

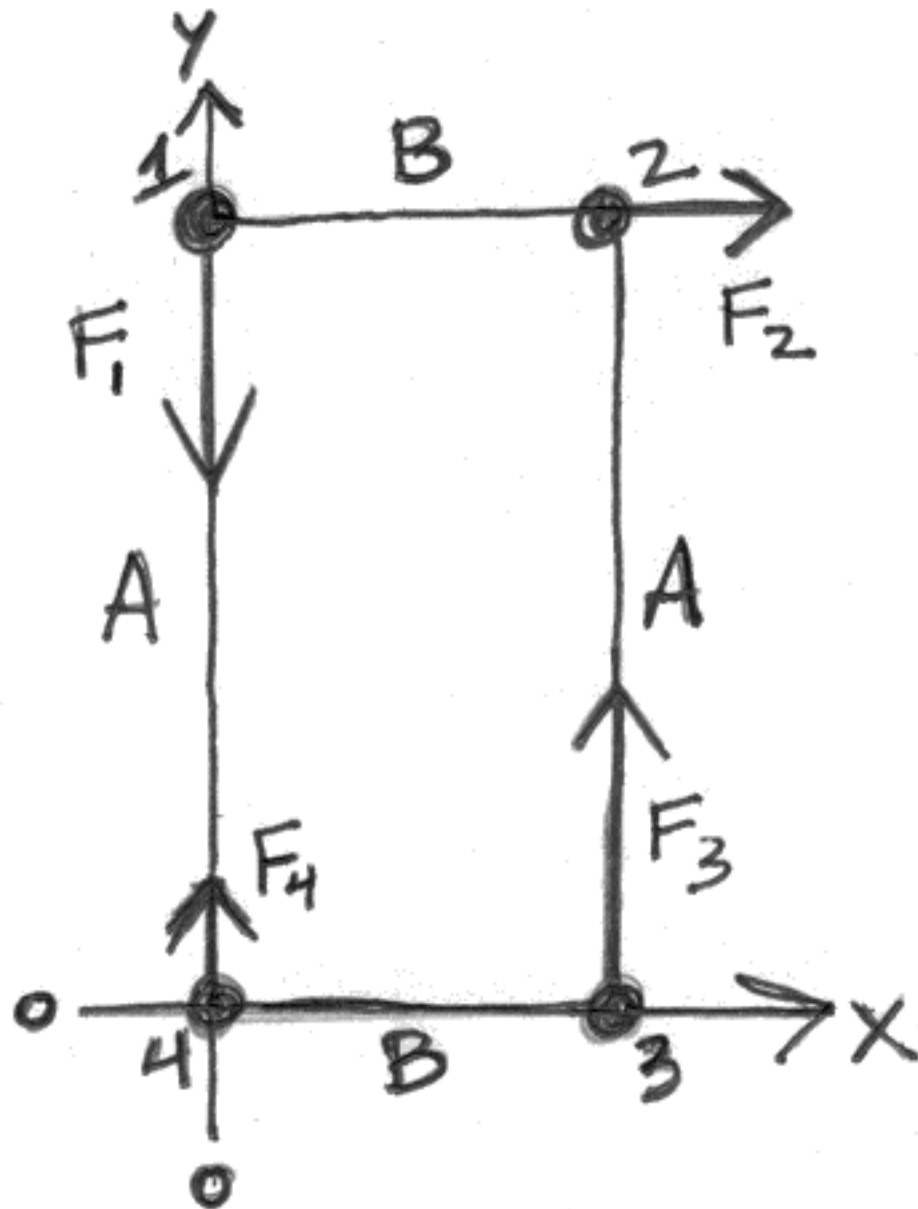
### A:(10 pts) Center of Mass of Four Point Masses

Four point masses are arranged in a rectangle as shown. Their masses are  $m_1 = 6g$ ,  $m_2 = 9g$ ,  $m_3 = 16g$ , and  $m_4 = 19g$ . The sides of the rectangle have lengths  $A = 4cm$  and  $B = 2cm$ . What are the coordinates  $(x, y)$  of the system center of mass? Forces are acting on each of the masses as shown, where  $F_1 = 6N$ ,  $F_2 = 4N$ ,  $F_3 = 8N$ , and  $F_4 = 2N$ . What is the magnitude  $a$  of the acceleration of the system center of mass?

•(3pts)  $x =$  \_\_\_\_\_

•(3pts)  $y =$  \_\_\_\_\_

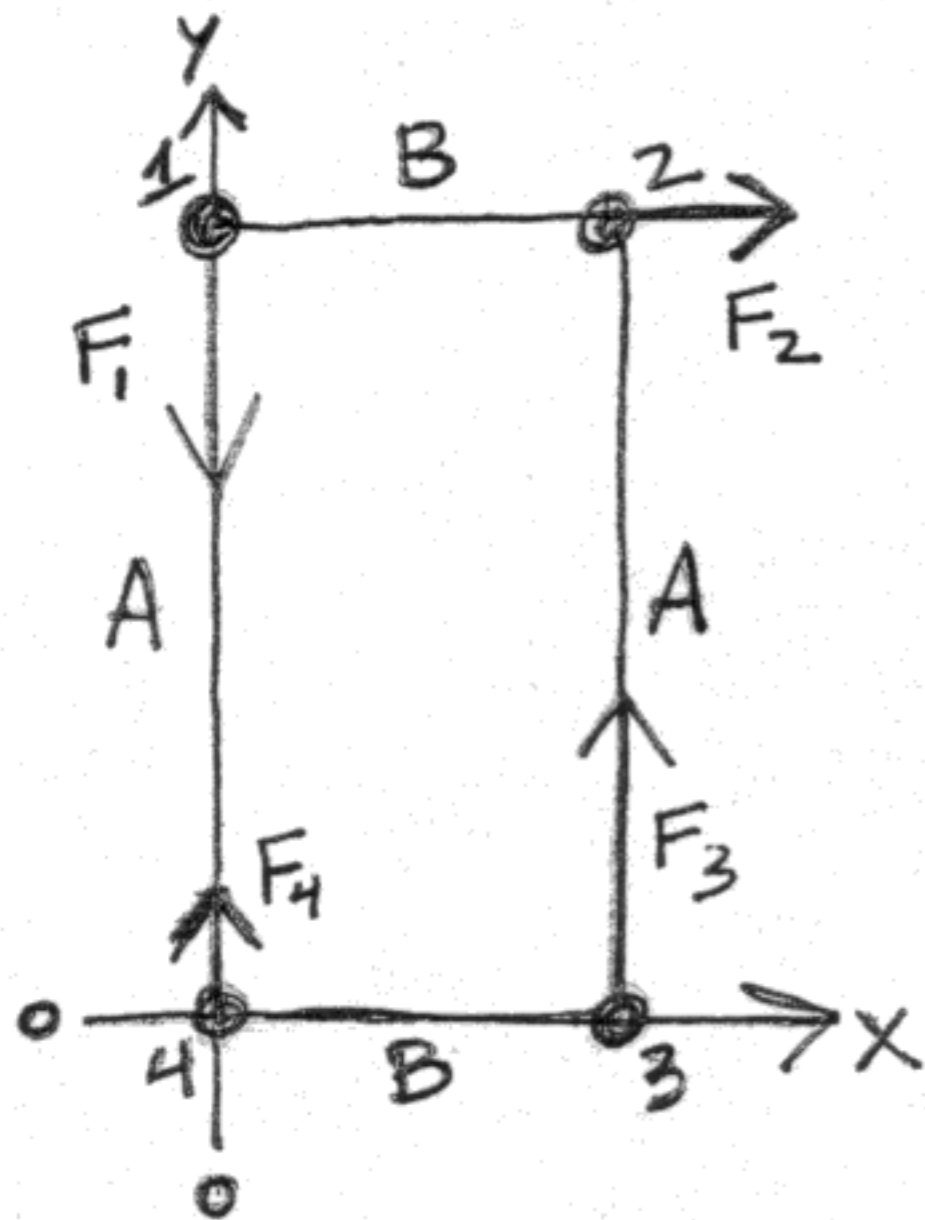
•(4pts)  $a =$  \_\_\_\_\_



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- (3pts)  $x = \underline{+1 \text{ cm}}$
- (3pts)  $y = \underline{+1.2 \text{ cm}}$
- (4pts)  $a = \underline{113 \text{ m/s}^2}$



$$M = m_1 + m_2 + m_3 + m_4 = \underline{50g} = .05 \text{ kg}$$

$$x = \frac{m_1 x_1 + m_2 x_2 + m_3 x_3 + m_4 x_4}{M} =$$

$$= \frac{m_2 B + m_3 B}{M} = \boxed{+1 \text{ cm}}$$

$$y = \frac{m_1 y_1 + m_2 y_2 + m_3 y_3 + m_4 y_4}{M}$$

$$= \frac{m_1 A + m_2 A}{M} = \boxed{+1.2 \text{ cm}}$$

$$F_x = F_2 = +4N$$

$$F_y = F_3 + F_4 - F_1 = +4N$$

$$F = \sqrt{F_x^2 + F_y^2} = 4\sqrt{2}N = \boxed{5.65685N}$$

$$a = F/M = \frac{4\sqrt{2}N}{.05 \text{ kg}} = \boxed{113.137 \text{ m/s}^2}$$