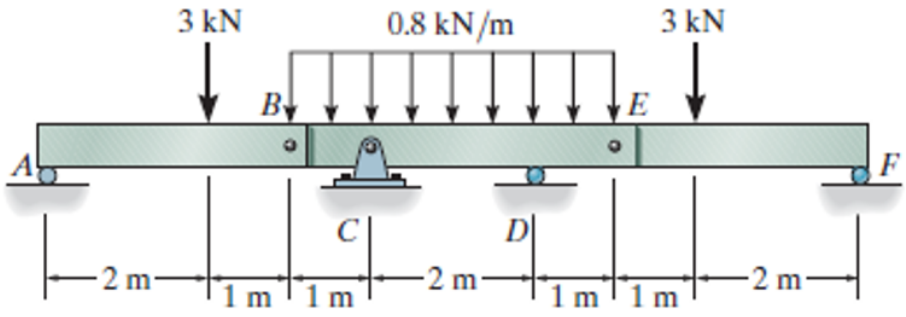
6–41. Draw the shear and moment diagrams for the compound beam. The three segments are connected by pins at B and E.



Prob. 6–41

assumptions

```
u = symunit;
old_assum = assumptions;
clearassum;
```

beam

```
b = beam;
b = b.add('reaction', 'force', 'Ra', 0);
b = b.add('applied', 'force', -3*u.kN, 2*u.m);
b = b.add('connection', 'force', 'Rb', 3*u.m);
b = b.add('reaction', 'force', 'Rc', 4*u.m);
b = b.add('reaction', 'force', 'Rd', 6*u.m);
b = b.add('connection', 'force', 'Re', 7*u.m);
b = b.add('applied', 'force', -3*u.kN, 8*u.m);
b = b.add('reaction', 'force', 'Rf', 10*u.m);
b = b.add('distributed', 'force', -0.8*u.kN/u.m, [3 7]*u.m);
b.L = 10*u.m;
```

elastic curve

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

```
y(x) =
```

$$\begin{cases} -\frac{x\ (69\ \mathrm{m}^2 - 5\ x^2)}{30\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } x \le 2\ \mathrm{m} \\ -\frac{10\ x^3 - 90\ x^2\ \mathrm{m} + 249\ x\ \mathrm{m}^2 - 120\ \mathrm{m}^3}{30\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } x \in (2\ \mathrm{m}, 3\ \mathrm{m}] \\ \frac{(x - 4\ \mathrm{m})\ (-x^3 - 2\ x^2\ \mathrm{m} + 28\ x\ \mathrm{m}^2 + 48\ \mathrm{m}^3)}{30\ \mathrm{E}\ \mathrm{I}}\ \frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (3\ \mathrm{m}, 4\ \mathrm{m}] \\ -\frac{(x - 4\ \mathrm{m})\ (x - 6\ \mathrm{m})\ (x^2 - 10\ x\ \mathrm{m} + 56\ \mathrm{m}^2)}{30\ \mathrm{E}\ \mathrm{I}}\ \frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (4\ \mathrm{m}, 6\ \mathrm{m}] \\ -\frac{(x - 6\ \mathrm{m})\ (x^3 - 32\ x^2\ \mathrm{m} + 312\ x\ \mathrm{m}^2 - 872\ \mathrm{m}^3)}{30\ \mathrm{E}\ \mathrm{I}}\ \frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (6\ \mathrm{m}, 7\ \mathrm{m}] \\ \frac{10\ x^3 - 210\ x^2\ \mathrm{m} + 1449\ x\ \mathrm{m}^2 - 3370\ \mathrm{m}^3}{30\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } x \in (7\ \mathrm{m}, 8\ \mathrm{m}] \\ -\frac{(x - 10\ \mathrm{m})\ (5\ x^2 - 100\ x\ \mathrm{m} + 431\ \mathrm{m}^2)}{30\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } 8\ \mathrm{m} < x \end{cases}$$

dy

dy(x) =

$$\begin{cases} -\frac{23\ \mathrm{m}^2 - 5\ x^2}{10\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } x \le 2\ \mathrm{m} \\ -\frac{10\ x^2 - 60\ x\ \mathrm{m} + 83\ \mathrm{m}^2}{10\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } x \in (2\ \mathrm{m}, 3\ \mathrm{m}] \\ -\frac{(x + 4\ \mathrm{m})\ (2\ x^2 - 11\ x\ \mathrm{m} + 8\ \mathrm{m}^2)}{15\ \mathrm{E}\ \mathrm{I}}\ \frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (3\ \mathrm{m}, 4\ \mathrm{m}] \\ -\frac{2\ (x - 5\ \mathrm{m})\ (x^2 - 10\ x\ \mathrm{m} + 40\ \mathrm{m}^2)}{15\ \mathrm{E}\ \mathrm{I}}\ \frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (4\ \mathrm{m}, 6\ \mathrm{m}] \\ -\frac{(x - 14\ \mathrm{m})\ (2\ x^2 - 29\ x\ \mathrm{m} + 98\ \mathrm{m}^2)}{15\ \mathrm{E}\ \mathrm{I}}\ \frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (6\ \mathrm{m}, 7\ \mathrm{m}] \\ \frac{10\ x^2 - 140\ x\ \mathrm{m} + 483\ \mathrm{m}^2}{10\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } x \in (7\ \mathrm{m}, 8\ \mathrm{m}] \\ -\frac{5\ x^2 - 100\ x\ \mathrm{m} + 477\ \mathrm{m}^2}{10\ \mathrm{E}\ \mathrm{I}}\ \mathrm{kN} & \text{if } 8\ \mathrm{m} < x \end{cases}$$

m

m(x) =

$$\begin{cases} x\,\mathrm{kN} & \text{if } x \le 2\,\mathrm{m} \\ -2\,(x-3\,\mathrm{m})\,\mathrm{kN} & \text{if } x \in (2\,\mathrm{m}, 3\,\mathrm{m}) \\ -\frac{2\,(x+2\,\mathrm{m})\,(x-3\,\mathrm{m})}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in [3\,\mathrm{m}, 4\,\mathrm{m}] \\ -\frac{2\,(x^2-10\,x\,\mathrm{m}+30\,\mathrm{m}^2)}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (4\,\mathrm{m}, 6\,\mathrm{m}] \\ -\frac{2\,(x-7\,\mathrm{m})\,(x-12\,\mathrm{m})}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (6\,\mathrm{m}, 7\,\mathrm{m}] \\ 2\,(x-7\,\mathrm{m})\,\mathrm{kN} & \text{if } x \in (7\,\mathrm{m}, 8\,\mathrm{m}] \\ -(x-10\,\mathrm{m})\,\mathrm{kN} & \text{if } 8\,\mathrm{m} < x \end{cases}$$

```
v
```

v(x) =

$$\begin{cases} \mathrm{kN} & \text{if } x \le 2\,\mathrm{m} \\ -2\,\mathrm{kN} & \text{if } x \in (2\,\mathrm{m}, 3\,\mathrm{m}) \\ -\frac{2\,(2\,x-1\,\mathrm{m})}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in [3\,\mathrm{m}, 4\,\mathrm{m}] \\ -\frac{4\,(x-5\,\mathrm{m})}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (4\,\mathrm{m}, 6\,\mathrm{m}] \\ -\frac{2\,(2\,x-19\,\mathrm{m})}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in (6\,\mathrm{m}, 7\,\mathrm{m}] \\ 2\,\mathrm{kN} & \text{if } x \in (7\,\mathrm{m}, 8\,\mathrm{m}] \\ -1\,\mathrm{kN} & \text{if } 8\,\mathrm{m} < x \end{cases}$$

```
w
```

w(x) =

$$\begin{cases} 0 & \text{if } x < 3\,\mathrm{m} \\ -\frac{4}{5}\,\frac{\mathrm{kN}}{\mathrm{m}} & \text{if } x \in [3\,\mathrm{m}, 7\,\mathrm{m}] \\ 0 & \text{if } 7\,\mathrm{m} < x \end{cases}$$

```
ra_vpa = vpa(ra) %#ok
```

ra_vpa =

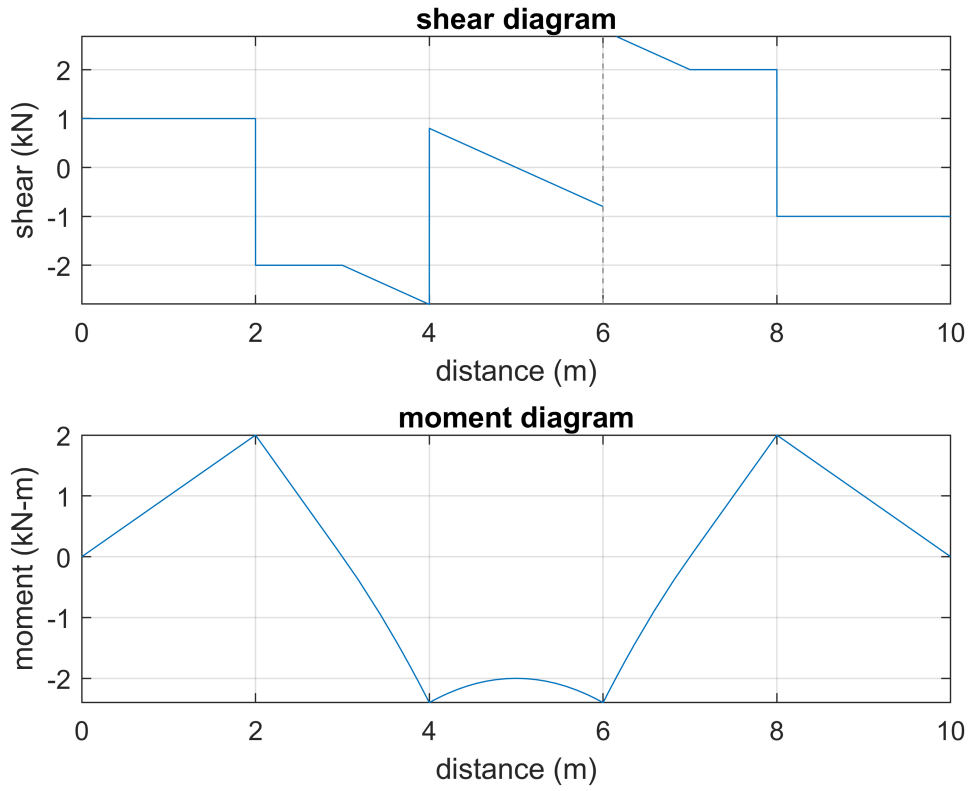
$$\begin{pmatrix} \mathrm{Ra} & \mathrm{kN} \\ \mathrm{Rb} & 2.0\,\mathrm{kN} \\ \mathrm{Rc} & 3.6\,\mathrm{kN} \\ \mathrm{Rd} & 3.6\,\mathrm{kN} \\ \mathrm{Re} & -2.0\,\mathrm{kN} \\ \mathrm{Rf} & \mathrm{kN} \end{pmatrix}$$

```
addvar(y);
```

```
clear ra_vpa;
```

shear and moment diagram

```
beam.shear_moment(m, v, [0 b.L], {'kN' 'm'});
```




```
setassum(old_assum, 'clear');
clear old_assum;
```