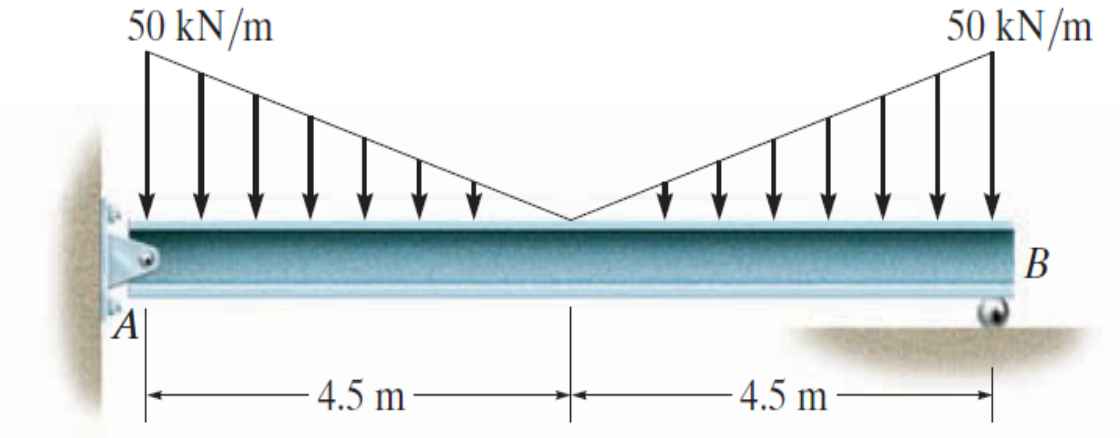
problem 6-37

6–37. Draw the shear and moment diagrams for the beam.



Prob. 6–37

beam

```
u = symunit;
x = sym('x');
E = sym('E');
I = sym('I');

old_assum = assumptions;
clearassum;
args = {'mode' 'factor'};
wf1 = findpoly(1, 'thru', [0 -50*u.kN/u.m], [4.5*u.m 0], args{:});
wf2 = findpoly(1, 'thru', [4.5*u.m 0], [9*u.m -50*u.kN/u.m], args{:});

b = beam; %(kN,m)
b = b.add('reaction', 'force', 'Ra', 0);
b = b.add('reaction', 'force', 'Rb', 9*u.m);
b = b.add('distributed', 'force', wf1, [0 4.5]*u.m);
b = b.add('distributed', 'force', wf2, [4.5 9]*u.m, [false true]);
b.L = 9*u.m;
```

elastic curve

```
[y dy m v w r] = b.elastic_curve(x, 'factor'); %#ok
y
```

y(x) =

$$\begin{cases} -\dfrac{5\,x\,(-16\,x^4+360\,x^3\,\mathrm{m}-3240\,x^2\,\mathrm{m}^2+98415\,\mathrm{m}^4)}{864\,\mathrm{E}\,\mathrm{I}}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } x \le \dfrac{9}{2}\,\mathrm{m} \\ -\dfrac{5\,(x-9\,\mathrm{m})\,(16\,x^4-216\,x^3\,\mathrm{m}+1296\,x^2\,\mathrm{m}^2-17496\,x\,\mathrm{m}^3+6561\,\mathrm{m}^4)}{864\,\mathrm{E}\,\mathrm{I}}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } \dfrac{9}{2}\,\mathrm{m} < x \end{cases}$$

dy

dy(x) =

$$\begin{cases} \dfrac{25\,(2\,x-9\,\mathrm{m})\,(8\,x^3-108\,x^2\,\mathrm{m}+486\,x\,\mathrm{m}^2+2187\,\mathrm{m}^3)}{864\,\mathrm{E}\,\mathrm{I}}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } x \le \dfrac{9}{2}\,\mathrm{m} \\ -\dfrac{25\,(2\,x-9\,\mathrm{m})\,(8\,x^3-108\,x^2\,\mathrm{m}+486\,x\,\mathrm{m}^2-3645\,\mathrm{m}^3)}{864\,\mathrm{E}\,\mathrm{I}}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } \dfrac{9}{2}\,\mathrm{m} < x \end{cases}$$

m

m(x) =

$$\begin{cases} \dfrac{25\,x\,(4\,x^2-54\,x\,\mathrm{m}+243\,\mathrm{m}^2)}{54}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } x \le \dfrac{9}{2}\,\mathrm{m} \\ -\dfrac{25\,(x-9\,\mathrm{m})\,(4\,x^2-18\,x\,\mathrm{m}+81\,\mathrm{m}^2)}{54}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } \dfrac{9}{2}\,\mathrm{m} < x \end{cases}$$

v

v(x) =

$$\begin{cases} \dfrac{25\,(2\,x-9\,\mathrm{m})^2}{18}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } x \le \dfrac{9}{2}\,\mathrm{m} \\ -\dfrac{25\,(2\,x-9\,\mathrm{m})^2}{18}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } \dfrac{9}{2}\,\mathrm{m} < x \end{cases}$$

w

w(x) =

$$\begin{cases} \dfrac{50\,(2\,x-9\,\mathrm{m})}{9}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } x \le \dfrac{9}{2}\,\mathrm{m} \\ -\dfrac{50\,(2\,x-9\,\mathrm{m})}{9}\ \dfrac{\mathrm{kN}}{\mathrm{m}^2} & \text{if } \dfrac{9}{2}\,\mathrm{m} < x \end{cases}$$

reactions

```
Ra = vpa(r.Ra) %#ok
```

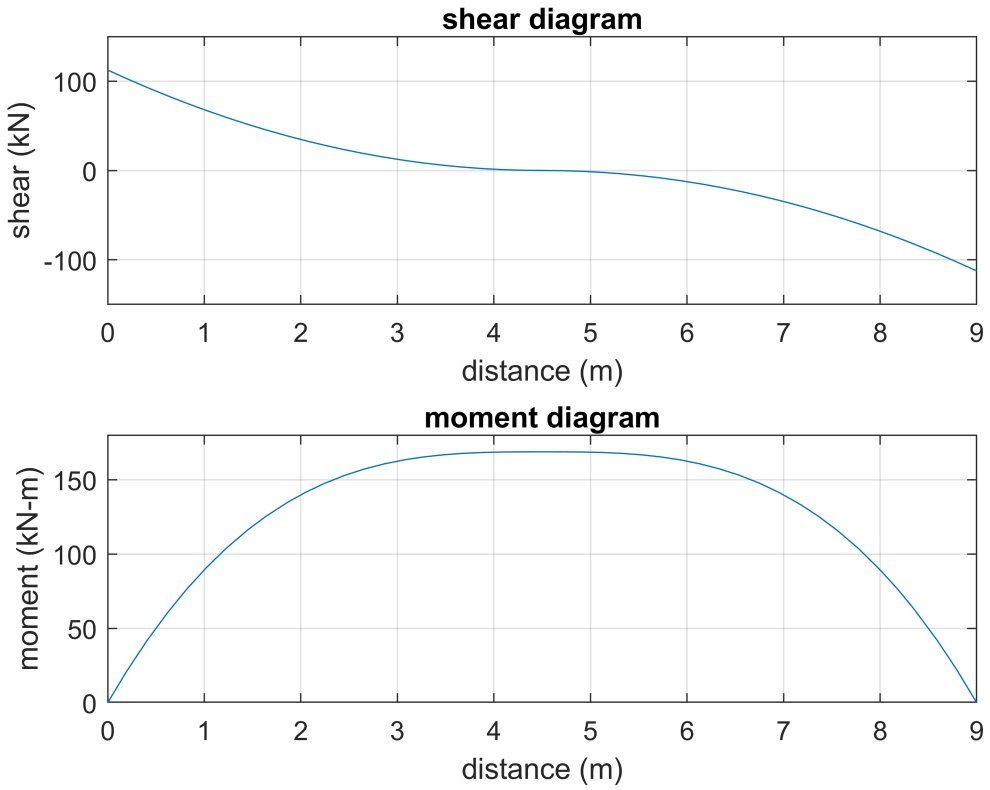
Ra = 112.5 kN

```
Rb = vpa(r.Rb) %#ok
```

Rb = 112.5 kN

shear and bending moment diagrams

```
beam.shear_moment(m, v, [0 9], {'kN' 'm'});
subplot(2,1,1);
axis([0 9 -150 150]);
subplot(2,1,2);
axis([0 9 0 180]);
```



clean up

```
setassum(old_assum);
clear args old_assum Ra Rb;
```