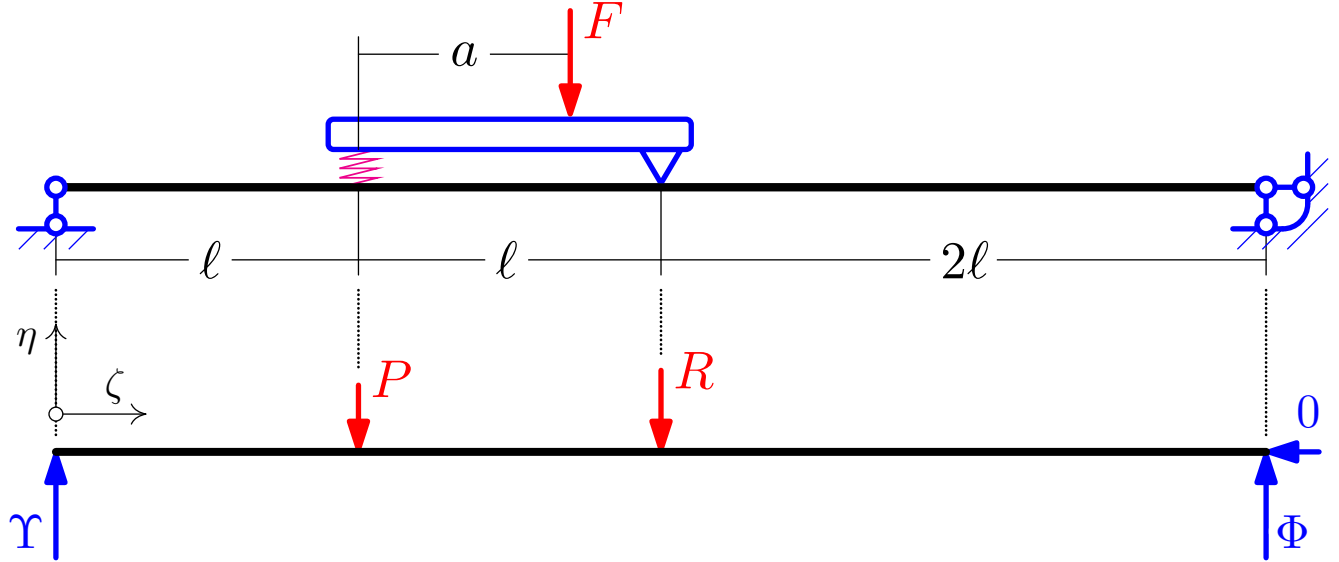An absolutely rigid bracket with a spring on one side rests on a hinged beam. At what distance a should a point force F be applied so that the bracket does not tilt? The length of the beam ℓ, the bending rigidity EJ (constant along the beam length) and the spring stiffness coefficient $k = \frac{EJ}{\ell^3}$ are known.

$$\mathcal{Q}(\zeta) = \left[\Upsilon\zeta^0\right]_0^{4\ell} - \left[P(\zeta-\ell)^0\right]_\ell^{4\ell} - \left[R(\zeta-2\ell)^0\right]_{2\ell}^{4\ell}$$

$$\mathcal{Q}(4\ell) = -\Phi$$

$$\mathcal{M}(\zeta) = \int\mathcal{Q}\,d\zeta = \left[\Upsilon\zeta\right]_0^{4\ell} - \left[P(\zeta-\ell)\right]_\ell^{4\ell} - \left[R(\zeta-2\ell)\right]_{2\ell}^{4\ell} + \overset{\circ}{\mathcal{M}}$$

$$\overset{\circ}{\mathcal{M}} = \mathcal{M}(0) = 0$$

$$\mathcal{M}(4\ell) = 0$$

$$EJ\vartheta(\zeta) = \int\mathcal{M}\,d\zeta = \left[\Upsilon\frac{\zeta^2}{2}\right]_0^{4\ell} - \left[P\frac{(\zeta-\ell)^2}{2}\right]_\ell^{4\ell} - \left[R\frac{(\zeta-2\ell)^2}{2}\right]_{2\ell}^{4\ell} + \overset{\circ}{\mathcal{M}}\zeta + \overset{\circ}{\vartheta}$$

$$EJv(\zeta) = \int EJ\vartheta\,d\zeta = \left[\Upsilon\frac{\zeta^3}{6}\right]_0^{4\ell} - \left[P\frac{(\zeta-\ell)^3}{6}\right]_\ell^{4\ell} - \left[R\frac{(\zeta-2\ell)^3}{6}\right]_{2\ell}^{4\ell} + \overset{\circ}{\mathcal{M}}\frac{\zeta^2}{2} + \overset{\circ}{\vartheta}\zeta + \overset{\circ}{v}$$

$$\overset{\circ}{v} = v(0) = 0$$

$$v(4\ell) = 0$$