Prob. 6.5

Define ROM relation for modulus:

```
> E1:=(Ef,Em,Vf) -> Vf*Ef+(1-Vf)*Em;
```

$$E1 := (Ef, Em, Vf) \rightarrow Vf\,Ef + (1 - Vf)\,Em$$

50% E-glass in epoxy:

```
> 'E[1](GPa)'=E1(76,2.4,.5);
```

$$E_1(GPa) = 39.20$$

60% HM carbon in epoxy:

```
> 'E[1](GPa)'=E1(340,2.4,.6);
```

$$E_1(GPa) = 204.96$$

60% Kevlar in epoxy:

```
> 'E[1](GPa)'=E1(124,2.4,.6);
>
```

$$E_1(GPa) = 75.36$$

Specific modulus (E/density):

ROM density relation:

```
> rho1:=(rho_f,rho_m,Vf) -> Vf*rho_f+(1-Vf)*rho_m;
```

$$\rho 1 := (rho\_f, rho\_m, Vf) \rightarrow Vf\,rho\_f + (1 - Vf)\,rho\_m$$

Glass/epoxy:

```
> 'rho[1]'=rho1(2540,1300,.5);
```

$$\rho_1 = 1920.$$

```
> Digits:=3:'(E/rho) (MPa-m^3/kg)'=39.2e3/1920;
```

$$\left(\frac{E}{\rho}\right)\left(MPa - \frac{m^3}{kg}\right) = 20.4$$

Carbon/epoxy:

```
> 'rho[1]'=rho1(1860,1300,.6);
```

$$\rho_1 = 1640.$$

```
> '(E/rho) (MPa-m^3/kg)'=205e3/1640;
```

$$\left(\frac{E}{\rho}\right)\left(MPa - \frac{m^3}{kg}\right) = 125.$$

Kevlar/epoxy:

```
> 'rho[1]'=rho1(1450,1300,.6);
```

$$\rho_1 = 1390.$$

```
> '(E/rho) (MPa-m^3/kg)'=75.4e3/1390;
```

$$\left(\frac{E}{\rho}\right)\left(MPa - \frac{m^3}{kg}\right) = 54.2$$