

```
[> restart;
=> #preferences single household;
> x0:=(c-2*eta)*(g-eta);
                                 $x0 := (c - 2\eta)(g - \eta)$  (1)
```

```
> #substitute budget constraint
x1:=subs(g=y-c,x0);
                                 $x1 := (c - 2\eta)(y - c - \eta)$  (2)
```

```
[> #optimal food consumption;
x2:=solve(diff(x1,c),c);
                                 $x2 := \frac{1}{2}y + \frac{1}{2}\eta$  (3)
```

```
> #foodshare is decreasing in income
x2a:=x2/y;
simplify(diff(x2a,y));
                                 $x2a := \frac{\frac{1}{2}y + \frac{1}{2}\eta}{y}$ 
                                 $-\frac{1}{2}\frac{\eta}{y^2}$  (4)
```

```
> #joint household--maximize sum of utilities but combine income
and share public good ;
#delta is cost of joint residence;
x3:=(c1-2*eta)*(2*y-c1-c2-eta) +(c2-2*eta)*(2*y-c1-c2-eta)-delta;
                                 $x3 := (c1 - 2\eta)(2y - c1 - c2 - \eta) + (c2 - 2\eta)(2y - c1 - c2 - \eta) - \delta$  (5)
```

```
> #focus on total food consumption
> x4:=simplify(subs(c1=c-c2,x3));
                                 $x4 := -c^2 + 3c\eta + 2cy + 4\eta^2 - 8\eta y - \delta$  (6)
```

```
> #optimal food consumption
x5:=solve(diff(x4,c),c);
                                 $x5 := \frac{3}{2}\eta + y$  (7)
```

```
[> #food share in joint household
> x5a:=x5/(2*y);
simplify(diff(x5a,y));
                                 $x5a := \frac{1}{2}\frac{\frac{3}{2}\eta + y}{y}$ 
                                 $-\frac{3}{4}\frac{\eta}{y^2}$  (8)
```

```
> #total utility in joint household;
```

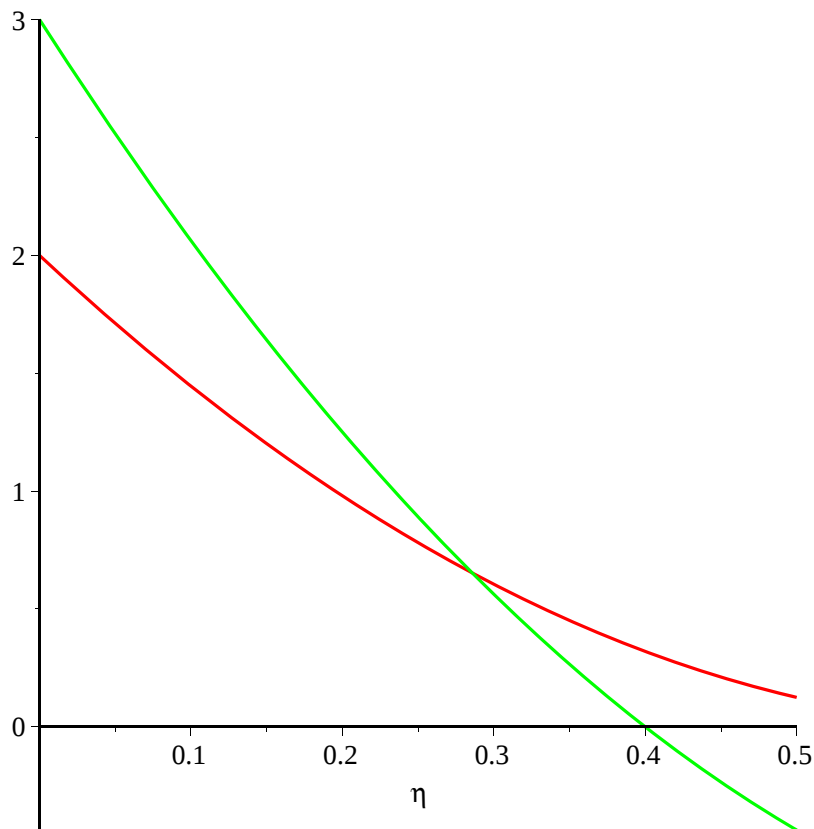
```
x6:=simplify(subs(c=x5,x4));
```

$$x6 := \frac{25}{4} \eta^2 - 5 \eta y + y^2 - \delta \quad (9)$$

```
> #combined utility if in separate households;
x7:=2*subs(c=x2,x1);
```

$$x7 := 2 \left(\frac{1}{2} y - \frac{3}{2} \eta \right)^2 \quad (10)$$

```
> #joint utility is higher when eta is higher;
plot(subs(y=2,delta=1,[x7,x6]),eta=0..0.5,color=[red,green]);
```



```
> x8:=[solve(subs(y=2,delta=1,x6=x7),eta)][2];
```

$$x8 := \frac{2}{7} \quad (11)$$

$$\frac{1}{2} \frac{\frac{4}{3} y + \frac{2}{3} \eta}{y}$$

(12)

```
> #foodshare is always higher in split households for given eta.
#but note that joint households only if eta>.6
```

```
#but split households only if eta<.6
#average foodshare for split households may be lower than joint.
plot(subs(y=2,[x2a,x5a,piecewise(eta>x8,x2a,x5a)]),eta=0..0.5,
color=[red,green,blue]);
```

