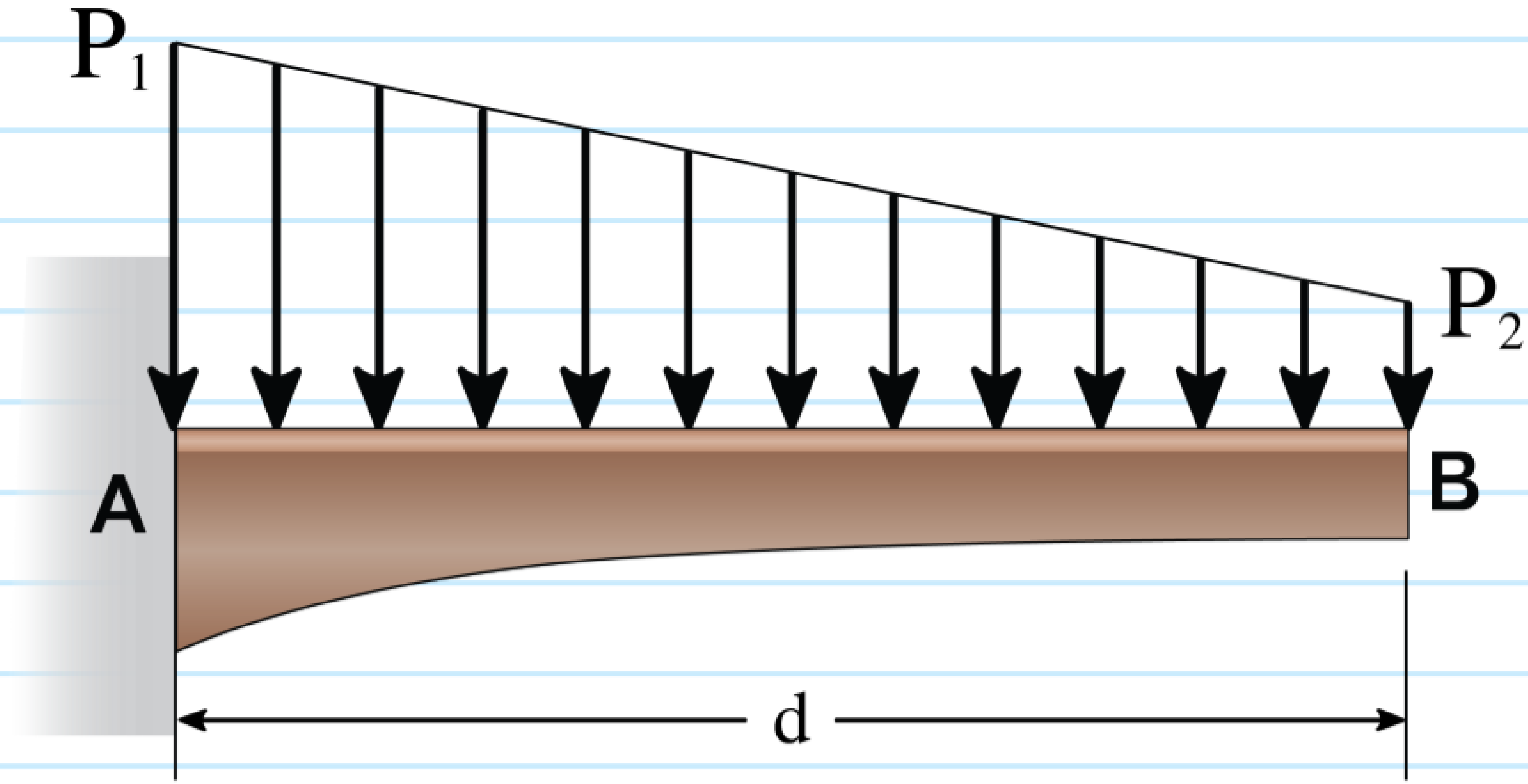
21-S-4-9-GD-001



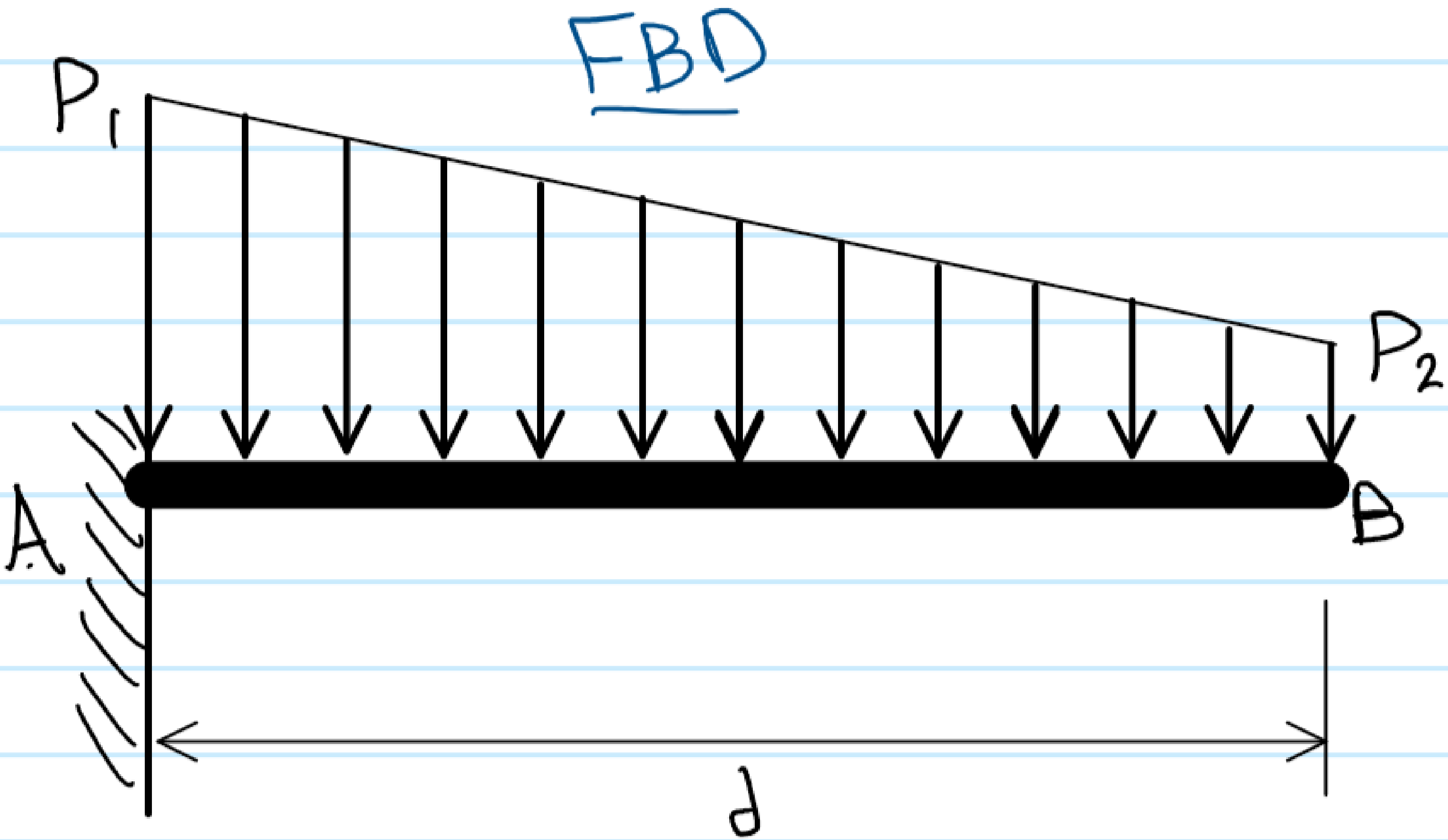
A d m beam is subjected to a distributed as shown, where $P_1 = P_1$ N/m and $P_2 = P_2$ N/m. What is the magnitude and location from A of the equivalent resultant of the load?

given

d, P_1, P_2

find

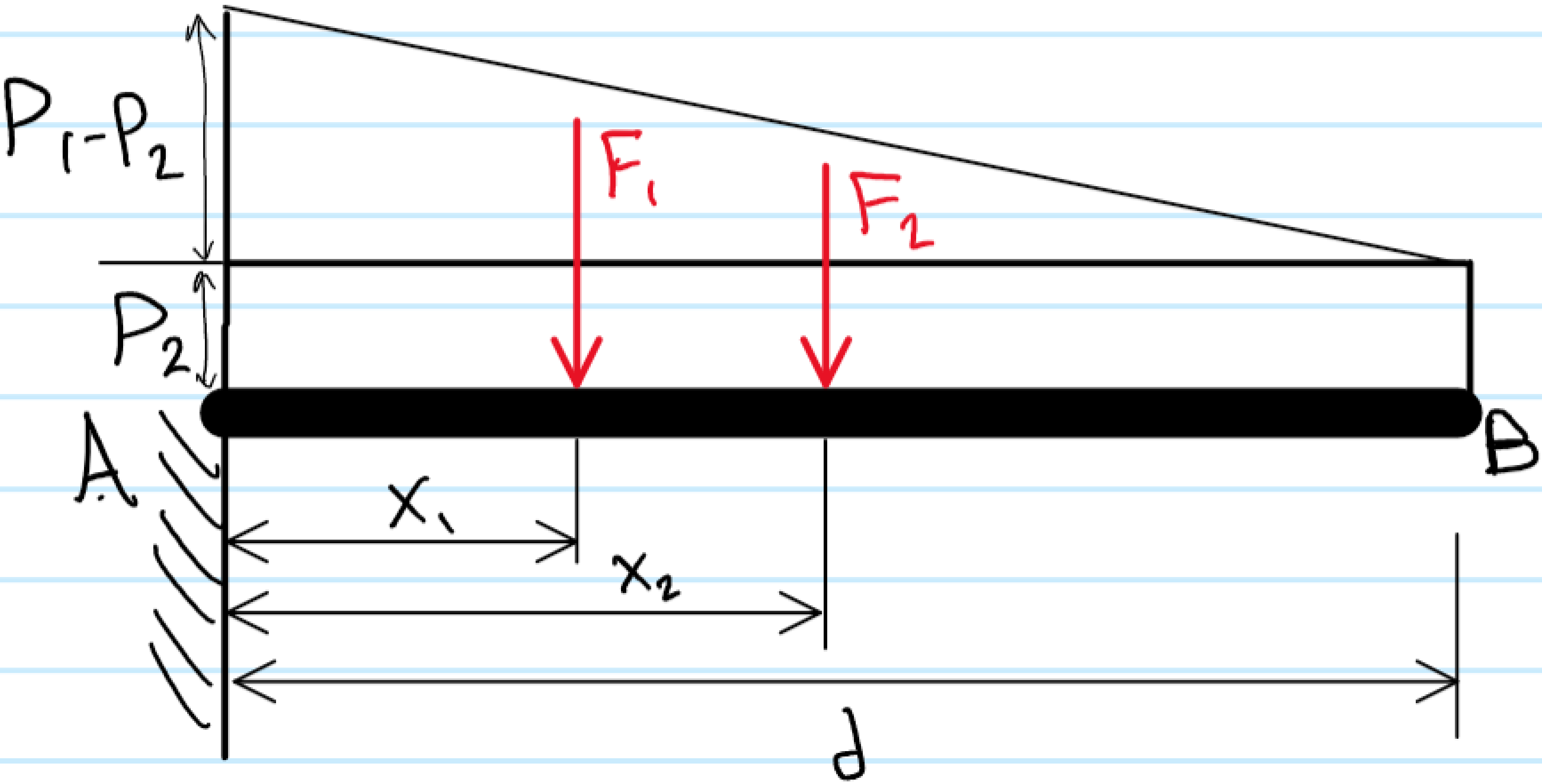
x



The loading area can be split into two smaller areas. Each line of action passes through its respective centroid.

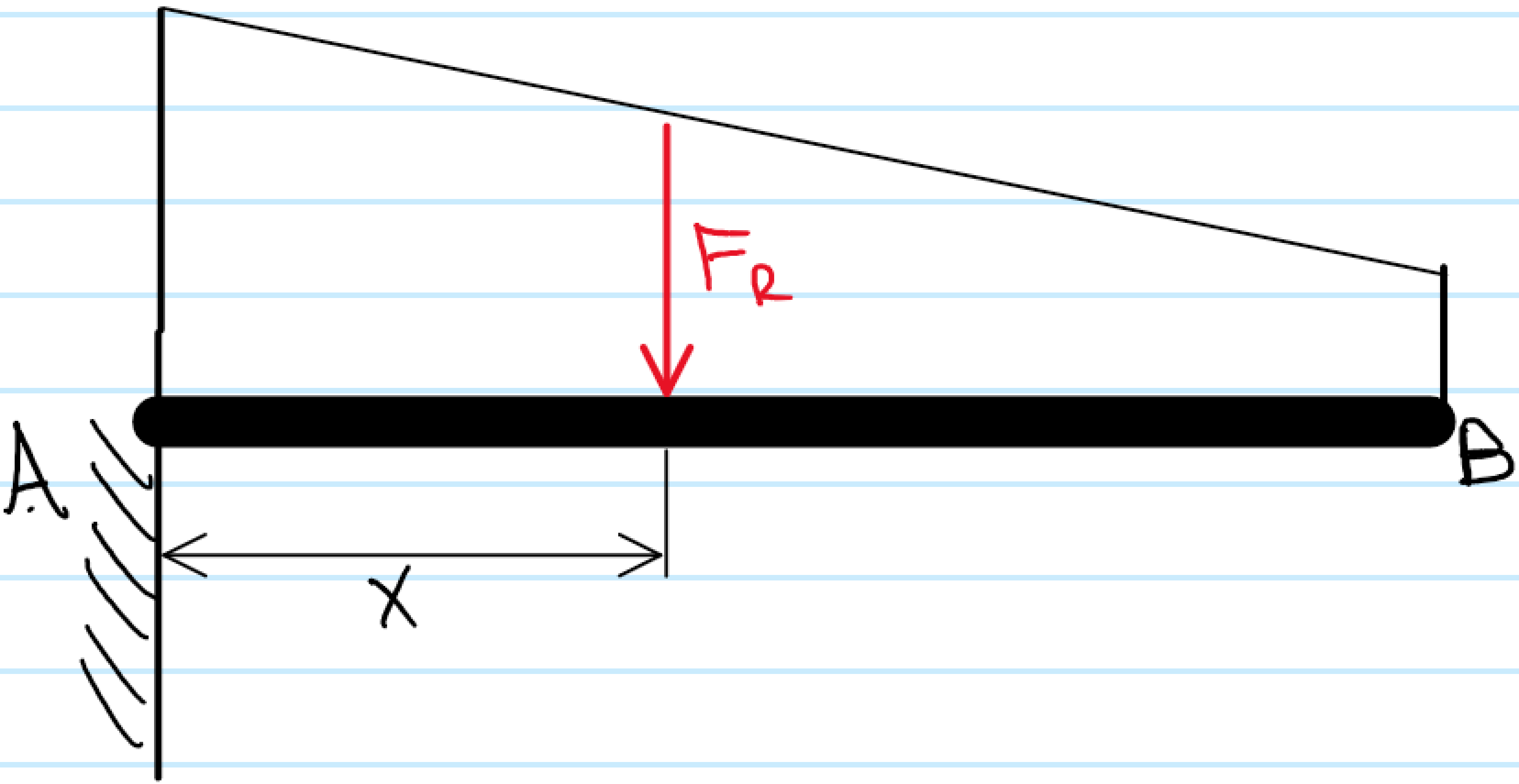
$F_1 = \frac{1}{2}(P_1 - P_2)d \qquad x_1 = \frac{1}{3}d$ (triangle)

$F_2 = P_2 d \qquad x_2 = \frac{1}{2}d$ (rectangle)



F_1 and F_2 can be reduced to a single resultant force F_R.

$$F_R = F_1 + F_2$$



To find the resultant force's location, the moments about A must be equated.

$$\circlearrowright + (M_R)_A = \Sigma M_A: \quad F_R x = F_1 x_1 + F_2 x_2$$

$$x = \frac{F_1 x_1 + F_2 x_2}{F_R}$$