

-----1

-1

$$\text{solve}(24 \cdot ra - (24 - a) + 12 \cdot rb = 0, ra)$$

$$ra = \frac{-(a + 12 \cdot (rb - 2))}{24}$$

-----2

-2

$$ra \cdot x \rightarrow m1$$

$$ra \cdot x$$

$$ra \cdot (x + a) - x \rightarrow m2$$

$$(ra - 1) \cdot x + a \cdot ra$$

$$ra \cdot (x + 12) - (x + 12 - a) + rb \cdot x \rightarrow m3$$

$$(ra + rb - 1) \cdot x + a + 12 \cdot ra - 12$$

$$\int_0^a \frac{m1^2}{2 \cdot ei} dx + \int_0^{12-a} \frac{m2^2}{2 \cdot ei} dx + \int_0^{12} \frac{m3^2}{2 \cdot ei} dx \Big|_{ra = \frac{-(a + 12 \cdot (rb - 2))}{24}} \rightarrow u$$

$$\frac{a^4 + 12 \cdot a^3 \cdot (rb - 4) + 576 \cdot a^2 - 5184 \cdot a \cdot rb + 20736 \cdot rb^2}{144 \cdot ei}$$

-----3

-3

$$\triangle \text{ solve}\left(\frac{d}{drb}(u) = 0, rb\right)$$

$$rb = \frac{-a \cdot (a^2 - 432)}{3456}$$

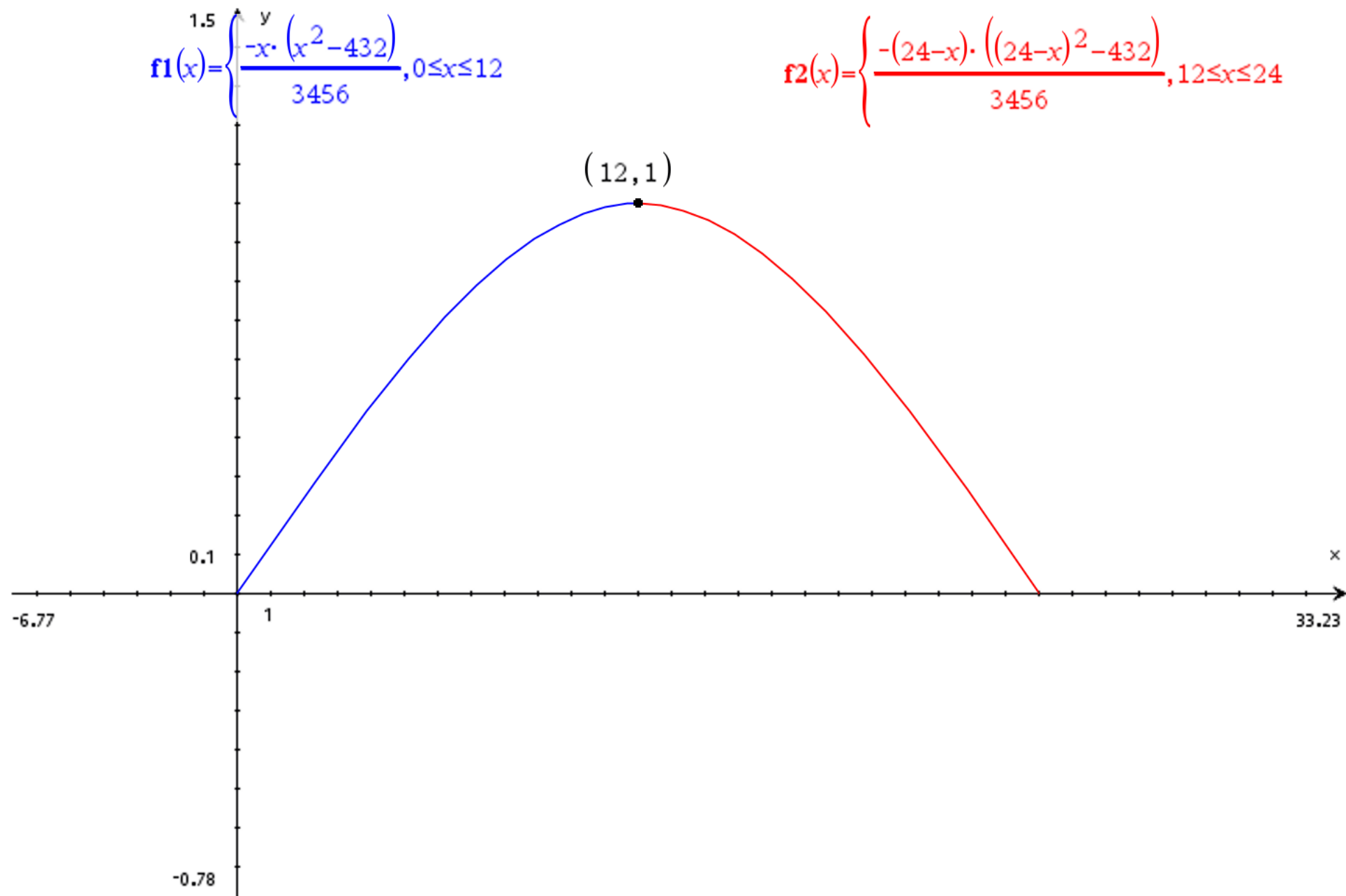
$$rb = \frac{-(24-a) \cdot ((24-a)^2 - 432)}{3456}$$

[]

$$rb = \frac{(a-24) \cdot (a^2 - 48 \cdot a + 144)}{3456}$$

$$f1(x) = \begin{cases} \frac{-x \cdot (x^2 - 432)}{3456}, & 0 \leq x \leq 12 \end{cases}$$

$$f2(x) = \begin{cases} \frac{-(24-x) \cdot ((24-x)^2 - 432)}{3456}, & 12 \leq x \leq 24 \end{cases}$$



-----1.1

1.1

$$\frac{-x_1 \cdot (30-x_1)^2}{30^2} \rightarrow fem1$$

$$\frac{-x_1 \cdot (x_1-30)^2}{900}$$

$$\frac{x_1^2 \cdot (30-x_1)}{30^2} \rightarrow fem2$$

$$\frac{-x_1^2 \cdot (x_1-30)}{900}$$

$$\frac{-x_2 \cdot (40-x_2)^2}{40^2} \rightarrow fem3$$

$$\frac{-x_2 \cdot (x_2-40)^2}{1600}$$

$$\frac{x_2^2 \cdot (40-x_2)}{40^2} \rightarrow fem4$$

$$\frac{-x_2^2 \cdot (x_2-40)}{1600}$$

$$\frac{-x_3 \cdot (30-x_3)^2}{30^2} \rightarrow fem5$$

$$\frac{-x_3 \cdot (x_3-30)^2}{900}$$

$$\frac{x_3^2 \cdot (30-x_3)}{30^2} \rightarrow fem6$$

$$\frac{-x_3^2 \cdot (x_3-30)}{900}$$

$$[fem1 \ fem2 \ fem3 \ fem4 \ fem5 \ fem6]^T \rightarrow fem$$

$$\begin{bmatrix} \frac{-x1 \cdot (x1-30)^2}{900} \\ \frac{-x1^2 \cdot (x1-30)}{900} \\ \frac{-x2 \cdot (x2-40)^2}{1600} \\ \frac{-x2^2 \cdot (x2-40)}{1600} \\ \frac{-x3 \cdot (x3-30)^2}{900} \\ \frac{-x3^2 \cdot (x3-30)}{900} \end{bmatrix}$$

$$[-fem1 \ -fem2-fem3 \ -fem4-fem5 \ -fem6]^T \rightarrow p$$

$$\begin{bmatrix} \frac{x1 \cdot (x1-30)^2}{900} \\ \frac{x1^3}{900} - \frac{x1^2}{30} + \frac{x2 \cdot (x2-40)^2}{1600} \\ \frac{x2^3}{1600} - \frac{x2^2}{40} + \frac{x3 \cdot (x3-30)^2}{900} \\ \frac{x3^2 \cdot (x3-30)}{900} \end{bmatrix}$$

-----2

2

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix} \rightarrow a$$

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

-----3

3

$$\begin{bmatrix} \frac{4 \cdot ei}{30} & \frac{2 \cdot ei}{30} & 0 & 0 & 0 & 0 \\ \frac{2 \cdot ei}{30} & \frac{4 \cdot ei}{30} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{4 \cdot ei}{40} & \frac{2 \cdot ei}{40} & 0 & 0 \\ 0 & 0 & \frac{2 \cdot ei}{40} & \frac{4 \cdot ei}{40} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{4 \cdot ei}{30} & \frac{2 \cdot ei}{30} \\ 0 & 0 & 0 & 0 & \frac{2 \cdot ei}{30} & \frac{4 \cdot ei}{30} \end{bmatrix} \rightarrow s$$

$$\begin{bmatrix} \frac{2 \cdot ei}{15} & \frac{ei}{15} & 0 & 0 & 0 & 0 \\ \frac{ei}{15} & \frac{2 \cdot ei}{15} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{ei}{10} & \frac{ei}{20} & 0 & 0 \\ 0 & 0 & \frac{ei}{20} & \frac{ei}{10} & 0 & 0 \\ 0 & 0 & 0 & 0 & \frac{2 \cdot ei}{15} & \frac{ei}{15} \\ 0 & 0 & 0 & 0 & \frac{ei}{15} & \frac{2 \cdot ei}{15} \end{bmatrix}$$

$$s \cdot a^T \cdot (a \cdot s \cdot a^T)^{-1} \cdot p + fem \rightarrow q$$



$$\begin{bmatrix} 0 \\ \frac{-7 \cdot x1^3}{27000} + \frac{7 \cdot x1}{30} + \frac{27 \cdot x2^3 - 2520 \cdot x2^2 + 57600 \cdot x2 - 8 \cdot x3 \cdot (x3-60) \cdot (x3-30)}{108000} \\ \frac{7 \cdot x1^3}{27000} - \frac{7 \cdot x1}{30} - \frac{x2^3}{4000} + \frac{7 \cdot x2^2}{300} - \frac{8 \cdot x2}{15} + \frac{x3 \cdot (x3-60) \cdot (x3-30)}{13500} \\ \frac{x1^3}{13500} - \frac{x1}{15} - \frac{x2^3}{4000} + \frac{x2^2}{150} + \frac{2 \cdot x2}{15} + \frac{7 \cdot x3 \cdot (x3-60) \cdot (x3-30)}{27000} \\ \frac{-x1^3}{13500} + \frac{x1}{15} + \frac{x2^3}{4000} - \frac{x2^2}{150} - \frac{2 \cdot x2}{15} - \frac{7 \cdot x3 \cdot (x3-60) \cdot (x3-30)}{27000} \\ 0 \end{bmatrix}$$

-----5.1

5.1

$$q[3,1]|x1=x \text{ and } x2=0 \text{ and } x3=0 \rightarrow mb1$$

$$\frac{7 \cdot x^3}{27000} - \frac{7 \cdot x}{30}$$

$$\text{solve}\left(\frac{d}{dx}(mb1)=0, x\right)$$

$$x=-17.3205 \text{ or } x=17.3205$$

$$mb1|x=17.3205$$

$$-2.6943$$

-----5.2

5.2



$$q[3,1]|_{x1=0 \text{ and } x2=x \text{ and } x3=0} \rightarrow mb2$$

$$\frac{-x^3}{4000} + \frac{7 \cdot x^2}{300} - \frac{8 \cdot x}{15}$$

$$\text{solve}\left(\frac{d}{dx}(mb2)=0, x\right)$$

$$x=15.0864 \text{ or } x=47.1358$$

$$mb2|x=15.0864$$

$$-3.59384$$

$$-----5.3$$

$$5.3$$

$$q[3,1]|_{x1=0 \text{ and } x2=0 \text{ and } x3=x} \rightarrow mb3$$

$$\frac{x \cdot (x-60) \cdot (x-30)}{13500}$$

$$\text{solve}\left(\frac{d}{dx}(mb3)=0, x\right)$$

$$x=12.6795 \text{ or } x=47.3205$$

$$mb3|x=12.6795$$

$$0.7698$$

$$-----6.1$$

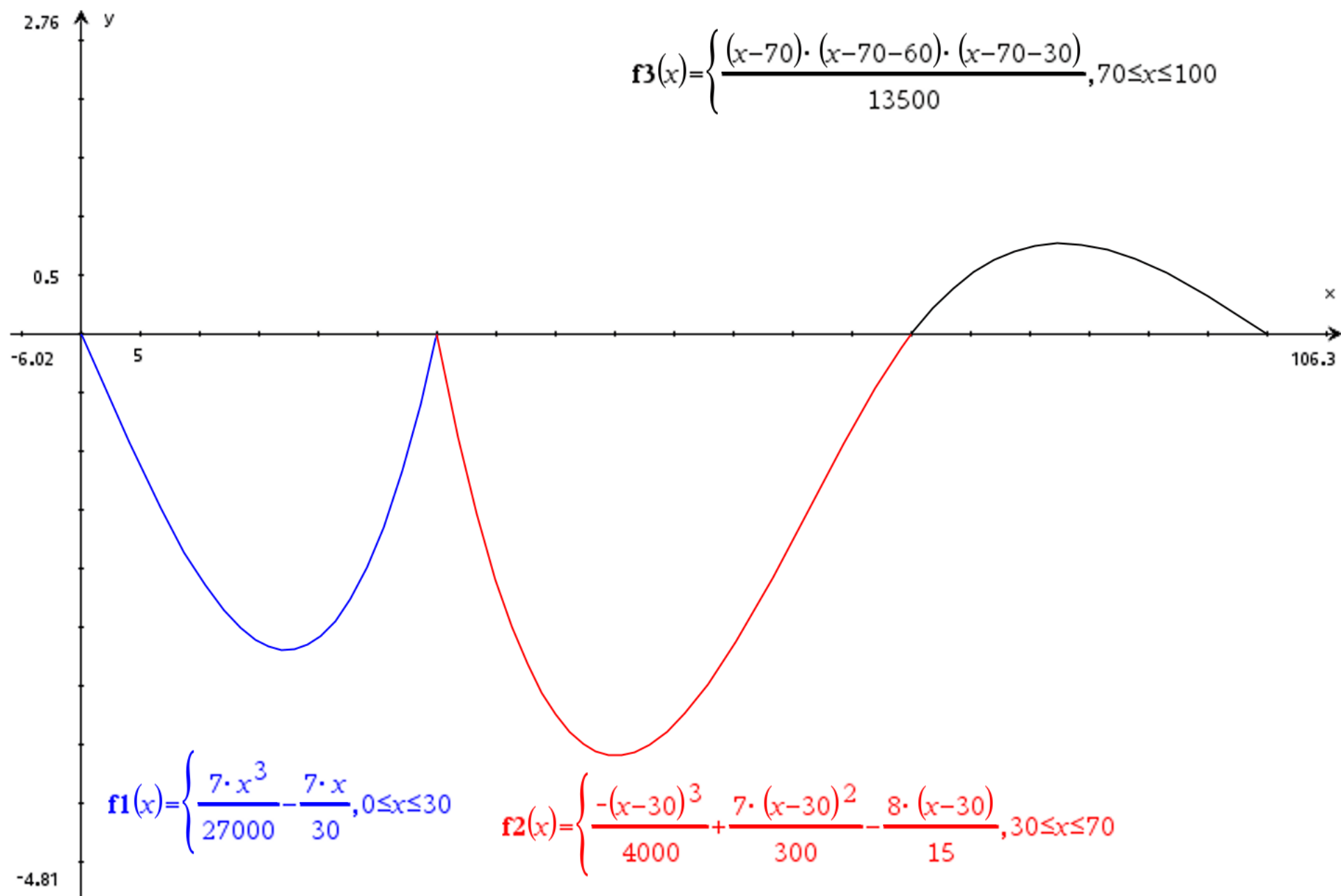
$$6.1$$

$$108 \cdot 0.77 + \int_0^{30} (mb3 \cdot 12.7) dx$$

$$273.66$$

$$108 \cdot -3.59 + \int_0^{30} (mb1 \cdot 12.7) dx + \int_0^{40} (mb2 \cdot 12.7) dx \quad -2183.36$$

□



-----1

-1

$$\text{solve}\left(\begin{cases} ra \cdot 80 + rb \cdot 40 - (80 - s) = 0 \\ ra + rb + rc - 1 = 0 \end{cases}, \{ra, rc\}\right)$$

$$ra = \frac{-(s + 40 \cdot (rb - 2))}{80} \text{ and } rc = \frac{s - 40 \cdot rb}{80}$$

-----2

-2

$$ra \cdot x | ra = \frac{-(s + 40 \cdot (rb - 2))}{80} \text{ and } rc = \frac{s - 40 \cdot rb}{80} \rightarrow m1$$

$$\frac{-(s + 40 \cdot (rb - 2)) \cdot x}{80}$$

$$ra \cdot (x + s) - x | ra = \frac{-(s + 40 \cdot (rb - 2))}{80} \text{ and } rc = \frac{s - 40 \cdot rb}{80} \rightarrow m2$$

$$\frac{-s^2}{80} - \frac{s \cdot (x + 40 \cdot (rb - 2))}{80} - \frac{rb \cdot x}{2}$$

$$rc \cdot x | ra = \frac{-(s + 40 \cdot (rb - 2))}{80} \text{ and } rc = \frac{s - 40 \cdot rb}{80} \rightarrow m3$$

$$\frac{(s - 40 \cdot rb) \cdot x}{80}$$

$$\int_0^s \frac{m1^2}{2 \cdot ei} dx + \int_0^{40-s} \frac{m2^2}{2 \cdot ei} dx + \int_0^{40} \frac{m3^2}{2 \cdot ei} dx \rightarrow u$$

$$\frac{s^4 + 40 \cdot (rb - 4) \cdot s^3 + 6400 \cdot s^2 - 192000 \cdot rb \cdot s + 2560000 \cdot rb^2}{480 \cdot ei}$$

-----3

-3

$$\triangle \text{ solve } \left( \frac{d}{drb}(u) = 0, rb \right)$$

$$rb = \frac{-s \cdot (s^2 - 4800)}{128000}$$

$$rc \cdot 40 | rc = \frac{s - 40 \cdot rb}{80} \text{ and } rb = \frac{-s \cdot (s^2 - 4800)}{128000}$$

$$\frac{s \cdot (s^2 - 1600)}{6400}$$

$$\frac{s \cdot (s^2 - 1600)}{6400} | s = \{10, 20, 30\}$$

$$\{-2.34375, -3.75, -3.28125\}$$

$$\frac{s \cdot (s^2 - 1600)}{6400} | s = 80 - x$$

$$\frac{-(x - 80) \cdot (x^2 - 160 \cdot x + 4800)}{6400}$$

$$\frac{-(x - 80) \cdot (x^2 - 160 \cdot x + 4800)}{6400} | x = \{50, 60, 70\}$$

$$\{-3.28125, -3.75, -2.34375\}$$

□

