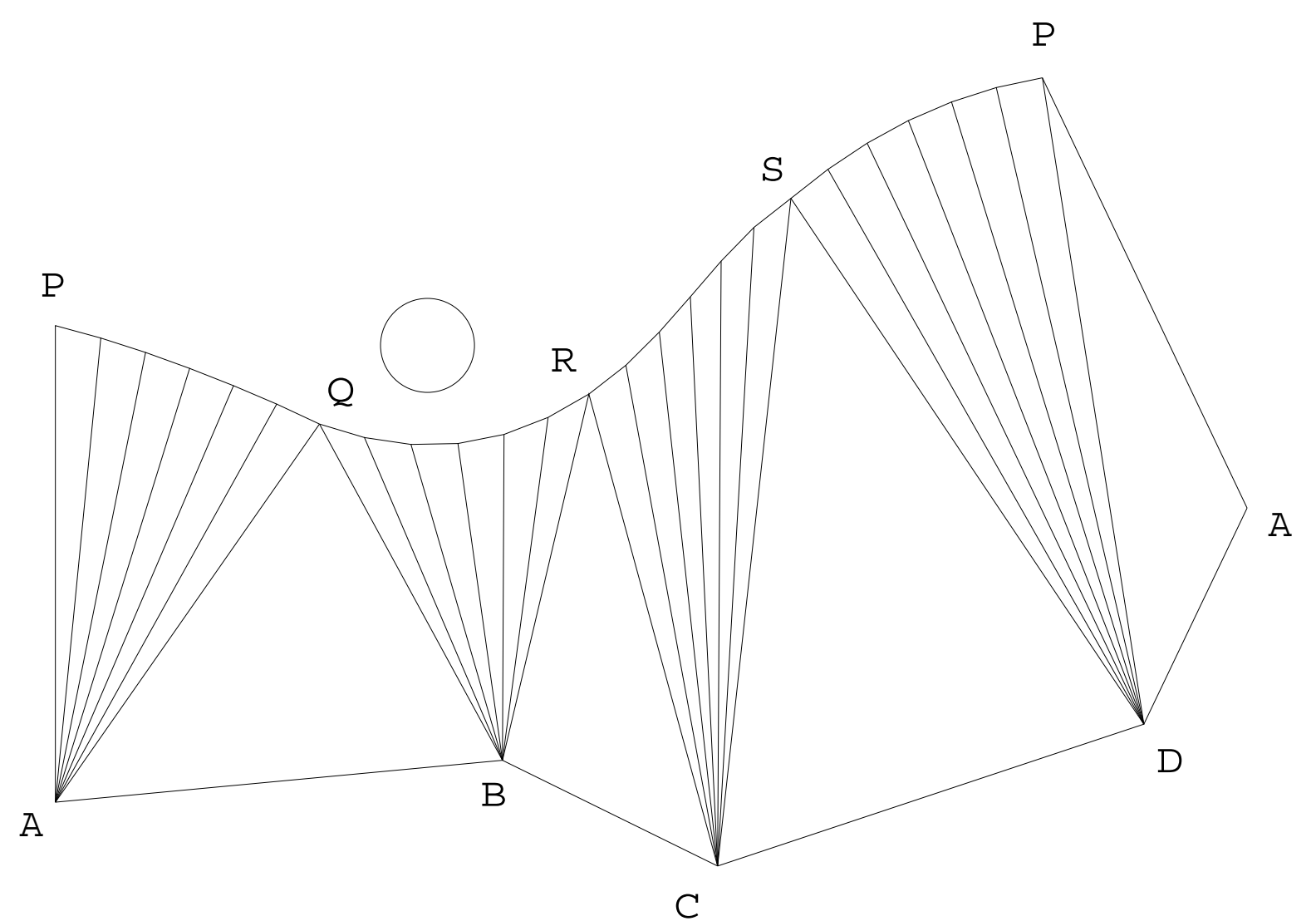
```
100 PI=3.141592654#:FTD=15*PI/180:LA=P1/2:R=6
110 XA=15.04:YA=-2.4:ZA=3.72:XB=7.84:YB=9.600001:ZB=9.12
112 XC=12.96:YC=14.4:ZC=5.28:XD=20.16:YD=2.4:ZD=-.12
120 FOR I=0 TO 6
130 Y=-R*COS(FTD*I):Z=R*SIN(FTD*I)
140 LPRINT "APQ";I;" ";SQR(XA*XA+(Y-YA)^2+(Z-ZA)^2)
150 NEXT I
160 LPRINT:REM Transition piece design MECH 289 10-02-15
170 FOR I=6 TO 12
180 Y=-R*COS(FTD*I):Z=R*SIN(FTD*I)
190 LPRINT "BQR";I-6;" ";SQR(XB*XB+(Y-YB)^2+(Z-ZB)^2)
200 NEXT I
210 LPRINT:REM TPDV020.BAS
220 FOR I=12 TO 18
230 Y=-R*COS(FTD*I):Z=R*SIN(FTD*I)
240 LPRINT "CRS";I-12;" ";SQR(XC*XC+(Y-YC)^2+(Z-ZC)^2)
250 NEXT I
260 LPRINT:REM Refer to Fig. 32 TPDV5A3
270 FOR I=18 TO 24
280 Y=-R*COS(FTD*I):Z=R*SIN(FTD*I)
290 LPRINT "DSP";I-18;" ";SQR(XD*XD+(Y-YD)^2+(Z-ZD)^2)
300 NEXT I
310 STOP:END:
```

```
APQ 0    15.90597
APQ 1    15.57009
APQ 2    15.31465
APQ 3    15.16147
APQ 4    15.12417
APQ 5    15.20615
APQ 6    15.4

BQR 0    12.78124
BQR 1    11.71636
BQR 2    10.97371
BQR 3    10.675
BQR 4    10.87722
BQR 5    11.54124
BQR 6    12.55389

CRS 0    16.32176
CRS 1    16.99079
CRS 2    17.92292
CRS 3    19.02142
CRS 4    20.19087
CRS 5    21.3466
CRS 6    22.41785

DSP 0    21.1367
DSP 1    21.31345
DSP 2    21.47913
DSP 3    21.62282
DSP 4    21.73526
DSP 5    21.80931
DSP 6    21.84033
```


P
P
S
Q
R
A
A
D
B
C