```
> restart;
  with(LinearAlgebra):
  with(Physics):
  with(plots):
  with(plottools):
  with(Typesetting):
  interface(typesetting=extended):
  interface(showassumed=0):
```

```
> L:=15;
  EI:=10000;

  #apply 1 unit of load at x = 10
  f:=x->1*Dirac(x-10);
```

$$L := 15$$
$$EI := 10000$$
$$f := x \mapsto \delta(x - 10)$$

```
> eq1:=EI*diff(y(x),x,x,x,x)=f(x)
```

$$eq1 := 10000\, y''''(x) = \delta(x - 10)$$

```
> #simply supported
  ic1:=y(0)=0, (D@@2)(y)(0)=0,y(L)=0,(D@@2)(y)(L)=0;
  #clamped at both ends
  ic2:=y(0)=0, (D@@1)(y)(0)=0,y(L)=0,(D@@1)(y)(L)=0;
  #clamped at one end, free at another end
  ic3:=y(0)=0, (D@@1)(y)(0)=0,(D@@2)(y)(L)=0,(D@@3)(y)(L)=0;
```

$$ic1 := y(0) = 0,\ \mathrm{D}^{(2)}(y)(0) = 0,\ y(15) = 0,\ \mathrm{D}^{(2)}(y)(15) = 0$$
$$ic2 := y(0) = 0,\ \mathrm{D}(y)(0) = 0,\ y(15) = 0,\ \mathrm{D}(y)(15) = 0$$
$$ic3 := y(0) = 0,\ \mathrm{D}(y)(0) = 0,\ \mathrm{D}^{(2)}(y)(15) = 0,\ \mathrm{D}^{(3)}(y)(15) = 0$$

```
> sol1:=dsolve({eq1, ic1}, {y(x)}): y1:=rhs(sol1);
  sol2:=dsolve({eq1, ic2}, {y(x)}): y2:=rhs(sol2);
  sol3:=dsolve({eq1, ic3}, {y(x)}): y3:=rhs(sol3);

  M1:=-EI*diff(diff(y1,x),x):
  V1:=diff(M1,x):

  M2:=-EI*diff(diff(y2,x),x):
  V2:=diff(M1,x):
```

```
M3:=-EI*diff(diff(y3,x),x):
V3:=diff(M1,x):
```

$$y1 := -\frac{x^2\,\theta(x-10)}{2000} - \frac{\theta(x-10)}{60} + \frac{x^3\,\theta(x-10)}{60000} - \frac{x^3}{180000} + \frac{x\,\theta(x-10)}{200} + \frac{x}{900}$$

$$y2 := \frac{x^2}{18000} - \frac{x^2\,\theta(x-10)}{2000} - \frac{\theta(x-10)}{60} + \frac{x^3\,\theta(x-10)}{60000} - \frac{7\,x^3}{1620000} + \frac{x\,\theta(x-10)}{200}$$

$$y3 := \frac{x^2}{2000} - \frac{x^2\,\theta(x-10)}{2000} - \frac{\theta(x-10)}{60} + \frac{x^3\,\theta(x-10)}{60000} - \frac{x^3}{60000} + \frac{x\,\theta(x-10)}{200}$$

```
> a:=plot(y1,x=0..L,title="Displacement function, simply supported"):
  b:=plot(M1,x=0..L,title="Moment distribution"):
  c:=plot(V1,x=0..L,title="Shear distribution"):

  d:=plot(y2,x=0..L,title="Displacement function, clamped at both end"):
  e:=plot(M2,x=0..L,title="Moment distribution"):
  f:=plot(V2,x=0..L,title="Shear distribution"):

  g:=plot(y3,x=0..L,title="Displacement function, clamped at one end, free at another end"):
  h:=plot(M3,x=0..L,title="Moment distribution"):
  i:=plot(V3,x=0..L,title="Shear distribution"):


> display(Array([a,b,c]));
  display(Array([d,e,f]));
  display(Array([g,h,i]));
```
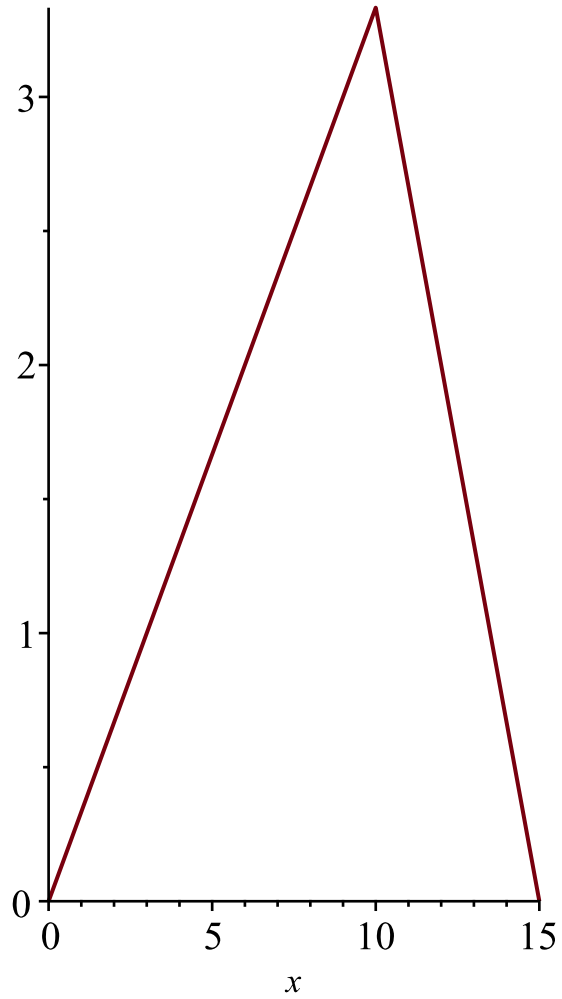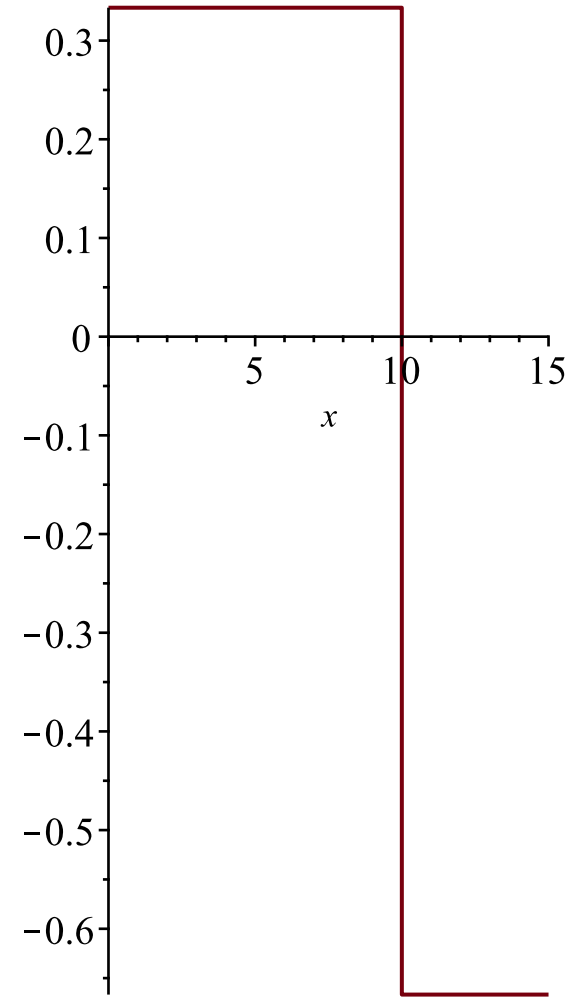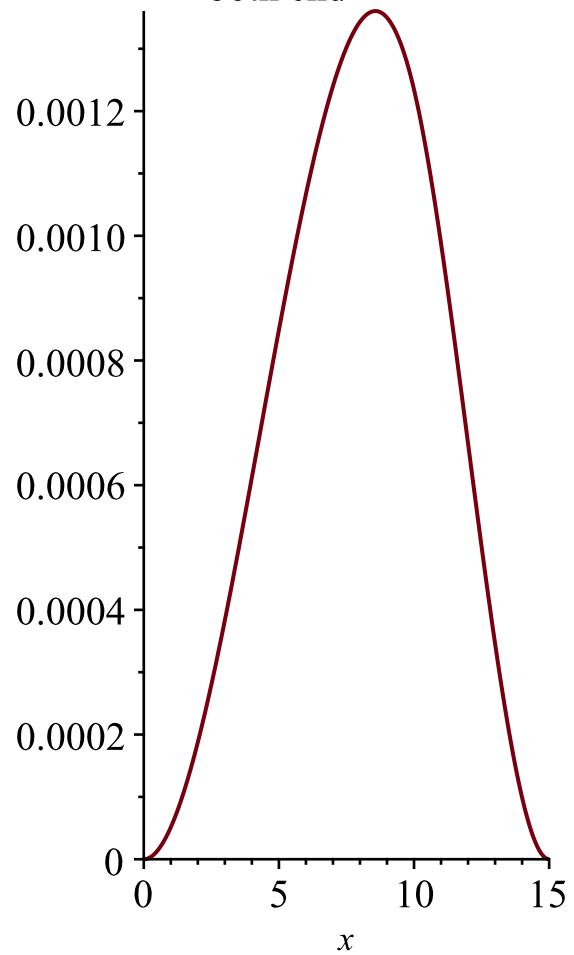
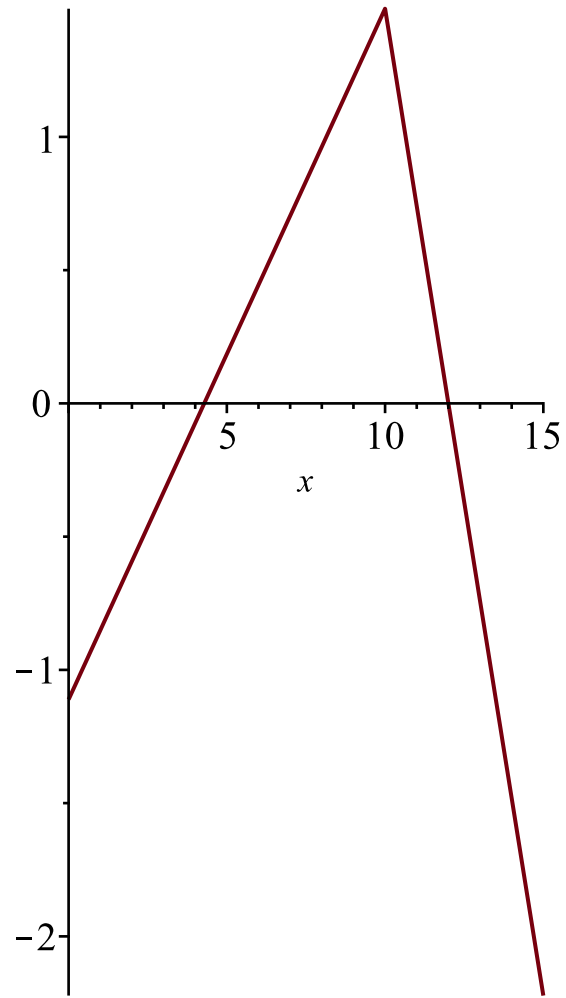## Displacement function, simply supported
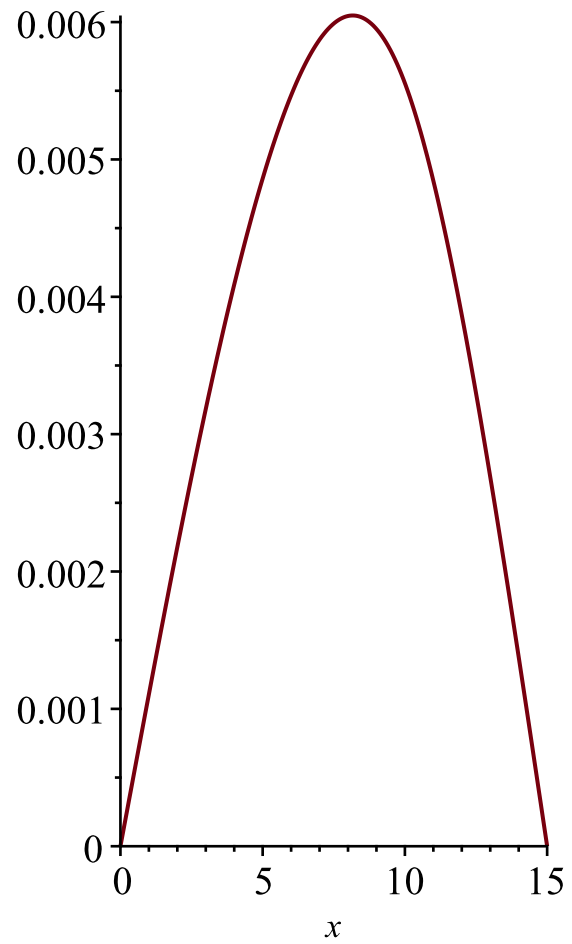
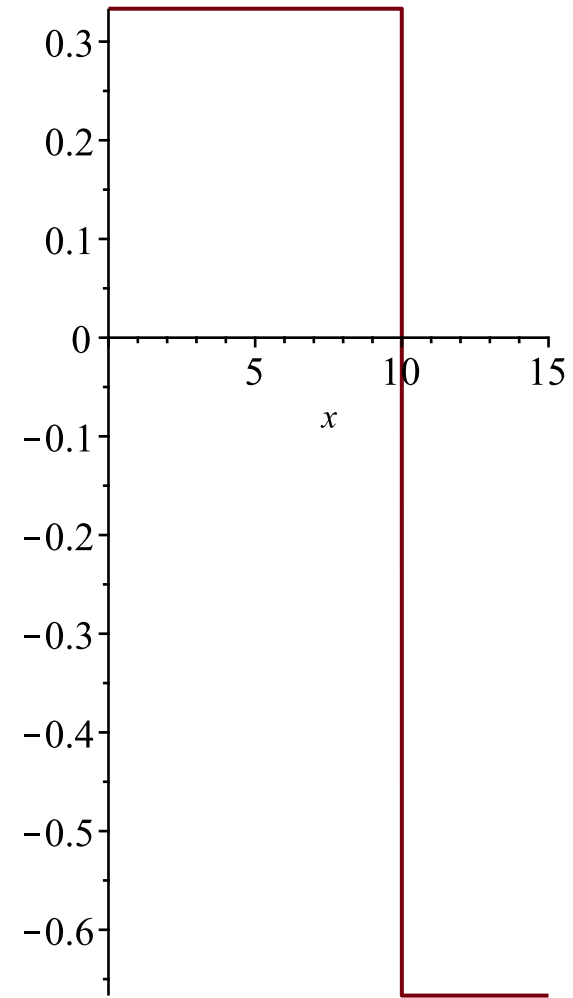## Moment distribution

Shear distribution

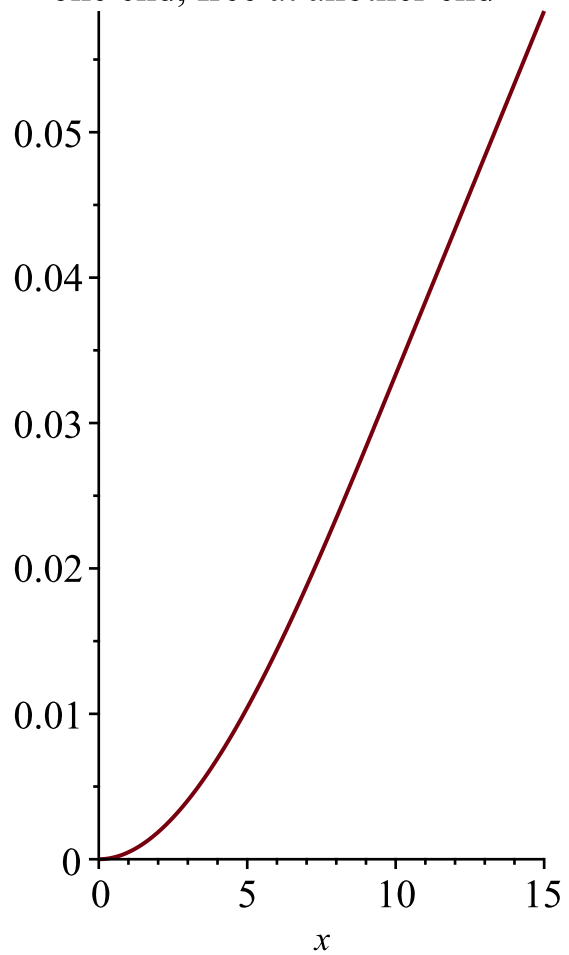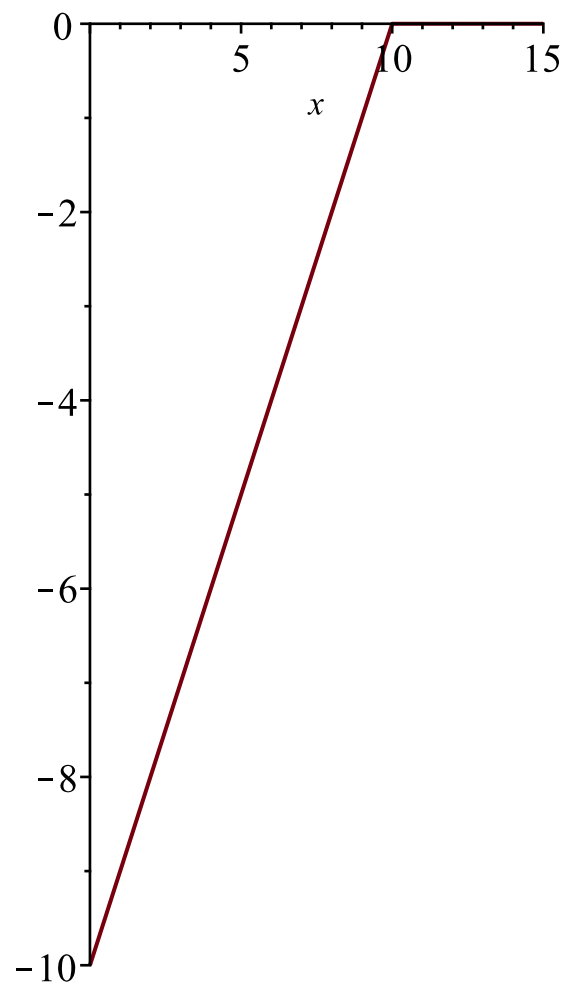Displacement function, clamped at both end

Moment distribution

Shear distribution

Displacement function, clamped at one end, free at another end

Moment distribution

Shear distribution