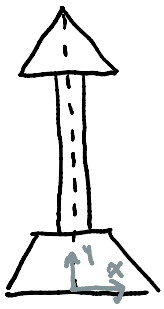
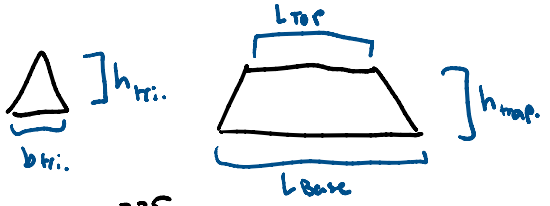
20-R-KIN-DK-11

July 22, 2020 9:46 AM

20-R-KIN-DK-11 Beginner Centre of mass



A preschooler has constructed a toy arrow from an arrangement of blocks. The blocks consist of plates in the shape of a triangle, a rectangle, and a trapezoid. Locate the centre of mass of the arrow if the blocks have constant density.
The rectangle has a width of ***w = 10mm*** and length ***l = 35 mm***.
The triangle has a base ***b = 25 mm*** and height ***h_tri = 25 mm***.
The trapezoid has a height ***h_trap = 12.5***, top length ***l_top = 20 mm***, and base length ***l_base = 30 mm***.



Triangle: $y_1 = \frac{1}{3}h = \frac{1}{3}(25_{mm}) + 35 + 12.5 = \frac{335}{6}$

$A_1 = 312.5$

Rectangle: $y_2 = 17.5 + 12.5 = 30$

$A_2 = 10 \times 35 = 350$

Trapezoid: $y_3 = \frac{1}{3}\left(\frac{2a+b}{a+b}\right)h = \frac{1}{3}\left(\frac{2(20)+30}{20+30}\right)(12.5) = \frac{55}{6}$

$A_3 = \frac{1}{2}h(a+b) = \frac{1}{2}(12.5)(20+30) = 312.5$

$$y_G = \frac{\frac{335}{6}(312.5) + 30(350) + \frac{55}{6}(312.5)}{975} = 30.53419803$$