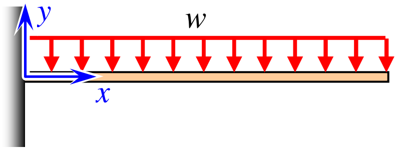
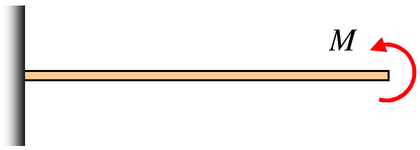
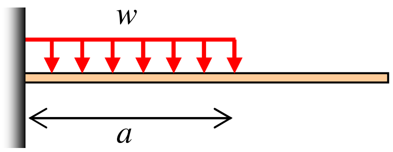
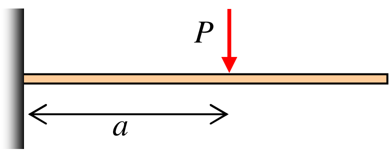
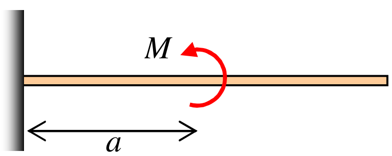
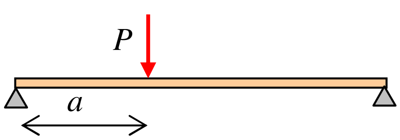
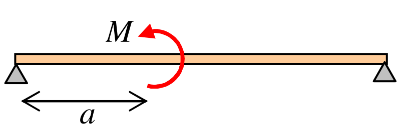
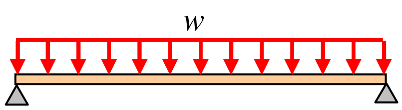
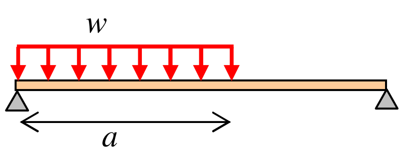
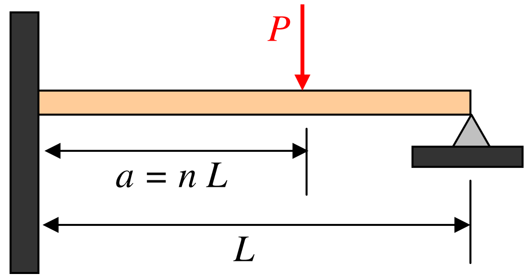
Beam and Loading	**Displacement (all beams have total length *L*)**
	$y=-\frac{w}{24EI}\left(x^4-4Lx^3+6L^2x^2\right)$
	$y=\frac{Mx^2}{2EI}$
	$y=\frac{w}{24EI}\left(4ax^3-6a^2x^2-x^4\right)+\frac{w}{24EI}(x-a)^4\langle x-a\rangle^0$
	$y=\frac{P}{6EI}\left(x^3-3ax^2\right)-\frac{P}{6EI}(x-a)^3\langle x-a\rangle^0$
	$y=\frac{M}{2EI}x^2-\frac{M}{2EI}(x-a)^2\langle x-a\rangle^0$
	$y=\frac{P(L-a)}{6LEI}\left(x^3+a^2x-2aLx\right)-\frac{P}{6EI}(x-a)^3\langle x-a\rangle^0$
	$y=\frac{M}{6LEI}\left(x^3+2L^2x-6aLx+3a^2x\right)-\frac{3M}{6EI}(x-a)^2\langle x-a\rangle^0$
	$y=-\frac{w}{24EI}\left(x^4-2Lx^3+L^3x\right)$
	$y=-\frac{wx}{24LEI}\left(a^4-4La^3+4a^2L^2+2a^2x^2-4aLx^2+Lx^3\right)$ $+\frac{w}{24EI}(x-a)^4\langle x-a\rangle^0$

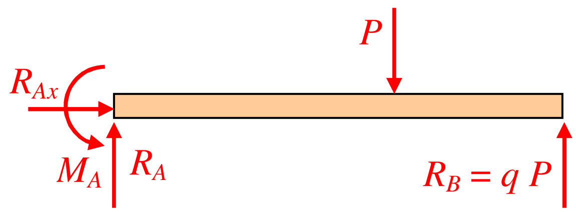
This beam has too many reactions (4 reactions in a 2-D Problem), and 3 of them are unknown (since $R_{Ax} = 0$).

Given P, L, and n, determine the reactions.
We start by defining R_B as some unknown fraction "q" of P: $R_B = qP$ (see FBD).
If we can solve for q, then we'll know everything.



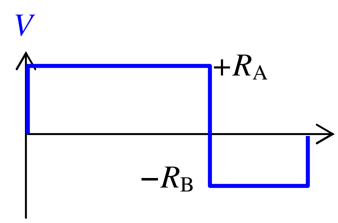
N2L: $R_A + R_B = P$, so $R_A = P(1 - q)$
Similarly, N2LR: $M_A = PL(n - q)$.

On the left: $V_1(x) = R_A = P(1 - q)$
Integrating: $M_1(x) = P(1 - q)x - M_A$, or
$M_1(x) = P(1 - q)x - PL(n - q)$

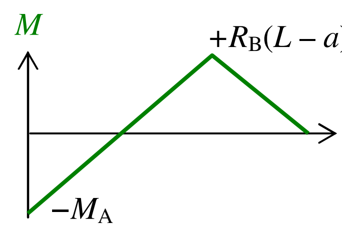


On the right: $V_2(x) = -R_B = -qP$
Integrating: $M_2(x) = -qP + R_BL$, or
$M_2(x) = R_B(L - x) = qP(L - x)$

These two answers must be consistent: they give the same M at $x = a = nL$.



Next, we use deflections:



On the left: $EIy_1'' = M_1$
$EIy_1' = \int M_1 dx = \frac{1}{2}P(1 - q)x^2 - PL(n - q)x + C_2$
BC: $y_1'(0) = 0 \rightarrow C_2 = 0$.
$EIy_1 = \int (\ldots)dx = (1/6)P(1 - q)x^3 - \frac{1}{2}PL(n - q)x^2 + C_4$
BC: $y_1(0) = 0 \rightarrow C_4 = 0$.
$EIy_1 = (1/6)P(1 - q)x^3 - \frac{1}{2}PL(n - q)x^2$

On the right: $EIy_2'' = M_2$
$EIy_2' = \int M_2 dx = qP(Lx - \frac{1}{2}x^2) + C_3$
$EIy_2 = \int (\ldots)dx = qP(\frac{1}{2}Lx^2 - (1/6)x^3) + C_3x + C_5$
BC: $y_1'(a) = y_2'(a)$
BC: $y_2(L) = 0$
$\rightarrow$ tons of algebra $\rightarrow C_3 = -\frac{1}{2}PL^2n^2$, and $C_5 = PL^3(\frac{1}{2}n^2 - (1/3)q)$

BC: $y_1(a) = y_2(a) \rightarrow$ more algebra

$$\boldsymbol{q = \tfrac{1}{2}(3n^2 - n^3)}$$

Reactions: $R_B = qP$ $\quad R_A = (1 - q)P$ $\quad M_A = PL(n - q)$