

Respuestas a problemas seleccionados

Capítulo 2

2.6 $\vec{F} = 38.3\mathbf{i} + 86.6\mathbf{j} + 32.14\mathbf{k}$ [N].

2.7 $\vec{F} = 40\mathbf{i} + 120\mathbf{j} + 30\mathbf{k}$ [N].

2.8 $\vec{F} = 60\mathbf{i} + 120\mathbf{j} + 40\mathbf{k}$ [N].

2.9 $T_{BA} = 73.71$ lb; $T_{BC} = 65.2$ lb.

2.11 $\vec{T}_{CB} = 120$ N ↗; $\vec{F}_{CA} = 62.1$ N ↘.

2.12 $\vec{T}_{CB} = 161.6$ N ↗; $\vec{F}_{CA} = 63.8$ N ↘.

2.13 $\vec{T}_{CB} = 390.4$ N ↗; $\vec{F}_{CA} = 302$ N ↘.

2.14 (a) $\vec{F}_{BA} = 57.73$ N →; $\vec{F}_{BC} = 115.47$ N ↗. (b) $\vec{F}_{BA} = 57.73$ N ←; $\vec{F}_{BC} = 115.47$ N ↘.

2.15 (a) $\vec{F}_{BA} = 53.18$ N ↘; $\vec{F}_{BC} = 134.67$ N ↗. (b) $\vec{F}_{BA} = 53.18$ N ↗; $\vec{F}_{BC} = 134.67$ N ↘.

2.16 (a) $\vec{F}_{BA} = 50$ N ↗; $\vec{F}_{BC} = 86.6$ N ↗. (b) $\vec{F}_{BA} = 50$ N ↙; $\vec{F}_{BC} = 86.6$ N ↘.

2.18 $\vec{R}_C = 45.9$ lb ↗; $\vec{R}_D = 45.9$ lb ↗; $\vec{R}_E = 131$ lb ↗.

2.19 $T_{AB} = 87.5$ N; $T_{AC} = 74.45$ N; $T_{AD} = 58$ N.

2.20 $T_{AC} = 89.34$ N; $T_{AD} = 69.63$ N; $W = 210$ N.

2.21 $T_{AB} = 70.52$ N; $T_{AD} = 46.76$ N; $W = 141$ N.

2.22 $T_{AB} = 84.45$ N; $T_{AC} = 71.85$ N; $W = 168.9$ N.

2.23 $T_{AB} = 116.67$ lb; $T_{AC} = 114.53$ lb; $T_{AD} = 183.25$ lb.

- 2.24 $T_{AC} = 61.85 \text{ lb}$; $T_{AD} = 98.96 \text{ lb}$; $W = 216 \text{ lb}$.
- 2.25 $T_{AB} = 104.92 \text{ lb}$; $T_{AD} = 164.8 \text{ lb}$; $W = 359.72 \text{ lb}$.
- 2.26 $T_{AB} = 84 \text{ lb}$; $T_{AC} = 82.5 \text{ lb}$; $W = 288.13 \text{ lb}$.
- 2.27 $T_{AC} = 52.8 \text{ lb}$; $T_{AD} = 67.2 \text{ lb}$; $F_V = 144 \text{ lb}$.
- 2.28 $T_{AB} = 90 \text{ lb}$; $T_{AD} = 84 \text{ lb}$; $F_V = 180 \text{ lb}$.
- 2.29 $T_{AB} = 102 \text{ lb}$; $T_{AC} = 74.8 \text{ lb}$; $F_V = 204 \text{ lb}$.
- 2.30 $T_{AB} = 126 \text{ lb}$; $T_{AC} = 92.4 \text{ lb}$; $T_{AD} = 117.6 \text{ lb}$.
- 2.31 $T_{AC} = 60 \text{ N}$; $T_{AD} = 103.93 \text{ N}$; $R_T = 227.15 \text{ N}$.
- 2.32 $T_{AC} = 103.93 \text{ N}$; $T_{AD} = 60 \text{ N}$; $R_T = 227.15 \text{ N}$.
- 2.33 $T_{AC} = 120 \text{ N}$; $T_{AD} = 120 \text{ N}$; $R_T = 288 \text{ N}$.
- 2.34 $T_{AC} = 128.33 \text{ lb}$; $T_{AD} = 151.31 \text{ lb}$; $R_V = 346.11 \text{ lb}$.
- 2.35 $T_{AB} = 104 \text{ lb}$; $T_{AC} = 111.23 \text{ lb}$; $T_{AD} = 131.15 \text{ lb}$.
- 2.36 $T_{AB} = 130.92 \text{ lb}$; $T_{AD} = 165.07 \text{ lb}$; $R_V = 377.58 \text{ lb}$.
- 2.37 $T_{AB} = 126.9 \text{ lb}$; $T_{AC} = 135.7 \text{ lb}$; $R_V = 366 \text{ lb}$.
- 2.38 $T_{AC} = 78.76 \text{ N}$; $T_{AD} = 93.13 \text{ N}$; $R_V = 163.95 \text{ N}$.
- 2.39 $T_{AB} = 51.43 \text{ N}$; $T_{AD} = 106.43 \text{ N}$; $R_V = 187.36 \text{ N}$.
- 2.40 $T_{AB} = 58 \text{ N}$; $T_{AC} = 101.48 \text{ N}$; $R_V = 211.25 \text{ N}$.
- 2.41 $T_{AB} = 63.13 \text{ N}$; $T_{AC} = 110.49 \text{ N}$; $T_{AD} = 130.62 \text{ N}$.

Capítulo 3

- 3.2 $\vec{M}_C = 1280\mathbf{j} + 880\mathbf{k} \text{ [Nm]}$.
- 3.3 $\vec{M}_O = 36\mathbf{i} + 112\mathbf{j} + 232\mathbf{k} \text{ [Nm]}$
- 3.4 $\vec{M}_O = 870\mathbf{i} - 480\mathbf{j} + 2400\mathbf{k} \text{ [Nm]}$; $M_{OB} = 114.78 \text{ Nm}$.
- 3.5 $\vec{M}_P = -420\mathbf{i} - 480\mathbf{j} \text{ [Nm]}$.
- 3.6 $\vec{M}_P = -360\mathbf{i} + 20\mathbf{j} + 450\mathbf{k} \text{ [Nm]}$.
- 3.9 (a) $\vec{F} = -80\mathbf{i} + 110\mathbf{j} + 160\mathbf{k} \text{ [N]}$; $\vec{M}_A = 1580\mathbf{i} - 160\mathbf{j} + 1450\mathbf{k} \text{ [Nm]}$.
(b) $\vec{F} = -80\mathbf{i} + 110\mathbf{j} + 160\mathbf{k} \text{ [N]}$; $\vec{M}_B = -180\mathbf{i} + 320\mathbf{j} + 240\mathbf{k} \text{ [Nm]}$.

- 3.10 (a) $\vec{F} = -80\mathbf{i} + 110\mathbf{j} - 160\mathbf{k}$ [N]; $\vec{M}_A = 180\mathbf{i} + 960\mathbf{j} + 1450\mathbf{k}$ [Nm].
 (b) $\vec{F} = -80\mathbf{i} + 110\mathbf{j} - 160\mathbf{k}$ [N]; $\vec{M}_B = -1580\mathbf{i} - 2080\mathbf{j} + 240\mathbf{k}$ [Nm].
- 3.12 (a) $\vec{R} = 140\mathbf{i} + 80\mathbf{j} + 20\mathbf{k}$ [lb]; $\vec{M}_A = -180.52\mathbf{i} + 470\mathbf{j} + 4.16\mathbf{k}$ [lbp].
 (b) $\vec{R} = 140\mathbf{i} + 80\mathbf{j} + 20\mathbf{k}$ [lb]; $\vec{M}_B = -1060.45\mathbf{i} + 2370\mathbf{j} - 1435.81\mathbf{k}$ [lbp].
- 3.13 (a) $\vec{R} = -26.58\mathbf{i} + 195.89\mathbf{j} - 36.95\mathbf{k}$ [lb]; $\vec{M}_A = 1123.72\mathbf{i} + 397.37\mathbf{j}$.
 + 1298.39 \mathbf{k} [lbp].
 (b) $\vec{R} = -26.58\mathbf{i} + 195.89\mathbf{j} - 36.95\mathbf{k}$ [lb]; $\vec{M}_B = -2010.52\mathbf{i}$.
 - 582.12 \mathbf{j} - 1639.96 \mathbf{k} [lbp].
- 3.15 $\vec{R} = -100\mathbf{i} - 167\mathbf{j}$ [N]; $\vec{M}_R = -501\mathbf{k}$ [Nm]; $x = 3$ m.
- 3.16 $\vec{R} = -100\mathbf{i} - 167\mathbf{j}$ [N]; $\vec{M}_R = -501\mathbf{k}$ [Nm]; $x = 3$ m.
- 3.17 $\vec{R} = 100\mathbf{i} - 167\mathbf{j}$ [N]; $\vec{M}_R = -1002\mathbf{k}$ [Nm]; $x = 6$ m.
- 3.18 $\vec{R} = -100\mathbf{i} + 133\mathbf{j}$ [N]; $\vec{M}_R = -532\mathbf{k}$ [Nm]; $x = -4$ m.
- 3.19 $\vec{F} = 250\mathbf{i} - 150\mathbf{j}$ [N]; $x = 7$ m.
- 3.20 $\vec{F} = 250\mathbf{i} - 150\mathbf{j}$ [N]; $x = 6$ m.
- 3.21 $W = 150$ lb; $x = 7.73$ p; $z = 6.53$ p.
- 3.22 $x = 7$ p; $z = 4.85$ p.

Capítulo 4

- 4.1 $\vec{A}_x = 360$ N \leftarrow ; $\vec{A}_y = 580$ N \uparrow ; $\vec{M}_A = 2120$ Nm \curvearrowright .
- 4.2 $\vec{A}_x = 300$ N \leftarrow ; $\vec{A}_y = 250$ N \downarrow ; $\vec{M}_A = 1000$ Nm \curvearrowright .
- 4.3 $\vec{A}_x = 360$ N \rightarrow ; $\vec{A}_y = 132$ N \uparrow ; $\vec{D} = 348$ N \uparrow .
- 4.4 $\vec{A}_x = 300$ N \rightarrow ; $\vec{A}_y = 100$ N \uparrow ; $\vec{C} = 450$ N \uparrow .
- 4.5 $\vec{A}_x = 184.6$ N \leftarrow ; $\vec{A}_y = 200$ N \uparrow ; $\vec{D} = 230.9$ N \nwarrow .
- 4.6 $\vec{A}_x = 130.7$ N \rightarrow ; $\vec{A}_y = 270$ N \downarrow ; $\vec{C} = 981.5$ N \nwarrow .
- 4.7 $\vec{A}_x = 120$ N \rightarrow ; $\vec{A}_y = 40$ N \uparrow ; $\vec{T} = 144.22$ N \nwarrow .
- 4.8 $\vec{A}_x = 75$ N \rightarrow ; $\vec{A}_y = 40$ N \uparrow ; $\vec{B}_x = 75$ N \leftarrow ; $\vec{B}_y = 60$ N \uparrow .

- 4.9 $\vec{A}_x = 30 \text{ N} \leftarrow; \vec{A}_y = 147.5 \text{ N} \uparrow; \vec{E} = 222.5 \text{ N} \uparrow.$
- 4.10 $\vec{A}_x = 50 \text{ N} \rightarrow; \vec{A}_y = 216.25 \text{ N} \uparrow; \vec{E} = 153.75 \text{ N} \uparrow.$
- 4.11 $\vec{A}_x = 937.5 \text{ N} \leftarrow; \vec{A}_y = 450 \text{ N} \uparrow; \vec{B} = 937.5 \text{ N} \rightarrow.$
- 4.12 $\vec{A}_x = 600 \text{ N} \leftarrow; \vec{A}_y = 450 \text{ N} \uparrow; \vec{B} = 600 \text{ N} \rightarrow.$
- 4.13 $\vec{A} = 300 \text{ N} \uparrow; \vec{A}_x = 0; \vec{A}_y = 250 \text{ N} \uparrow.$
- 4.14 $\vec{A} = 300 \text{ N} \uparrow; \vec{F}_x = 60 \leftarrow; \vec{F}_y = 250 \text{ N} \uparrow.$
- 4.15 $\vec{P} = 347.7 \text{ lb} \downarrow; \vec{A}_x = 115.9 \text{ lb} \rightarrow; \vec{A}_y = 316.6 \text{ lb} \uparrow.$
- 4.16 (a) $\vec{A}_x = 25.1 \text{ lb} \rightarrow; \vec{A}_y = 100.9 \text{ lb} \downarrow; \vec{D} = 57.7 \text{ lb} \searrow.$ (b) $\vec{A}_x = 56.3 \text{ lb} \rightarrow;$
 $\vec{A}_y = 68.1 \text{ lb} \downarrow; \vec{D} = 21.5 \text{ lb} \searrow.$ (c) $\vec{P} = 95.8 \text{ lb} \downarrow; \vec{A}_x = 75 \text{ lb} \rightarrow; \vec{A}_y = 34 \text{ lb} \downarrow.$

Capítulo 5

- 5.1 $\vec{A}_x = 200 \text{ N} \leftarrow; \vec{A}_y = 150 \text{ N} \uparrow; \vec{B} = 200 \text{ N} \rightarrow; F_{AB} = 150 \text{ N (T)};$
 $F_{AC} = 200 \text{ N (T)}; F_{BC} = 250 \text{ N (C)}.$
- 5.2 $\vec{A}_x = 0; \vec{A}_y = 100 \text{ N} \uparrow; \vec{B} = 100 \text{ N} \uparrow; F_{AD} = F_{BD} = 160 \text{ N (C)};$
 $F_{AC} = F_{BC} = 125 \text{ N (T)}; F_{CD} = 200 \text{ N (T)}.$
- 5.3 $\vec{A}_x = 80 \text{ N} \leftarrow; \vec{A}_y = 200 \text{ N} \uparrow; \vec{B} = 80 \text{ N} \rightarrow; F_{AD} = 128 \text{ N (T)}; F_{AC} = 100 \text{ N (T)};$
 $F_{BC} = 100 \text{ N (T)}; F_{CD} = 0; F_{BD} = 128 \text{ N (C)}.$
- 5.4 $\vec{A}_x = 0; \vec{A}_y = 150 \text{ N} \uparrow; \vec{E} = 250 \text{ N} \uparrow; F_{BD} = 187.5 \text{ N (C)}; F_{BC} = 125 \text{ N (T)};$
 $F_{AC} = 112.5 \text{ N (T)}.$
- 5.5 $\vec{A}_x = 0; \vec{A}_y = 200 \text{ N} \uparrow; \vec{E} = 250 \text{ N} \uparrow; F_{BD} = 187.5 \text{ N (C)}; F_{BC} = 62.5 \text{ N (T)};$
 $F_{AC} = 150 \text{ N (T)}.$
- 5.6 $F_{BC} = 25 \text{ N (T)}; F_{CD} = 25 \text{ N (C)}; F_{DE} = 25 \text{ N (C)}; F_{EF} = 25 \text{ N (T)}.$
- 5.7 $F_{BC} = 50 \text{ N (T)}; F_{CD} = 50 \text{ N (C)}; F_{DE} = 0; F_{EF} = 75 \text{ N (T)}.$
- 5.8 $\vec{A}_y = 300 \text{ N} \uparrow; \vec{F}_x = 0; \vec{F}_y = 250 \text{ N} \uparrow; F_{BD} = 200 \text{ N (C)}; F_{CD} = 60 \text{ N (T)};$
 $F_{CE} = 166.67 \text{ N (T)}.$

5.9 $\vec{A}_y = 300 \text{ N} \uparrow$; $\vec{F}_x = 60 \text{ N} \leftarrow$; $\vec{F}_y = 250 \text{ N} \uparrow$; $F_{BD} = 260 \text{ N (C)}$; $F_{CD} = 60 \text{ N (T)}$;
 $F_{CE} = 166.67 \text{ N (T)}$.

5.10 $\vec{A}_y = 325 \text{ N} \uparrow$; $\vec{F}_x = 50 \text{ N} \leftarrow$; $\vec{F}_y = 225 \text{ N} \uparrow$; $F_{BD} = 216.67 \text{ N (C)}$; $F_{CD} = 30 \text{ N (T)}$;
 $F_{CE} = 150 \text{ N (T)}$.

5.11 $\vec{A}_y = 325 \text{ N} \uparrow$; $\vec{F}_x = 110 \text{ N} \leftarrow$; $\vec{F}_y = 225 \text{ N} \uparrow$; $F_{BD} = 276.67 \text{ N (C)}$; $F_{CD} = 30 \text{ N (T)}$;
 $F_{CE} = 150 \text{ N (T)}$.

5.12 $\vec{A}_x = 0$; $\vec{A}_y = 225 \text{ N} \uparrow$; $\vec{G} = 275 \text{ N} \uparrow$; $F_{DE} = 412.5 \text{ N (C)}$; $F_{DK} = 31.25 \text{ N (C)}$;
 $F_{JK} = 431.25 \text{ N (T)}$.

5.13 $\vec{A}_x = 0$; $\vec{A}_y = 400 \text{ N} \uparrow$; $\vec{G} = 300 \text{ N} \uparrow$; $F_{CD} = 375 \text{ N (C)}$; $F_{ID} = 125 \text{ N (C)}$;
 $F_{IJ} = 450 \text{ N (T)}$.

5.14 $\vec{A}_x = 1275 \text{ N} \rightarrow$; $\vec{B}_x = 1275 \text{ N} \leftarrow$; $\vec{B}_y = 450 \text{ N} \uparrow$; $F_{FH} = 262.5 \text{ N (T)}$;
 $F_{FG} = 562.5 \text{ N (T)}$; $F_{EG} = 600 \text{ N (C)}$.

5.15 $\vec{A}_x = 937.5 \text{ N} \rightarrow$; $\vec{B}_x = 937.5 \text{ N} \leftarrow$; $\vec{B}_y = 450 \text{ N} \uparrow$; $F_{DF} = 600 \text{ N (T)}$;
 $F_{EF} = 562.5 \text{ N (C)}$; $F_{EG} = 262.5 \text{ N (C)}$.

5.16 $\vec{A}_x = 60 \leftarrow$; $\vec{A}_y = 170 \text{ N} \uparrow$; $\vec{E} = 220 \text{ N} \uparrow$; $F_{BC} = 269 \text{ N (C)}$; $F_{FC} = 157 \text{ N (T)}$;
 $F_{FG} = 160 \text{ N (T)}$.

5.17 $\vec{A}_x = 60 \leftarrow$; $\vec{A}_y = 180 \text{ N} \uparrow$; $\vec{E} = 240 \text{ N} \uparrow$; $F_{CD} = 300 \text{ N (C)}$; $F_{CH} = 128 \text{ N (T)}$;
 $F_{GH} = 135 \text{ N (T)}$.

5.18 $\vec{A}_x = 50 \text{ N} \leftarrow$; $\vec{A}_y = 220 \text{ N} \uparrow$; $\vec{E} = 260 \text{ N} \uparrow$; $F_{BC} = 219 \text{ N (C)}$; $F_{BG} = 120 \text{ N (C)}$;
 $F_{FG} = 270 \text{ N (T)}$; $F_{CG} = 160 \text{ N (T)}$.

5.19 $\vec{A}_x = 80 \text{ N} \leftarrow$; $\vec{A}_y = 200 \text{ N} \uparrow$; $\vec{E} = 280 \text{ N} \uparrow$; $F_{CD} = 256 \text{ N (C)}$; $F_{GD} = 94 \text{ N (C)}$;
 $F_{GH} = 210 \text{ N (T)}$; $F_{CG} = 177 \text{ N (T)}$.

5.20 $\vec{A}_x = 50 \text{ N} \leftarrow$; $\vec{A}_y = 140 \text{ N} \uparrow$; $\vec{E} = 180 \text{ N} \uparrow$; $F_{BC} = 184 \text{ N (C)}$; $F_{FC} = 95 \text{ N (T)}$;
 $F_{FG} = 130 \text{ N (T)}$.

5.21 $\vec{A}_x = 60 \text{ N} \leftarrow$; $\vec{A}_y = 170 \text{ N} \uparrow$; $\vec{E} = 220 \text{ N} \uparrow$; $F_{CD} = 269 \text{ N (C)}$; $F_{CG} = 95 \text{ N (T)}$;
 $F_{FG} = 160 \text{ N (T)}$.

5.22 $\vec{A}_x = 120 \text{ N} \leftarrow$; $\vec{A}_y = 300 \text{ N} \uparrow$; $\vec{J} = 400 \text{ N} \uparrow$; $F_{CD} = 416 \text{ N (C)}$; $F_{FD} = 285 \text{ N (T)}$;
 $F_{FG} = 227 \text{ N (T)}$.

- 5.23 $\vec{A}_x = 120 \text{ N} \leftarrow; \vec{A}_y = 310 \text{ N} \uparrow; \vec{J} = 390 \text{ N} \uparrow; F_{HI} = 552 \text{ N (C)}; F_{HK} = 112 \text{ N (T)}; F_{LK} = 340 \text{ N (T)}.$
- 5.24 $\vec{A}_x = 90 \text{ N} \leftarrow; \vec{A}_y = 312.5 \text{ N} \uparrow; \vec{J} = 387.5 \text{ N} \uparrow; F_{BC} = 448 \text{ N (C)}; F_{EC} = 148 \text{ N (T)}; F_{EF} = 285 \text{ N (T)}.$
- 5.25 $\vec{A}_x = 120 \text{ N} \leftarrow; \vec{A}_y = 390 \text{ N} \uparrow; \vec{J} = 470 \text{ N} \uparrow; F_{BC} = 474 \text{ N (C)}; F_{FC} = 95 \text{ N (T)}; F_{FG} = 415 \text{ N (T)}.$
- 5.26 $\vec{A}_x = 120 \text{ N} \leftarrow; \vec{A}_y = 380 \text{ N} \uparrow; \vec{J} = 480 \text{ N} \uparrow; F_{HI} = 519 \text{ N (C)}; F_{LI} = 96 \text{ N (C)}; F_{LK} = 384 \text{ N (T)}.$
- 5.27 $\vec{A}_x = 90 \text{ N} \leftarrow; \vec{A}_y = 392.5 \text{ N} \uparrow; \vec{J} = 467.5 \text{ N} \uparrow; F_{CD} = 346 \text{ N (C)}; F_{CG} = 224 \text{ N (C)}; F_{FG} = 329 \text{ N (T)}.$
- 5.28 $\vec{A}_x = 120 \text{ N} \leftarrow; \vec{A}_y = 318 \text{ N} \uparrow; \vec{J} = 382 \text{ N} \uparrow; F_{CD} = 439 \text{ N (C)}; F_{FD} = 213 \text{ N (T)}; F_{FL} = 331 \text{ N (T)}.$
- 5.29 $\vec{A}_x = 120 \text{ N} \leftarrow; \vec{A}_y = 310 \text{ N} \uparrow; \vec{J} = 390 \text{ N} \uparrow; F_{HI} = 528 \text{ N (C)}; F_{HK} = 90 \text{ N (T)}; F_{LK} = 340 \text{ N (T)}.$
- 5.30 $\vec{A}_x = 90 \text{ N} \leftarrow; \vec{A}_y = 350 \text{ N} \uparrow; \vec{J} = 390 \text{ N} \uparrow; F_{BC} = 625 \text{ N (C)}; F_{EC} = 136 \text{ N (T)}; F_{EF} = 510 \text{ N (T)}.$

Capítulo 6

- 6.1 $A = 216 \text{ cm}^2; \bar{x} = 6 \text{ cm}; \bar{y} = 9 \text{ cm}.$
- 6.2 $A = 240 \text{ cm}^2; \bar{x} = 11 \text{ cm}; \bar{y} = 8.4 \text{ cm}.$
- 6.3 $A = 240 \text{ cm}^2; \bar{x} = 5.8 \text{ cm}; \bar{y} = 12 \text{ cm}.$
- 6.4 $A = 289.75 \text{ cm}^2; \bar{x} = 6.78 \text{ cm}; \bar{y} = 12 \text{ cm}.$
- 6.5 $A = 341.26 \text{ cm}^2; \bar{x} = 13 \text{ cm}; \bar{y} = 8.38 \text{ cm}.$
- 6.6 $A = 262.35 \text{ cm}^2; \bar{x} = 6.47 \text{ cm}; \bar{y} = 9.18 \text{ cm}.$
- 6.7 $A = 92.73 \text{ cm}^2; \bar{x} = 4.6 \text{ cm}; \bar{y} = 4.6 \text{ cm}.$
- 6.8 $A = 121.7 \text{ cm}^2; \bar{x} = 5.64 \text{ cm}; \bar{y} = 5.14 \text{ cm}.$

- 6.9 $A = 196.3 \text{ cm}^2$; $\bar{x} = 7.4 \text{ cm}$; $\bar{y} = 7.33 \text{ cm}$.
- 6.10 $A = 177.7 \text{ cm}^2$; $\bar{x} = 5.64 \text{ cm}$; $\bar{y} = 8.17 \text{ cm}$.
- 6.11 $A = 128.27 \text{ cm}^2$; $\bar{x} = 6.35 \text{ cm}$; $\bar{y} = 8.6 \text{ cm}$.
- 6.12 $A = 110.25 \text{ cm}^2$; $\bar{x} = 4.59 \text{ cm}$; $\bar{y} = 6.73 \text{ cm}$.
- 6.13 $A = 139.7 \text{ cm}^2$; $\bar{x} = 6.13 \text{ cm}$; $\bar{y} = 8.43 \text{ cm}$.
- 6.14 $A = 132.48 \text{ cm}^2$; $\bar{x} = 4.79 \text{ cm}$; $\bar{y} = 9.08 \text{ cm}$.
- 6.15 $A_x = 0$; $\vec{A}_y = 38.14 \text{ kN} \uparrow$; $\vec{B} = 58.27 \text{ kN} \uparrow$.
- 6.16 $A_x = 0$; $\vec{A}_y = 44.13 \text{ kN} \uparrow$; $\vec{B} = 64.67 \text{ kN} \uparrow$.
- 6.17 $A_x = 0$; $\vec{A}_y = 39.3 \text{ kN} \uparrow$; $\vec{B} = 60.7 \text{ kN} \uparrow$.
- 6.18 $A_x = 0$; $\vec{A}_y = 59.42 \text{ kN} \uparrow$; $\vec{B} = 36.58 \text{ kN} \uparrow$.
- 6.19 $A_x = 0$; $\vec{A}_y = 28.62 \text{ kN} \uparrow$; $\vec{B} = 51.38 \text{ kN} \uparrow$.
- 6.20 $A_x = 0$; $\vec{A}_y = 45 \text{ kN} \uparrow$; $\vec{M}_A = 486 \text{ kNm} \curvearrowright$.
- 6.21 $A_x = 0$; $\vec{A}_y = 12 \text{ kN} \uparrow$; $\vec{M}_A = 21 \text{ kNm} \curvearrowright$.
- 6.22 $A_x = 0$; $\vec{A}_y = 19.2 \text{ kN} \downarrow$; $\vec{M}_A = 57.6 \text{ kNm} \curvearrowright$.

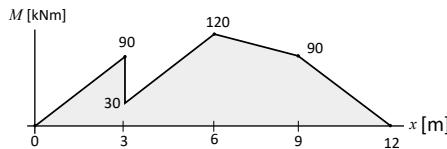
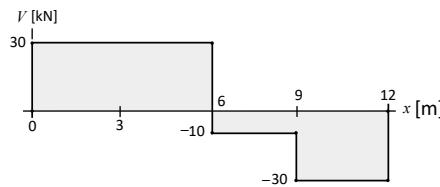
Capítulo 7

- 7.1 $I_{x'} = \left(\frac{4}{3}\right) a^4$; $I_x = \left(\frac{16}{3}\right) a^4$.
- 7.2 $I_{x'} = \left(\frac{\pi}{4}\right) a^4$; $I_x = \left(\frac{5\pi}{4}\right) a^4$.
- 7.3 $I_{x'} = \left(\frac{4}{3} - \frac{\pi}{4}\right) a^4$; $I_x = \left(\frac{16}{3} - \frac{5\pi}{4}\right) a^4$.
- 7.4 $I_{x'} = \left(\frac{1}{3}\right) a^4$; $I_x = \left(\frac{7}{3}\right) a^4$.
- 7.5 $I_{x'} = a^4$; $I_x = 3a^4$.
- 7.6 $I_{x'} = \left(\frac{\pi}{4} - \frac{1}{3}\right) a^4$; $I_x = \left(\frac{5\pi}{4} - \frac{7}{3}\right) a^4$.
- 7.7 $\bar{x} = 9 \text{ cm}$; $\bar{y} = 13 \text{ cm}$; $I_{x'} = 19\ 560 \text{ cm}^4$; $I_{y'} = 3\ 984 \text{ cm}^4$.
- 7.8 $\bar{x} = 9 \text{ cm}$; $\bar{y} = 7.5 \text{ cm}$; $I_{x'} = 6\ 396 \text{ cm}^4$; $I_{y'} = 2\ 040 \text{ cm}^4$.
- 7.9 $\bar{x} = 9 \text{ cm}$; $\bar{y} = 13 \text{ cm}$; $I_{x'} = 21\ 504 \text{ cm}^4$; $I_{y'} = 11\ 136 \text{ cm}^4$.
- 7.10 $\bar{x} = 5.5 \text{ cm}$; $\bar{y} = 7.5 \text{ cm}$; $I_{x'} = 6\ 396 \text{ cm}^4$; $I_{y'} = 3\ 804 \text{ cm}^4$.

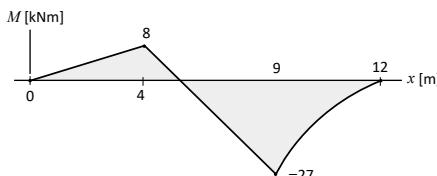
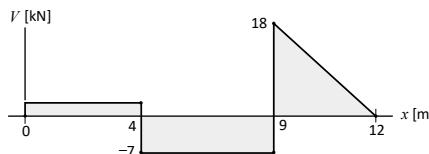
- 7.11 $\bar{x} = 6.67 \text{ cm}$; $\bar{y} = 13 \text{ cm}$; $I_{x'} = 19\,560 \text{ cm}^4$; $I_{y'} = 6\,336 \text{ cm}^4$.
- 7.12 $\bar{x} = 16 \text{ cm}$; $\bar{y} = 13 \text{ cm}$; $I_{x'} = 19\,560 \text{ cm}^4$; $I_{y'} = 11\,040 \text{ cm}^4$.
- 7.13 $\bar{x} = 21.9 \text{ cm}$; $\bar{y} = 40.9 \text{ cm}$; $I_{x'} = 3\,975\,863 \text{ cm}^4$; $I_{y'} = 1\,419\,527 \text{ cm}^4$.
- 7.14 $\bar{x} = 50 \text{ cm}$; $\bar{y} = 59 \text{ cm}$; $I_{x'} = 9\,457\,800 \text{ cm}^4$; $I_{y'} = 2\,567\,730 \text{ cm}^4$.
- 7.15 $\bar{x} = 23.8 \text{ cm}$; $\bar{y} = 59 \text{ cm}$; $I_{x'} = 6\,870\,894 \text{ cm}^4$; $I_{y'} = 1\,446\,122 \text{ cm}^4$.
- 7.16 $\bar{x} = 55 \text{ cm}$; $\bar{y} = 40 \text{ cm}$; $I_{x'} = 5\,126\,756 \text{ cm}^4$; $I_{y'} = 1\,805\,457 \text{ cm}^4$.
- 7.17 $I_x = 2\,562 \text{ cm}^4$; $W_x = 320.25 \text{ cm}^3$; $k_x = 6.27 \text{ cm}$; $I_y = 1\,150 \text{ cm}^4$;
 $W_y = 191.67 \text{ cm}^3$; $k_y = 4.2 \text{ cm}$.
 $I_x = 634.7 \text{ cm}^4$; $W_x = 105.78$.
- 7.18 cm^3 ; $k_x = 3.98 \text{ cm}$; $I_y = 1\,040.4 \text{ cm}^4$;
 $W_y = 148.57 \text{ cm}^3$; $k_y = 5.1 \text{ cm}$.
- 7.19 $I_x = 948.66 \text{ cm}^4$; $W_x = 158.11 \text{ cm}^3$; $k_x = 4.49 \text{ cm}$; $I_y = 323.16 \text{ cm}^4$;
 $W_y = 64.63 \text{ cm}^3$; $k_y = 2.8 \text{ cm}$.

Capítulo 8

- 8.1 $\vec{A} = 25 \text{ kN} \uparrow$; $\vec{C} = 50 \text{ kN} \uparrow$; $V(x) = 25(x)^0 - 60(x - 3)^0 + 50(x - 6)^0 \text{ [kN]}$;
 $M(x) = 25(x)^1 - 60(x - 3)^1 + 50(x - 6)^1 \text{ [kNm]}$; Punto A: $x = 0, V = 25 \text{ kN}, M = 0$;
Punto B: $x = 3 \text{ m}, V = -35 \text{ kN}, M = 75 \text{ kNm}$;
Punto C: $x = 6 \text{ m}, V = 15 \text{ kN}, M = -30 \text{ kNm}$;
Punto D: $x = 8 \text{ m}, V = 15 \text{ kN}, M = 0$;
 $M_{\max} = 75 \text{ kNm}, x = 3 \text{ m}$.
- 8.2 $\vec{A} = 22.5 \text{ kN} \uparrow$; $\vec{D} = 37.5 \text{ kN} \uparrow$; $V(x) = 22.5(x)^0 - 60(x - 6)^0 \text{ [kN]}$;
 $M(x) = 22.5(x)^1 - 60(x - 3)^0 - 60(x - 6)^1 \text{ [kNm]}$;
Punto A: $x = 0, V = 22.5 \text{ kN}, M = 0$;
Punto B: $x = 3 \text{ m}, V = 22.5 \text{ kN}, M = 7.5 \text{ kNm}$;
Punto C: $x = 6 \text{ m}, V = -37.5 \text{ kN}, M = 75 \text{ kNm}$;
Punto D: $x = 8 \text{ m}, V = -37.5 \text{ kN}, M = 0$;
 $M_{\max} = 75 \text{ kNm}, x = 6 \text{ m}$.
- 8.3 $\vec{A} = 30 \text{ kN} \uparrow$; $\vec{E} = 30 \text{ kN} \uparrow$; $V(x) = 30(x)^0 - 40(x - 6)^0 - 20(x - 9)^0 \text{ [kN]}$;
 $M(x) = 30(x)^1 - 60(x - 3)^0 - 40(x - 6)^1 - 20(x - 9)^1 \text{ [kNm]}$.



- 8.4 $\vec{A} = 2 \text{ kN} \uparrow; \vec{C} = 25 \text{ kN} \uparrow; w(x) = 6(x-9)^0 \text{ [kN/m]}; V(x) = 2\langle x \rangle^0 - 9\langle x-4 \rangle^0 + 25\langle x-9 \rangle^0 - 6\langle x-9 \rangle^1 \text{ [kN]}; M(x) = 2\langle x \rangle^1 - 9\langle x-4 \rangle^1 + 25\langle x-9 \rangle^1 - 3\langle x-9 \rangle^2 \text{ [kNm]}.$



- 8.5 $\vec{A} = 38.5 \text{ kN} \uparrow; \vec{C} = 21.5 \text{ kN} \uparrow; w(x) = 18(x)^0 - 18(x-3)^0 \text{ [kN/m]}; V(x) = 38.5\langle x \rangle^0 + 21.5\langle x-6 \rangle^0 - 18\langle x \rangle^1 + 18\langle x-3 \rangle^1 \text{ [kN]}; M(x) = 38.5\langle x \rangle^1 + 21.5\langle x-6 \rangle^1 - 9\langle x \rangle^2 + 9\langle x-3 \rangle^2 \text{ [kNm]};$

Punto A: $x = 0, V = 38.5 \text{ kN}, M = 0;$ Punto B: $x = 3 \text{ m}, V = -15.5 \text{ kN},$

$M = 34.5 \text{ kNm};$ Punto C: $x = 6 \text{ m}, V = 6 \text{ kN}, M = -12 \text{ kNm};$ Punto

D: $x = 8 \text{ m}, V = 6 \text{ kN}, M = 0; M_{\max} = 41.15 \text{ kNm}, x = 2.14 \text{ m}.$

8.6 $\vec{A} = 17 \text{ kN} \uparrow; \vec{C} = 48 \text{ kN} \uparrow; w(x) = 10(x - 4)^0 - 10(x - 10)^0 [\text{kN/m}]$;

$$V(x) = 17(x)^0 + 48(x - 10)^0 - 10(x - 4)^1 + 10(x - 10)^1 [\text{kN}]$$

$$M(x) = 17(x)^1 + 48(x - 10)^1 - 5(x - 4)^2 + 5(x - 10)^2 [\text{kNm}]$$

Punto A: $x = 0, V = 17 \text{ kN}, M = 0$; Punto B: $x = 4 \text{ m}, V = 17 \text{ kN}$,

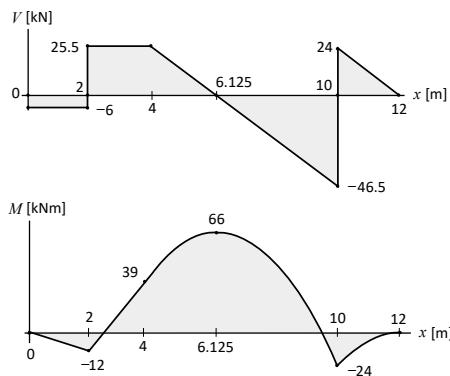
$M = 68 \text{ kNm}$; Punto C: $x = 10 \text{ m}, V = 5 \text{ kN}, M = -10 \text{ kNm}$; Punto

D: $x = 12 \text{ m}, V = 5 \text{ kN}, M = 0; M_{\max} = 82.45 \text{ kNm}, x = 5.7 \text{ m}$.

8.7 $\vec{B} = 31.5 \text{ kN} \uparrow; \vec{D} = 70.5 \text{ kN} \uparrow; w(x) = 12(x - 4)^0 [\text{kN/m}]$;

$$V(x) = -6(x)^0 + 31.5(x - 2)^0 + 70.5(x - 10)^0 - 12(x - 4)^1 [\text{kN}]$$

$$M(x) = -6(x)^1 + 31.5(x - 2)^1 + 70.5(x - 10)^1 - 6(x - 4)^2 [\text{kNm}]$$



Diagramas prob 8.7

8.8 $\vec{A} = 30 \text{ kN} \uparrow; \vec{E} = 36 \text{ kN} \uparrow; w(x) = 10(x - 4)^0 - 10(x - 10)^0 [\text{kN/m}]$;

$$V(x) = 30(x)^0 - 6(x - 2)^0 - 10(x - 4)^1 + 10(x - 10)^1 [\text{kN}]$$

$$M(x) = 30(x)^1 - 6(x - 2)^1 - 5(x - 4)^2 + 5(x - 10)^2 [\text{kNm}]$$

Punto A: $x = 0, V = 30 \text{ kN}, M = 0$; Punto B: $x = 2 \text{ m}, V = 24 \text{ kN}$,

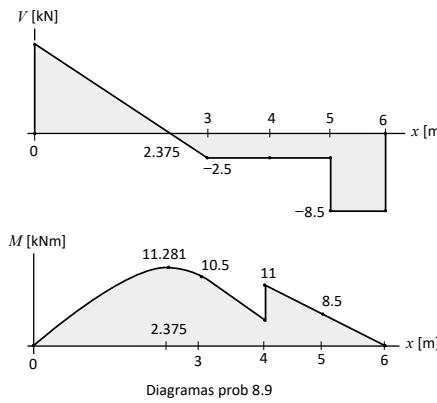
$M = 60 \text{ kNm}$; Punto C: $x = 4 \text{ m}, V = 24 \text{ kN}, M = 108 \text{ kNm}$;

Punto D: $x = 10 \text{ m}, V = -36 \text{ kN}, M = 72 \text{ kNm}$; Punto E: $x = 12 \text{ m}, V = -36 \text{ kN}, M = 0; M_{\max} = 136.8 \text{ kNm}, x = 6.4 \text{ m}$.

8.9 $\vec{A} = 9.5 \text{ kN} \uparrow; \vec{E} = 8.5 \text{ kN} \uparrow; w(x) = 4(x)^0 - 4(x - 3)^0 [\text{kN/m}]$;

$$V(x) = 9.5(x)^0 - 6(x - 5)^0 - 4(x)^1 + 4(x - 3)^1 [\text{kN}]$$

$$M(x) = 9.5(x)^1 - 6(x - 5)^1 - 2x^2 + 2(x - 3)^2 + 3(x - 4)^0 [\text{kNm}]$$

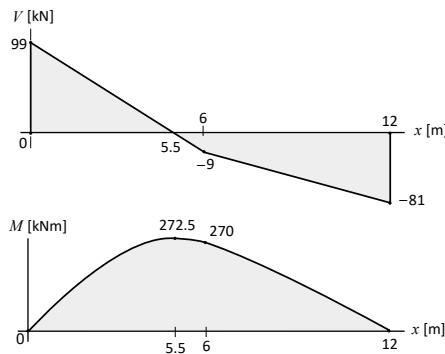


- 8.10 $\vec{A} = 51 \text{ kN} \uparrow; \vec{C} = 99 \text{ kN} \uparrow; w(x) = 18(x)^0 \text{ [kN/m]}; V(x) = 51(x)^0 - 6(x-3)^0 + 99(x-6)^0 - 18(x)^1 \text{ [kN]}; M(x) = 51(x)^1 - 6(x-3)^1 + 99(x-6)^1 - 9(x)^2 \text{ [kNm]};$ Punto A: $x = 0, V = 51 \text{ kN}, M = 0;$
 Punto B: $x = 3 \text{ m}, V = -9 \text{ kN}, M = 72 \text{ kNm};$ Punto C: $x = 6 \text{ m}, V = 36 \text{ kN}, M = -36 \text{ kNm};$ Punto D: $x = 8 \text{ m}, V = 0, M = 0; M_{\max} = 72.25 \text{ kNm}, x = 2.83 \text{ m}.$

- 8.11 $\vec{A} = 109.5 \text{ kN} \uparrow; \vec{C} = 112.5 \text{ kN} \uparrow; w(x) = 18(x)^0 \text{ [kN/m]}; V(x) = 109.5(x)^0 - 6(x-9)^0 - 18(x)^1 \text{ [kN]}; M(x) = 109.5(x)^1 - 6(x-9)^1 - 9(x)^2 \text{ [kNm]}$; Punto A: $x = 0, V = 109.5 \text{ kN}, M = 0;$ Punto B: $x = 9 \text{ m}, V = -58.5 \text{ kN}, M = 256.5 \text{ kNm};$ Punto C: $x = 12 \text{ m}, V = -112.5 \text{ kN}, M = 0;$ $M_{\max} = 333 \text{ kNm}, x = 6.08 \text{ m}.$

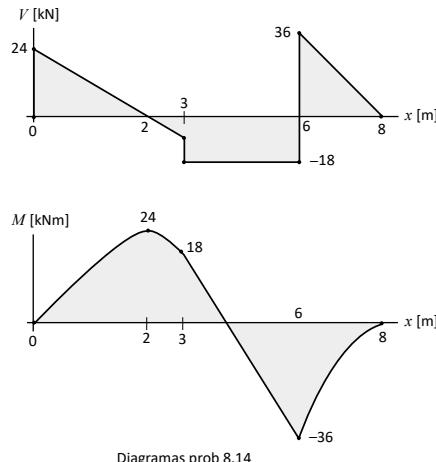
- 8.12 $\vec{B} = 31 \text{ kN} \uparrow; \vec{D} = 17 \text{ kN} \uparrow; w(x) = 6(x-3)^0 - 6(x-6)^0 + 4(x-6)^0 \text{ [kN/m]}; V(x) = -6(x)^0 + 31(x-3)^0 - 6(x-3)^1 + 6(x-6)^1 - 4(x-6)^1 \text{ [kN]}; M(x) = -6(x)^1 + 31(x-3)^1 - 3(x-3)^2 + 3(x-6)^2 - 2(x-6)^2 \text{ [kNm]}$; Punto A: $x = 0, V = -6 \text{ kN}, M = 0;$ Punto B: $x = 3 \text{ m}, V = 25 \text{ kN}, M = -18 \text{ kNm};$ Punto C: $x = 6 \text{ m}, V = 7 \text{ kN}, M = 30 \text{ kNm};$ Punto D: $x = 12 \text{ m}, V = -17 \text{ kN}, M = 0;$ $M_{\max} = 36.125 \text{ kNm}, x = 7.75 \text{ m}.$

- 8.13 $\vec{A} = 99 \text{ kN} \uparrow; \vec{C} = 81 \text{ kN} \uparrow; w(x) = 18(x)^0 - 18(x-6)^0 + 12(x-6)^0 \text{ [kN/m]}; V(x) = 99(x)^0 - 18(x)^1 + 18(x-6)^1 - 12(x-6)^1 \text{ [kN]}; M(x) = 99(x)^1 - 9(x)^2 + 9(x-6)^2 - 6(x-6)^2 \text{ [kNm]}.$



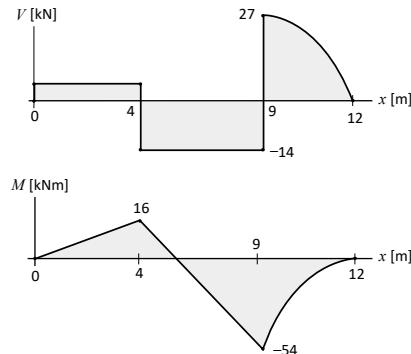
Diagramas prob 8.13

- 8.14 $\vec{A} = 24 \text{ kN} \uparrow; \vec{C} = 54 \text{ kN} \uparrow; w(x) = 12(x)^0 - 12(x-3)^0 + 18(x-6)^0 \text{ [kN/m];}$
 $V(x) = 24(x)^0 - 6(x-3)^0 + 54(x-6)^0 - 12(x)^1 + 12(x-3)^1 - 18(x-6)^1 \text{ [kN];}$
 $M(x) = 24(x)^1 - 6(x-3)^1 + 54(x-6)^1 - 6(x)^2 + 6(x-3)^2 - 9(x-6)^2 \text{ [kNm].}$



Diagramas prob 8.14

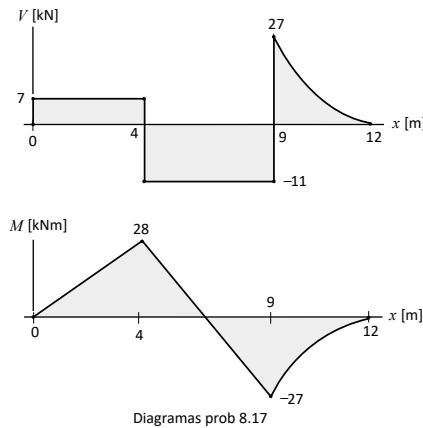
- 8.15 $\vec{A} = 4 \text{ kN} \uparrow; \vec{C} = 41 \text{ kN} \uparrow; w(x) = 6(x-9)^1 \text{ [kN/m]; } V(x) = 4(x)^0 - 18(x-4)^0 + 41(x-9)^0 - 3(x-9)^2 \text{ [kN]; } M(x) = 4(x)^1 - 18(x-4)^1 + 41(x-9)^1 - (x-9)^3 \text{ [kNm].}$



Diagramas prob 8.15

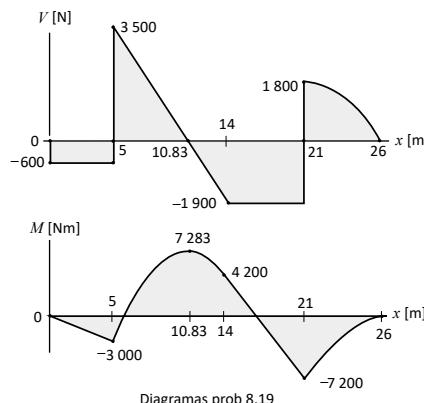
- 8.16 $\vec{A} = 28 \text{ kN} \uparrow; \vec{D} = 68 \text{ kN} \uparrow; w(x) = 3(x-4)^1 - 3(x-8)^1 \text{ [kN/m]}; V(x) = 28(x)^0 - 1.5(x-4)^2 + 1.5(x-8)^2 \text{ [kN]}; M(x) = 28(x)^1 - 0.5(x-4)^3 + 0.5(x-8)^3 \text{ [kNm]};$
 Punto A: $x = 0, V = 28 \text{ kN}, M = 0$; Punto B: $x = 4 \text{ m}, V = 28 \text{ kN}, M = 112 \text{ kNm}$;
 Punto C: $x = 8 \text{ m}, V = 4 \text{ kN}, M = 192 \text{ kNm}$; Punto D: $x = 14 \text{ m}, V = -68 \text{ kN}, M = 0$;
 $M_{\max} = 192.67 \text{ kNm}, x = 8.33 \text{ m.}$

- 8.17 $\vec{A} = 7 \text{ kN} \uparrow; \vec{C} = 38 \text{ kN} \uparrow; w(x) = 18(x-9)^0 - 6(x-9)^1 \text{ [kN/m]}; V(x) = 7(x)^0 - 18(x-4)^0 + 38(x-9)^0 - 18(x-9)^1 + 3(x-9)^2 \text{ [kN]}; M(x) = 7(x)^1 - 18(x-4)^1 + 38(x-9)^1 - 9(x-9)^2 + (x-9)^3 \text{ [kNm]}.$



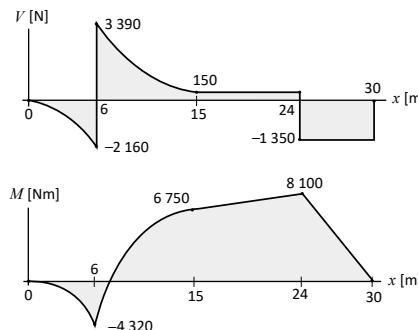
Diagramas prob 8.17

- 8.18 $\vec{A} = 39 \text{ kN} \uparrow; \vec{D} = 51 \text{ kN} \uparrow; w(x) = 12(x - 3)^0 - 4(x - 9)^1 [\text{kN/m}]; V(x) = 39(x)^0 - 12(x - 3)^1 - 2(x - 9)^2 [\text{kN}]; M(x) = 39(x)^1 - 6(x - 3)^2 - 0.67(x - 9)^3 [\text{kNm}]$
 Punto A: $x = 0, V = 39 \text{ kN}, M = 0$; Punto B: $x = 3 \text{ m}, V = 39 \text{ kN}, M = 117 \text{ kNm}$
 Punto C: $x = 9 \text{ m}, V = -33 \text{ kN}, M = 135 \text{ kNm}$; Punto D: $x = 12 \text{ m}, V = -51 \text{ kN}, M = 0; M_{\max} = 180.375 \text{ kNm}, x = 6.25 \text{ m}$.
- 8.19 $\vec{A} = 4100 \text{ N} \uparrow; \vec{D} = 3700 \text{ N} \uparrow; w(x) = 600(x - 5)^0 - 600(x - 14)^0 + 100(x - 20)^1 [\text{N/m}]; V(x) = -600(x)^0 + 4100(x - 5)^0 + 3700(x - 20)^0 - 600(x - 5)^1 + 600(x - 14)^1 - 50(x - 20)^2 [\text{N}]; M(x) = -600(x)^1 + 4100(x - 5)^1 + 3700(x - 20)^1 - 300(x - 5)^2 + 300(x - 14)^2 - \frac{50}{3}(x - 20)^3 [\text{Nm}]$.



Diagramas prob 8.19

- 8.20 $\vec{B} = 5550 \text{ N} \uparrow; \vec{E} = 1350 \text{ N} \uparrow; w(x) = 120(x)^1 - 120(x - 6)^1 - 80(x - 6)^1 + 80(x - 15)^1 [\text{N/m}]; V(x) = 5550(x - 6)^0 - 1500(x - 24)^0 - 60(x)^2 + 60(x - 6)^2 + 40(x - 6)^2 - 40(x - 15)^2 [\text{N}]; M(x) = 5550(x - 6)^1 - 1500(x - 24)^1 - 20(x)^3 + 20(x - 6)^3 + \frac{40}{3}(x - 6)^3 - \frac{40}{3}(x - 15)^3 [\text{Nm}]$.



Diagramas prob 8.20

- 8.21 $\vec{B} = 3\,600 \text{ N} \uparrow; \vec{E} = 4\,050 \text{ N} \uparrow; w(x) = 600(x - 11)^0 - 100(x - 20)^1 [\text{N/m}]; V(x) = -450(x)^0 + 3\,600(x - 5)^0 - 600(x - 11)^1 + 50(x - 20)^2 [\text{N}]; M(x) = -450(x)^1 + 3\,600(x - 5)^1 - 300(x - 11)^2 + \frac{50}{3}(x - 20)^3 [\text{Nm}];$ Punto A: $x = 0, V = -450 \text{ N}, M = 0;$ Punto B: $x = 5 \text{ m}, V = 3\,150 \text{ N}, M = -2\,250 \text{ Nm};$ Punto C: $x = 11 \text{ m}, V = 3\,150 \text{ N}, M = 16\,650 \text{ Nm};$ Punto D: $x = 20 \text{ m}, V = -2\,250 \text{ N}, M = 20\,700 \text{ Nm};$ Punto E: $x = 26 \text{ m}, V = -4\,050 \text{ N}, M = 0; M_{\max} = 24\,918 \text{ Nm}, x = 16.25 \text{ m}.$
- 8.22 $\vec{A} = 1\,220 \text{ N} \uparrow; \vec{D} = 7\,240 \text{ N} \uparrow; w(x) = 80(x - 5)^1 - 80(x - 14)^1 - 120(x - 18)^1 + 120(x - 24)^1 [\text{N/m}]; V(x) = 1\,220(x)^0 + 7\,240(x - 18)^0 - 40(x - 5)^2 + 40(x - 14)^2 + 60(x - 18)^2 - 60(x - 24)^2 [\text{N}]; M(x) = 1\,220(x)^1 + 7\,240(x - 18)^1 - \frac{40}{3}(x - 5)^3 + \frac{40}{3}(x - 14)^3 + 20(x - 18)^3 - 20(x - 24)^3 [\text{Nm}];$ Punto A: $x = 0, V = 1\,220 \text{ N}, M = 0;$ Punto B: $x = 5 \text{ m}, V = 1\,220 \text{ N}, M = 6\,100 \text{ Nm};$ Punto C: $x = 14 \text{ m}, V = -2\,020 \text{ N}, M = 7\,360 \text{ Nm};$ Punto D: $x = 18 \text{ m}, V = 2\,340 \text{ N}, M = -6\,480 \text{ Nm};$ Punto E: $x = 24 \text{ m}, V = 180 \text{ N}, M = -1\,080 \text{ Nm};$ Punto F: $x = 30 \text{ m}, V = 180 \text{ N}, M = 0; M_{\max} = 10\,592 \text{ Nm}, x = 10.52 \text{ m}.$

Capítulo 9

- 9.1 $P = 168.8 \text{ N}.$
- 9.2 (a) $\alpha = 30.96^\circ.$ (b) $\vec{F} = 41.2 \text{ lb} \nearrow.$
- 9.3 (a) $\vec{F}_S = 29 \text{ N} \searrow.$ (b) $\vec{F}_S = 31 \text{ N} \nwarrow.$
- 9.4 (a) $P = 419.8 \text{ N}.$ (b) $P = 198.8 \text{ N}.$ (c) $P = 319.25 \text{ N}.$
- 9.5 $P = 300 \text{ lb}.$
- 9.6 $P = 130.23 \text{ lb}.$
- 9.7 (a) $\vec{F}_S = 29.4 \text{ lb} \rightarrow.$ (b) $\vec{F}_S = 25 \text{ lb} \leftarrow.$ (c) $\vec{F}_K = 22.17 \text{ lb} \leftarrow.$
- 9.8 (a) $\vec{F}_S = 39.7 \text{ N} \nwarrow.$ (b) $\vec{F}_K = 45.9 \text{ N} \nwarrow.$ (c) $\vec{F}_S = 46.89 \text{ N} \searrow.$
- 9.9 $\alpha = 51.34^\circ.$
- 9.10 $u_S = 0.5.$
- 9.11 $P = 11.75 \text{ lb}.$
- 9.12 $\alpha = 59.28^\circ.$
- 9.13 $u_S = 0.572.$

9.14 $P = 313.51 \text{ N}$.

9.15 (a) $\vec{F}_K = 150 \text{ N} \leftarrow$. (b) La caja no se volteá.

9.16 (a) $P = 240 \text{ N}$. (b) $h = 75 \text{ cm}$.