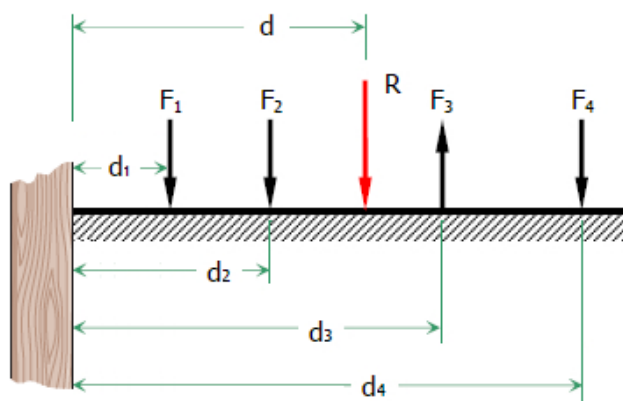




2.2 Resultant of Coplanar Parallel Force System

Parallel forces can be in the same or in opposite directions. The magnitude of the parallel resultant force R is the magnitude of the algebraic sum of the given forces.



$$\uparrow^+ R = \sum F_i$$

$$R = -F_1 - F_2 + F_3 - F_4$$

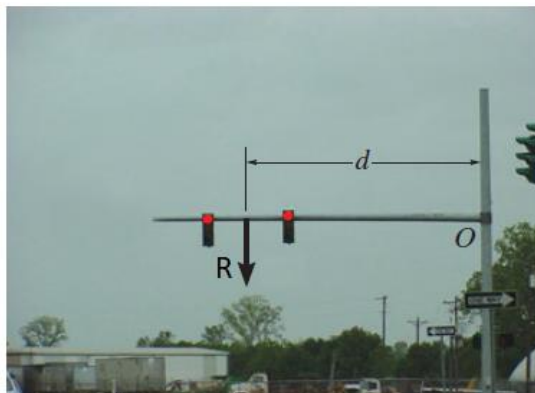
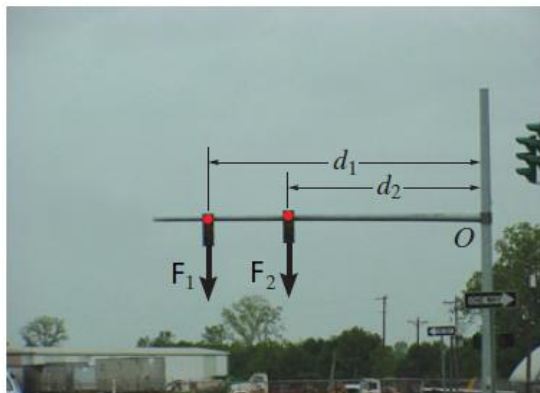
The position of the resultant can be determined according to the principle of moments.

$$\curvearrowright M_R = R \cdot d = \sum F_i \cdot d_i$$

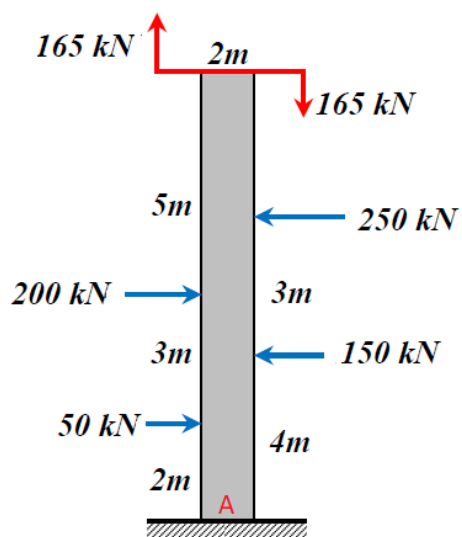
$$R \cdot d = F_1 \cdot d_1 + F_2 \cdot d_2 - F_3 \cdot d_3 + F_4 \cdot d_4$$



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Example No. 1: For the force system shown in figure, determine the magnitude and position of the resultant with respect to point A.



Solution:

$$M_{couple} = 165 \times 2 = 330 \text{ kN.m} \quad \curvearrowright$$



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$$\rightarrow^+ R = \sum F_i$$

$$R = 200 + 50 - 250 - 150$$

$$R = -150 \text{ kN} = 150 \text{ kN} \leftarrow$$

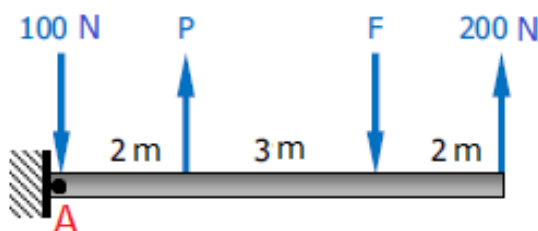
$$\curvearrowright R \cdot d = \sum F_i \cdot d_i \quad (\text{Respect to } A)$$

$$-150 \cdot d = 200 \times 5 + 50 \times 2 - 250 \times 7 - 150 \times 4 + 330$$

$$d = \frac{-920}{-150}$$

$$d = 6.13 \text{ m}$$

Example No. 2: Find the value of P and F so that the four forces shown in Figure produce an upward resultant of 300 N acting at 4 m from point A.





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Solution:

$$\uparrow^+ R = \sum F_i$$

$$300 = -100 + P - F + 200$$

$$P = 200 + F \dots \dots \dots (1)$$

$$\curvearrowright R \cdot d = \sum F_i \cdot d_i \quad (\text{respect to } A)$$

$$-300 \times 4 = 100 \times 0 - P \times 2 + F \times 5 - 200 \times 7$$

$$-2P + 5F - 200 = 0 \dots \dots \dots (2)$$

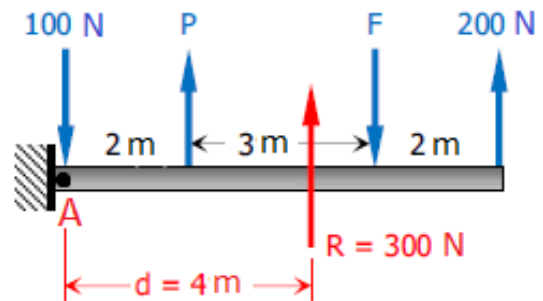
Sub eq. (1) in eq. (2) to get:

$$-2(200 + F) + 5F - 200 = 0$$

$$F = 200 \text{ N } \downarrow,$$

Sub value of (F) in eq. (1) to get;

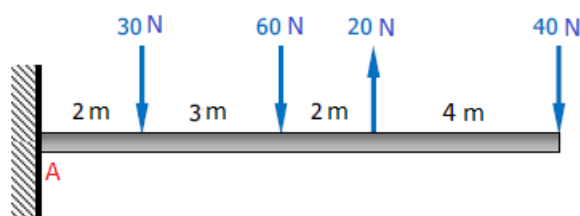
$$P = 400 \text{ N } \uparrow$$





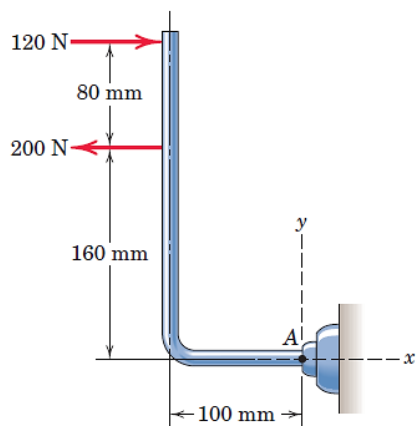
Problems:

1. A parallel force system acts on the cantilever beam shown in Figure. Determine the magnitude and position of the resultant.



Answer: $R = 110\text{ N} \downarrow$, $d = 6\text{ m}$ from point A

2. Compute the magnitude and position of the resultant of the two forces acting on a beam with respect to point A as shown in Figure.

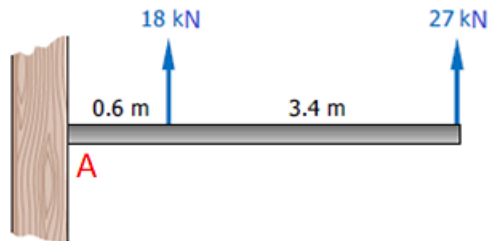


Answer: $R = 80\text{ N} \leftarrow$, $d = 40\text{ mm}$ up point A

3. The resultant of three parallel loads (one is missing in Figure below) is 13.6 kN acting up at 3 m to the right of A. Compute the magnitude and position of the missing load.



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Answer: $F = 31.4 \text{ kN} \downarrow$ at 2.48 m to the right of A