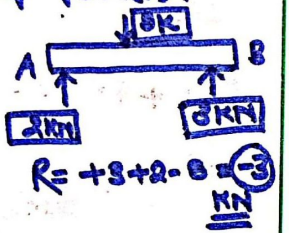
B.T.E.U.P. 2003, 06, 07, 10, 11, 12

Varignon's theorem:-

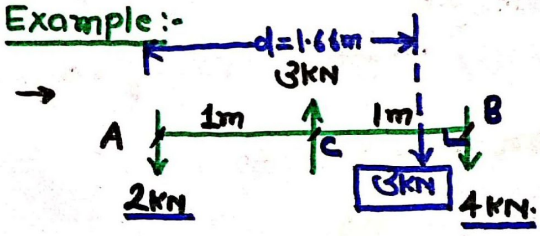
→ It states that, "The sum of moments of all the forces will be equal to the moment produced by the resultant of forces".

Mathematically;

⇒ $\boxed{\Sigma M_A = R \times d}$



Example:-



Resultant (R) = ΣF_y (↑⊕ve : ↓⊖ve)

$R = -2+3-4$

$R = -3$ KN (↓ward) (Magnitude)

Location of Resultant:-

By Varignon's theorem of moments

$\boxed{\Sigma M_A = R \times d}$ —① (↺ +ve ↻ −ve)

$\Sigma M_A = (+3\times1 - 4\times2) + (2\times0)$

$[\Sigma M_A = 3-8 = \underline{-5 \text{ KN-m}}$ (C.W.)] —②

from ① –

$-3 \times d = -5$ KN-m

$d = \frac{-5}{-3} = \frac{5}{3}$ m

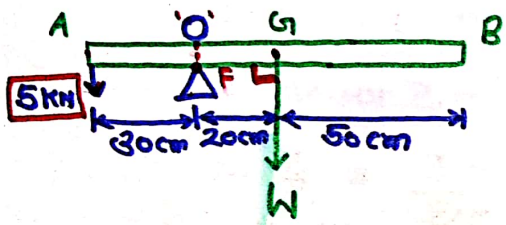
$\boxed{d = 1.66 \text{ m}}$ Position: W.R.T. point A.

Note:- Can be used to find out the location of resultant for Coplanar ≠ Non-Concurrent forces system.

B.T.E.U.P. 1977 :-

Question:- A uniform rod of length 1m is balanced by putting a 5KN load on one end of rod from 30cm of balanced point. Find the weight of the rod.

Solve:- Given data -



By taking Moment at point 'O' -

$$+(5 \times 30 - W \times 20) = 0$$

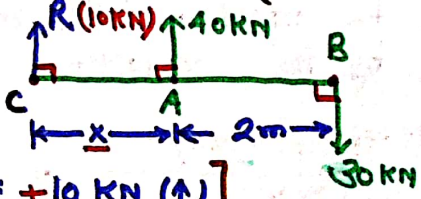
$$\left[W = \frac{150}{20} = 7.5 \text{ KN}\right]$$ Ans.

B.T.E.U.P. 2001

Question:- Find the magnitude and direction of Resultant of 2- different parallel forces. (unlike). as shown.

Given data.

$\Sigma F = 0$



$$[R = +40 - 30 = +10 \text{ KN } (\uparrow)]$$ magnitude.

Taking Moment about C -

$\Sigma M_C = 0$

$$+(40 \times x)\uparrow - [30 \times (x+2)]\downarrow = 0$$

$$40x = 30x + 60$$

$$10x = 60$$

$$[x = 6\text{m}]$$ Position direction.

Ans.