MATH 253   Spring 2003   Section 502
Maple Quiz Solutions

```
> restart:with(VecCalc):VCalias:
```

#1

```
> f:=MF(<x,y,z>,(x-7)^2+(y-5)^2+(z-5)^2);
```
$$f := (x, y, z) \rightarrow (x - 7)^2 + (y - 5)^2 + (z - 5)^2$$

```
> delf:=Grad(f);
```
$$delf := [(x, y, z) \rightarrow -14 + 2\,x, (x, y, z) \rightarrow -10 + 2\,y, (x, y, z) \rightarrow -10 + 2\,z]$$

```
> g:=MF(<x,y,z>,36*x^2+9*y^2+4*z^2);
```
$$g := (x, y, z) \rightarrow 36\,x^2 + 9\,y^2 + 4\,z^2$$

```
> delg:=Grad(g);
```
$$delg := [(x, y, z) \rightarrow 72\,x, (x, y, z) \rightarrow 18\,y, (x, y, z) \rightarrow 8\,z]$$

```
> eqs:=equate( delf &@ <x,y,z>, simplify(lambda*delg &@ <x,y,z>));
```
$$eqs := \{-14 + 2\,x = 72\,\lambda\,x, -10 + 2\,y = 18\,\lambda\,y, -10 + 2\,z = 8\,\lambda\,z\}$$

```
> constr:=g &@ <x,y,z> = 108;
```
$$constr := 36\,x^2 + 9\,y^2 + 4\,z^2 = 108$$

```
> sol:=solve({op(eqs),constr},{x,y,z,lambda});
```

$$sol := \{z = 3, y = 2, \lambda = \frac{-1}{6}, x = 1\}, \{\lambda = -\frac{1}{18}$$

$$+ \frac{16}{3645} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)^4$$

$$- \frac{28}{729} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)^3$$

$$+ \frac{299}{2430} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)^2$$

$$- \frac{61}{810} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1),$$

$$z = 3\,\text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1), x =$$

$$\frac{71}{15} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)$$

$$+ \frac{512}{1215} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)^4$$

$$- \frac{704}{243} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)^3$$

$$+ \frac{2584}{405} \text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)^2 - \frac{64}{3}, y$$

$$= 8\,\text{RootOf}(64\,\_Z^5 - 560\,\_Z^4 + 1794\,\_Z^3 - 1098\,\_Z^2 - 4455\,\_Z + 6075, label = \_L1)$$

$$+ \frac{128}{243} \, \mathrm{RootOf}(64 \,\_Z^5 - 560 \,\_Z^4 + 1794 \,\_Z^3 - 1098 \,\_Z^2 - 4455 \,\_Z + 6075,\, label = \_L1)^4$$

$$- \frac{736}{243} \, \mathrm{RootOf}(64 \,\_Z^5 - 560 \,\_Z^4 + 1794 \,\_Z^3 - 1098 \,\_Z^2 - 4455 \,\_Z + 6075,\, label = \_L1)^3$$

$$+ \frac{460}{81} \, \mathrm{RootOf}(64 \,\_Z^5 - 560 \,\_Z^4 + 1794 \,\_Z^3 - 1098 \,\_Z^2 - 4455 \,\_Z + 6075,\, label = \_L1)^2 - \frac{50}{3} \}$$

```
> P:=subs(sol[1],<x,y,z>);
```
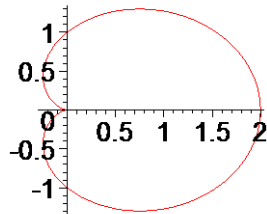
$$P := \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

```
> dist:=sqrt(f &@ P);
```

$$dist := 7$$

#2

```
> polarplot(1+cos(theta), theta=0..2*Pi);
```



```
> delta:=2+r*cos(theta);
```

$$\delta := 2 + r \cos(\theta)$$

```
> M:=Muint(delta*r, r=0..1+cos(theta), theta=0..2*Pi); M:=value(%);
```

$$M := \int_0^{2\pi} \int_0^{1+\cos(\theta)} (2 + r \cos(\theta))\, r \, dr \, d\theta$$

$$M := \frac{17\pi}{4}$$

```
> Mx:=Muint(r*cos(theta)*delta*r, r=0..1+cos(theta), theta=0..2*Pi);
  Mx:=value(%);
```

$$Mx := \int_0^{2\pi} \int_0^{1+\cos(\theta)} r^2 \cos(\theta)\,(2 + r \cos(\theta)) \, dr \, d\theta$$

$$Mx := \frac{129\pi}{32}$$

```
> xbar:=Mx/M;
```

$$xbar := \frac{129}{136}$$