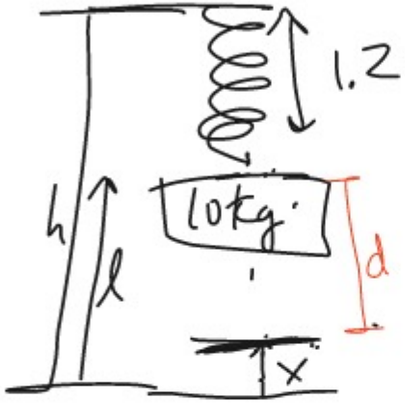
7. Prof. Brandon's first grandson, Matthew James (MJ), was too young to go trick-or-treating on his first Halloween this year. So his sister, Caitlyn Elizabeth (CE), and his cousin Sydney Jean (SJ), decided to suspend MJ in his jolly-jumper from the ceiling of their front porch where he could watch them trick-or-treat around the neighbourhood. The jolly jumper acted like an ideal spring with an unstretched length of 1.20 m and with a spring constant of 98.0 N/m. The girls attached MJ, of total mass 10.0 kg in his costume, to the lower end of the jolly-jumper and released him from rest. If the ceiling to floor distance was 3.70 m, how close to the floor did MJ come after the girls released him? (Answers in m.)



$1.2\,m$, $K = 98.0\,\frac{N}{m}$, $h = 3.7\,m$

$\Delta E = \Delta K + \Delta U_g + \Delta U_s$

$0 = (0 - 0) + (mgx - mgl) + \left(\frac{1}{2}kd^2 - 0\right)$

$mgx - mgl = -mgd$

$= -mgd + \frac{1}{2}kd^2$

$2mg = kd$

$\frac{2mg}{k} = d$

$d = 2.00\,m$, $h = 3.70\,m \Rightarrow h = 1.20\,m + 2.00\,m + x$

$x = 3.70\,m - 1.20\,m - 2.00\,m$

$= 0.50\,m.$