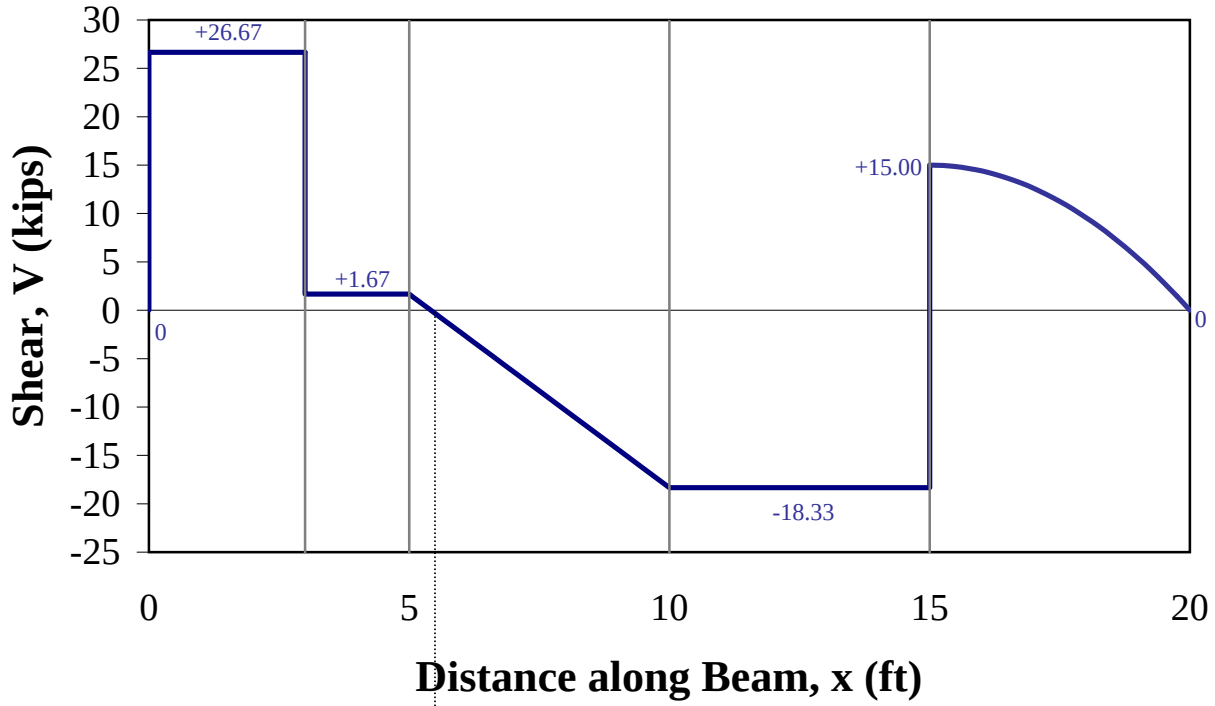
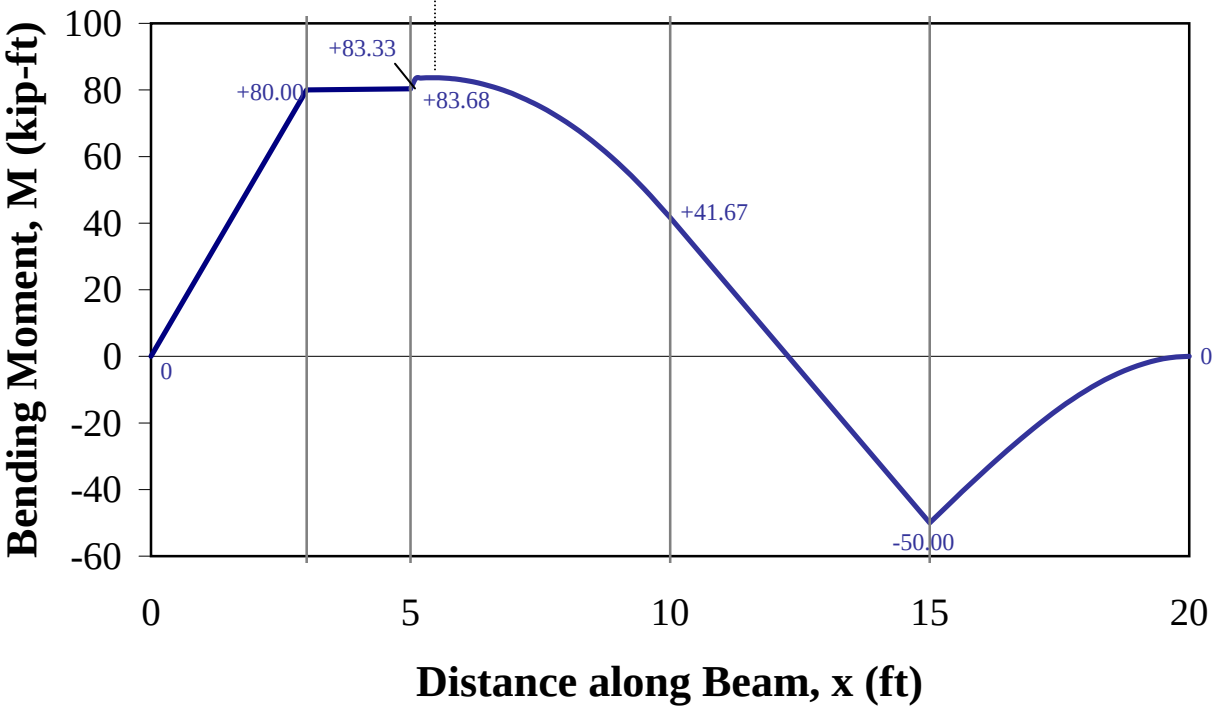
Partial Solution to Shear and Moment Diagrams Example Problem





Section E-F: $-w = -1.2(x-15) = -1.2x + 18$

$V_E^+ = V_E^- + R_E = -18.\overline{3} + 33.\overline{3} = +15.0$

$$V_{EF} = +15.0 + \int_{15}^{x} (-1.2x + 18)\,dx = +15.0 + \left[-0.6x^2 + 18x\right]_{15}^{x}$$

$$= +15.0 - 0.6x^2 + 18x - \left[-0.6(15)^2 + 18(15)\right] = +15 - 0.6x^2 + 18x + 135 - 270$$

$$V_{EF} = -120 + 18x - 0.6x^2$$

$M_E^+ = M_E^- = -50$ kip-ft ; $M_{EF} = -50 + \int_{15}^{x} (-120 + 18x - 0.6x^2\,dx = -50 + \left[-120x + 9x^2 - 0.2x^3\right]_{15}^{x}$

$$M_{EF} = -50 - 120x + 9x^2 - 0.2x^3 - \left[-120(15) + 9(15)^2 - 0.2(15)^3\right]$$

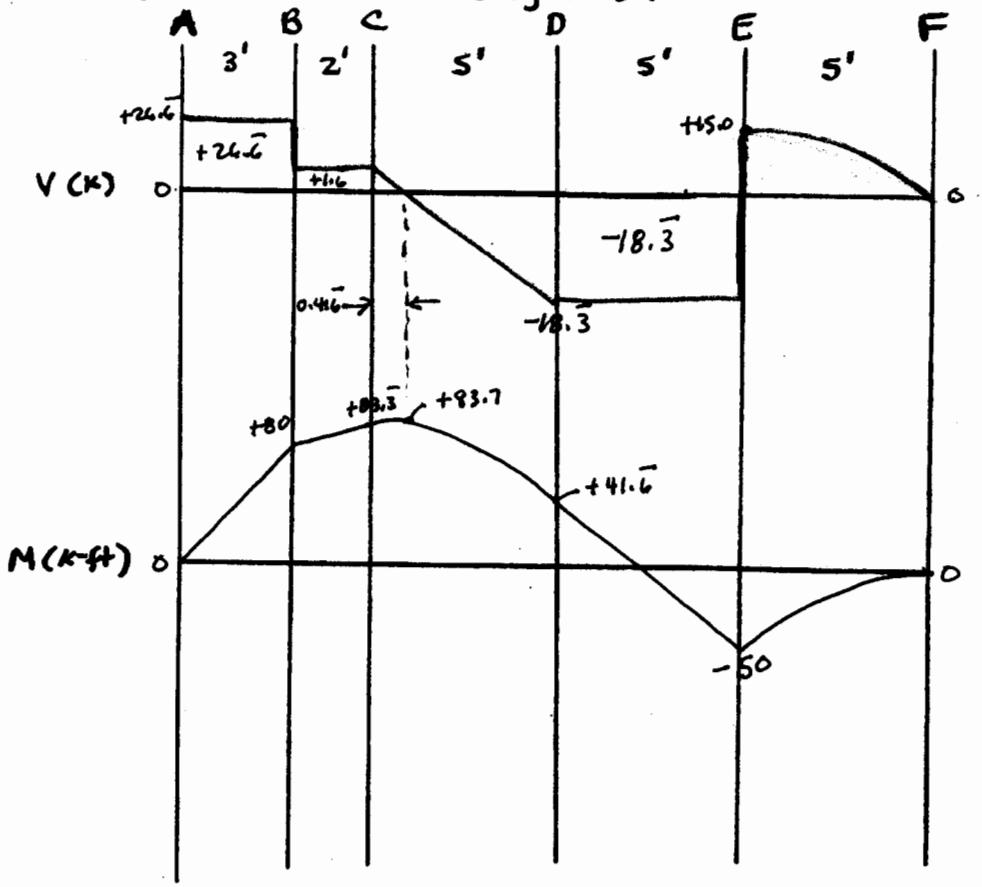
$$M_{EF} = -50 - 120x + 9x^2 - 0.2x^3 - \left[-1800 + 2025 - 675\right]$$

$$M_{EF} = +400 - 120x + 9x^2 - 0.2x^3$$

$$M_F = +400 - 120(20) + 9(20)^2 - 0.2(20)^3 = +400 - 2400 + 3600 - 1600 = 0$$

(checks)

Now draw V and M diagrams:



Summary of Answers: See V and M diagrams above.

Summary of Shear and Moment Equations

Section AB ($0 < x < 3'$)

$V_{AB} = +26.\bar{6}$ kips

$M_{AB} = +26.\bar{6}\,x$ kip-ft

Section BC ($3' < x < 5'$)

$V_{BC} = +1.\bar{6}$ kips

$M_{BC} = 75 + 1.\bar{6}\,x$ kip-ft

Section CD ($5' < x < 10'$)

$V_{CD} = +21.\bar{6} - 4x$ kips

$M_{CD} = 25 + 21.\bar{6}\,x - 2x^2$ kip-ft

Section DE ($10' < x < 15'$)

$V_{DE} = -18.\bar{3}$ kips

$M_{DE} = 225 - 18.\bar{3}\,x$ kip-ft

Section EF ($15' < x < 20'$)

$V_{EF} = -120 + 18x - 0.6x^2$ kips

$M_{EF} = +400 - 120x + 9x^2 - 0.2x^3$ kip-ft