MATH 253 Fall 2003 Section 506 P. Yasskin
Maple Quiz Solutions

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

#1

Method 1: Lagrange Multipliers

```
> V:=MF([L,W,H],L*W*H);
```

$$V := (L, \mathrm{W}, H) \to L\ \mathrm{W}\ H$$

```
> constr:=V(L,W,H)=3;
```

$$constr := L\ \mathrm{W}\ H = 3$$

```
> A:=MF([L,W,H],2*L*W+3*L*H+4*W*H);
```

$$A := (L, \mathrm{W}, H) \to 2\ \mathrm{W}\ L + 3\ L\ H + 4\ \mathrm{W}\ H$$

```
> delV:=Grad(V) &@ [L,W,H];
```

$$delV := [\mathrm{W}\ H, L\ H, L\ \mathrm{W}]$$

```
> delA:=Grad(A) &@ [L,W,H];
```

$$delA := [2\ \mathrm{W} + 3\ H, 2\ L + 4\ H, 3\ L + 4\ \mathrm{W}]$$

```
> eqs:=equate(delA,lambda*delV);
```

$$eqs := \{2\ \mathrm{W} + 3\ H = \lambda\ \mathrm{W}\ H, 2\ L + 4\ H = \lambda\ L\ H, 3\ L + 4\ \mathrm{W} = \lambda\ L\ \mathrm{W}\}$$

```
> sol:=solve({op(eqs),constr},{L,W,H, lambda});
```

$$sol := \{\lambda = 4, \mathrm{W} = \frac{3}{2}, L = 2, H = 1\}, \{L = 2\ \mathrm{RootOf}(\_Z^2 + \_Z + 1, label = \_L2),$$

$$H = \mathrm{RootOf}(\_Z^2 + \_Z + 1, label = \_L2), \mathrm{W} = \frac{3}{2}\ \mathrm{RootOf}(\_Z^2 + \_Z + 1, label = \_L2),$$

$$\lambda = -4 - 4\ \mathrm{RootOf}(\_Z^2 + \_Z + 1, label = \_L2)\}$$

```
> evalf(sol[2]);
```

$$\{H = -0.5000000000 + 0.8660254038\ I, \mathrm{W} = -0.7500000000 + 1.299038106\ I,$$

$$\lambda = -2.000000000 - 3.464101615\ I, L = -1.000000000 + 1.732050808\ I\}$$

```
> subs(sol[1],[L,W,H]);
```

$$\left[2, \frac{3}{2}, 1\right]$$

Method 2: Eliminate a Variable

```
> V:=L*W*H;
```

$$V := L\ \mathrm{W}\ H$$

```
> H1:=solve(V=3,H);
```

$$H1 := \frac{3}{L\ \mathrm{W}}$$

```
> A:=MF([L,W,H],2*L*W+3*L*H+4*W*H);
```

$$A := (L, \mathrm{W}, H) \to 2\ \mathrm{W}\ L + 3\ L\ H + 4\ \mathrm{W}\ H$$

```
> A1:=MF([L,W],A(L,W,H1));
```

$$A1 := (L, \mathrm{W}) \to 2\,\mathrm{W}\,L + \frac{9}{\mathrm{W}} + \frac{12}{L}$$

```
> delA:=Grad(A1)&@ [L,W];
```

$$delA := \left[\frac{2\,(L^2\,\mathrm{W} - 6)}{L^2}, \frac{2\,L\,\mathrm{W}^2 - 9}{\mathrm{W}^2}\right]$$

```
> eqs:=equate(delA,0);
```

$$eqs := \left\{\frac{2\,(L^2\,\mathrm{W} - 6)}{L^2} = 0, \frac{2\,L\,\mathrm{W}^2 - 9}{\mathrm{W}^2} = 0\right\}$$

```
> sol:=solve(eqs,{L,W});
```

$$sol := \left\{\mathrm{W} = \frac{3}{2}, L = 2\right\},$$

$$\left\{L = 2\,\mathrm{RootOf}(\_Z^2 + \_Z + 1, label = \_L2), \mathrm{W} = \frac{3}{2}\,\mathrm{RootOf}(\_Z^2 + \_Z + 1, label = \_L2)\right\}$$

```
> evalf(sol[2]);
```

$$\{\mathrm{W} = -0.7500000000 + 1.299038106\,I, L = -1.000000000 + 1.732050808\,I\}$$

```
> subs(sol[1], [L,W,H1]);
```

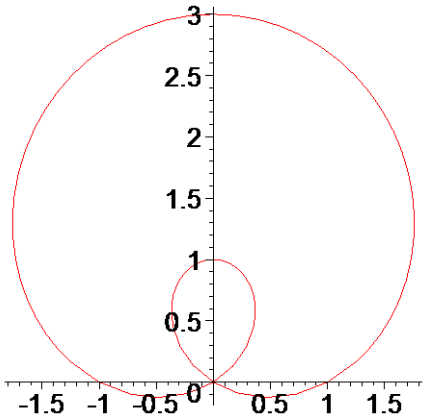
$$\left[2, \frac{3}{2}, 1\right]$$

#2

```
> r1:=1+2*sin(theta);
```

$$r1 := 1 + 2\sin(\theta)$$

```
> plot(r1, theta=0..2*Pi, coords=polar);
```




```
> solve(r1=0,theta);
```

$$-\frac{\pi}{6}$$

```
> A1:=Muint(r, r=0..r1, theta=-Pi/6..7*Pi/6); A1:=value(%);
  evalf(%);
```

$$A1 := \int_{-\frac{\pi}{6}}^{\frac{7\pi}{6}} \int_{0}^{1+2\sin(\theta)} r\,dr\,d\theta$$

$$A1 := \frac{3\sqrt{3}}{2} + 2\pi$$

8.881261520

```
> A2:=Muint(r, r=0..r1, theta=7*Pi/6..11*Pi/6); A2:=value(%);
  evalf(%);
```

$$A2 := \int_{\frac{7\pi}{6}}^{\frac{11\pi}{6}} \int_{0}^{1+2\sin(\theta)} r\,dr\,d\theta$$

$$A2 := -\frac{3\sqrt{3}}{2} + \pi$$

0.543516442

```
> A:=A1-A2; evalf(%);
```

$$A := 3\sqrt{3} + \pi$$

8.337745078

```
>
```