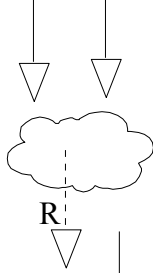
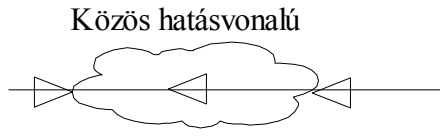


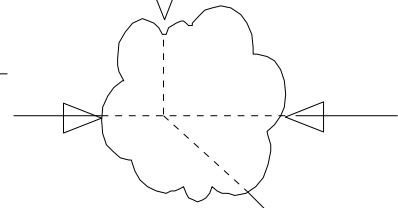
Párhuzamos hatásvonalú



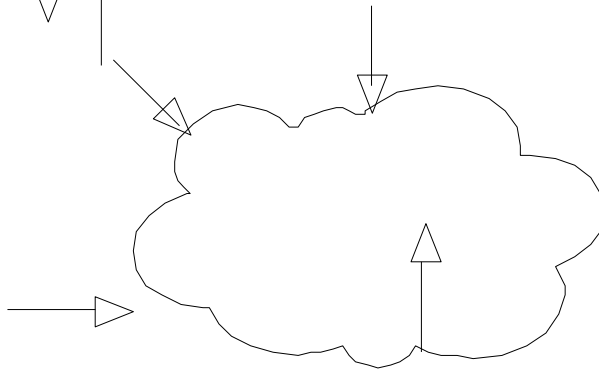
Erőrendszer eredője



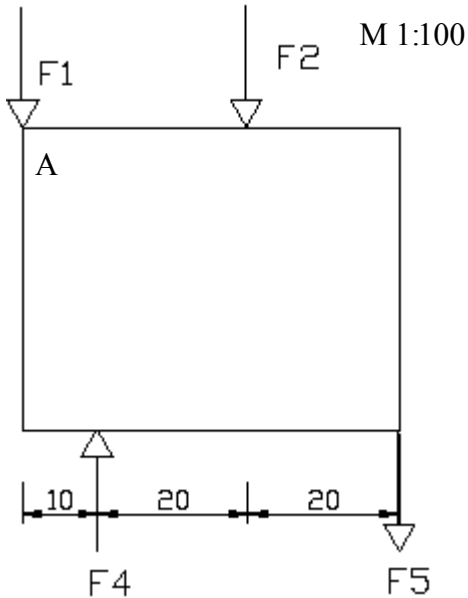
Közös metszéspontú



Az eredő a közös metszéspontból fog kiindulni

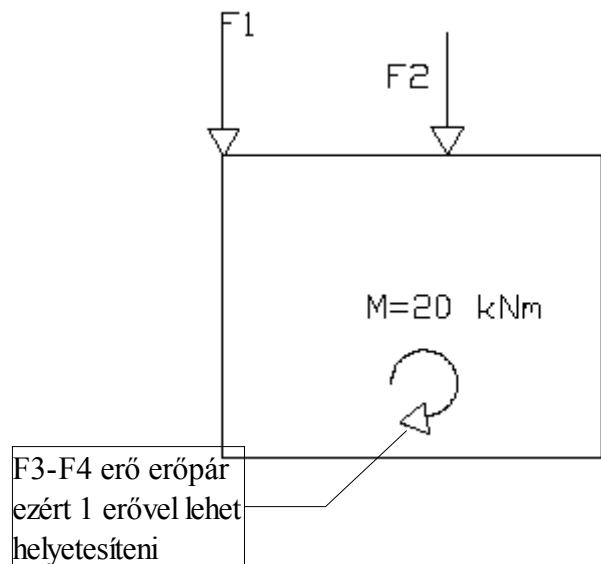


Szétszórt erő rendszer



Erőpár

- F1= 8 kN
- F2= 6 kN
- F3= 5 kN
- F4= 5 kN



Az erőpár: a test bármely pontjára ugyan akkora erővel hat

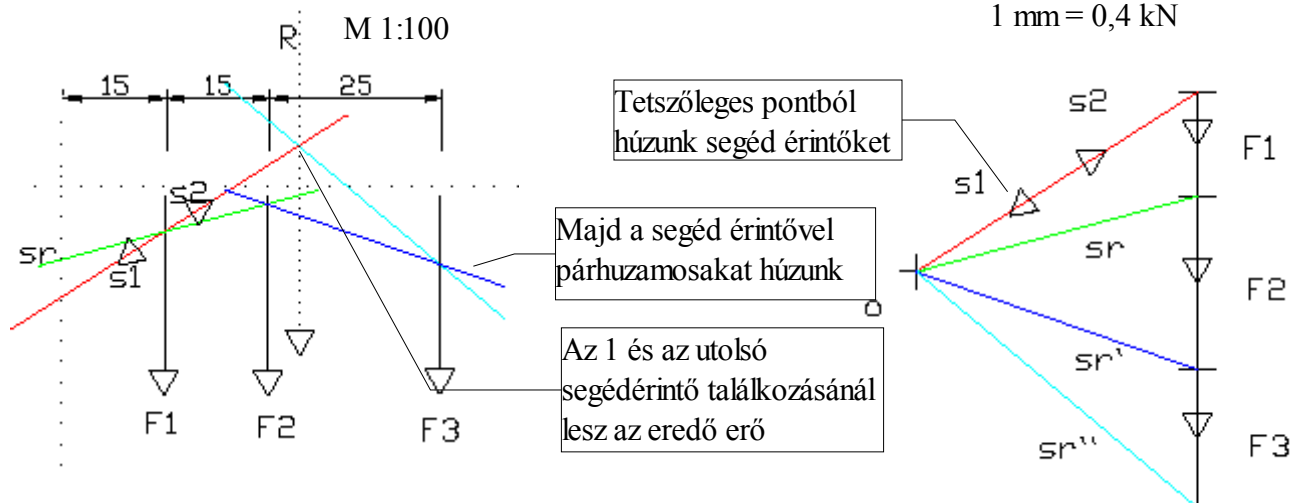
Az A ponttól az eredő erő

$$R_x = 0$$

$$R_y = \sum F_x \quad R_y = F_1 + F_3 + F_3 - F_4 = 14 \text{ kN}$$

$$\sum M_A = R_y * x_r \quad F_2 * 3 + M = 14 * x \Rightarrow x = \frac{6 * 3 + 20}{14} = [2,71 \text{ m}]$$

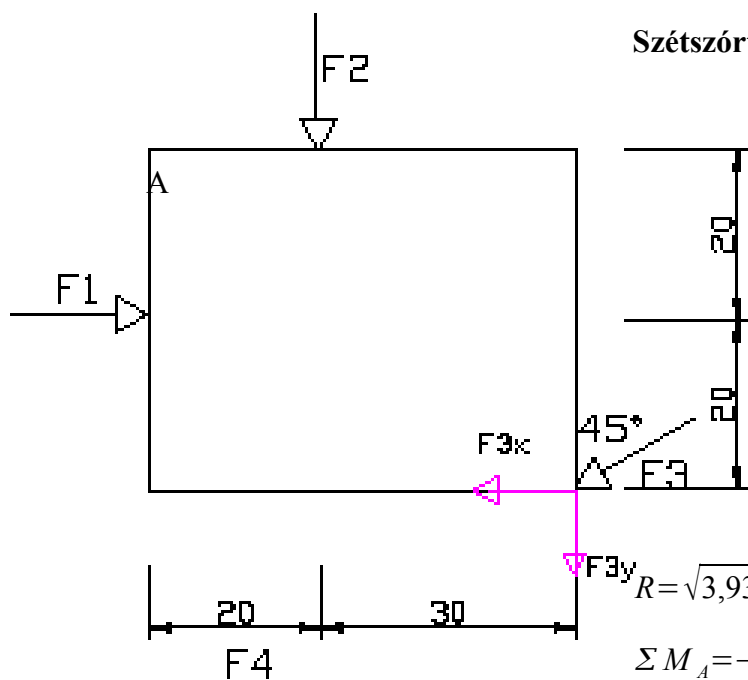
## Párhuzamos erő



$$R = F_1 + F_2 + F_3 = 24 \text{ kN}$$

$$R * x = F_1 * 1,5 + F_2 * 3 + F_3 * 5,5 \Rightarrow x = \frac{F_1 * 1,5 + F_2 * 3 + F_3 * 5,5}{R} = 3,46 \text{ m}$$

## Szétszórt erőrendszer



$$F_1 = 11 \text{ kN}$$

$$F_2 = 10 \text{ kN}$$

$$F_3 = 10 \text{ kN}$$

$$F_{3x} = F_3 * \sin 45 = 7,071 \text{ kN}$$

$$F_{3y} = F_3 * \cos 45 = 7,071 \text{ kN}$$

$$R_x = \sum F_x = F_1 - F_{3x} = 11 - 7,071 = 3,93 \text{ kN}$$

$$R_y = \sum F_y = F_2 + F_{3y} = 10 + 7,071 = 17,07 \text{ kN}$$

$$\operatorname{tg} \alpha = \frac{R_y}{R_x} = \frac{17,07}{3,93} = 4,34 \Rightarrow \alpha = 77,03^\circ$$

$$R = \sqrt{3,93^2 + 17,07^2} = 17,52 \text{ kN}$$

$$\sum M_A = -F_1 * 2 + F_2 * 2 + F_{3x} * 4 + F_{3y} * 5 = 61,63 \text{ kNm}$$

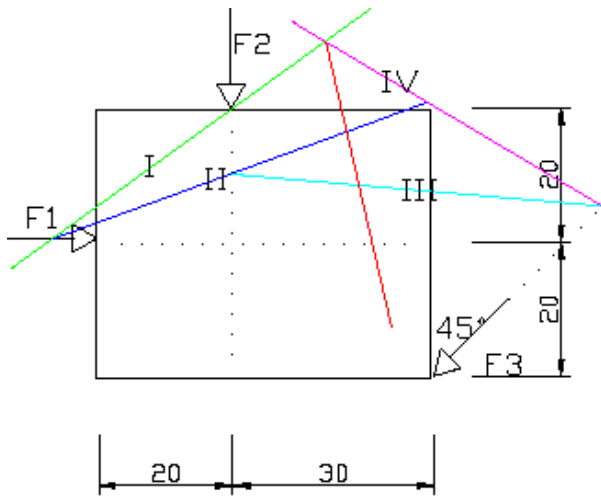
A vonalát x tengelyen milyen távolságra metszi

$$\sum M_A = R_y * x \Rightarrow x = \frac{\sum M_A}{R_y} = \frac{61,63}{17,07} = 3,61 \text{ m}$$

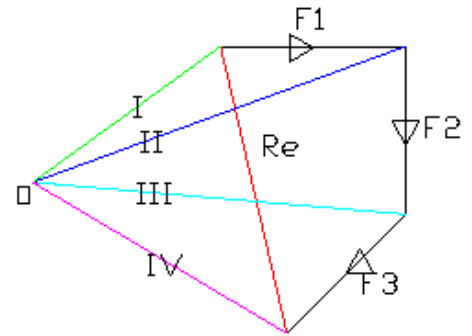
A vonalát y tengelyen milyen távolságra metszi

$$\sum M_A = R_x * x \Rightarrow x = \frac{\sum M_A}{R_x} = \frac{61,63}{3,93} = 15,68 \text{ m}$$

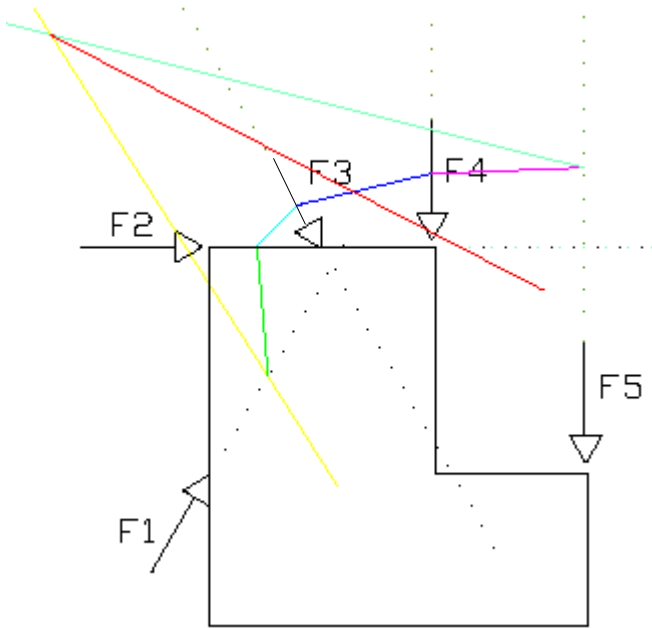
## Megoldás szerkesztéssel



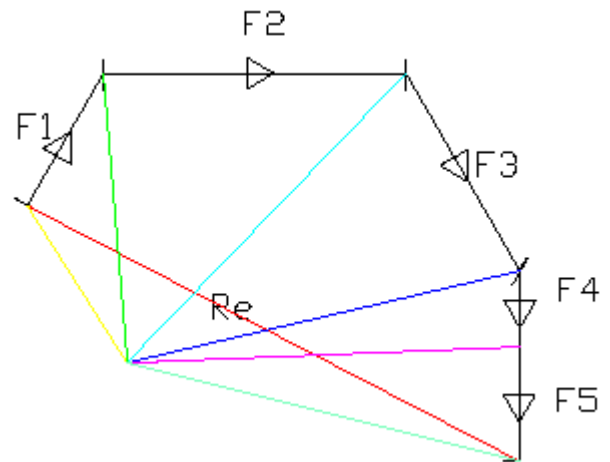
1 mm (=) 0,4 kN



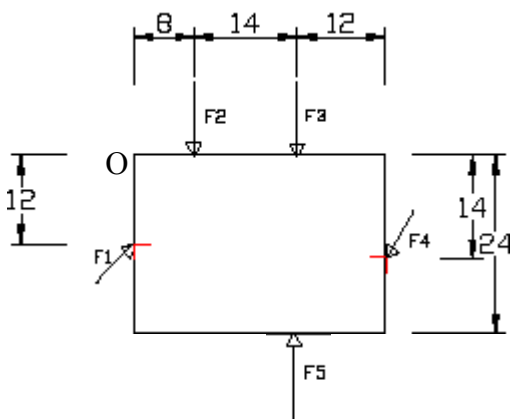
## Házi feladat



1 mm (=) 0,2 kN



## Gyakorló feladatok



- F1= 6 kN
- F2= 11 kN
- F3= 8 kN (5kN)
- F4= 10 kN
- F5= 3 kN

**Statika I alaptétele** alapján az F3 és F5 erőt össze lehet vonni ezért  $F_3 - F_5 = 8 - 3 = 5 \text{ kN}$

Felbontjuk az erőket x és y

$$F_{1x} = F_1 * \sin 45 = 6 * \sin 45 = 4,24 \text{ kN} \quad F_{1y} = F_1 * \cos 45 = 6 * \cos 45 = 4,24 \text{ kN}$$

$$F_{4x} = F_4 * \sin 30 = 10 * \sin 30 = 5 \text{ kN} \quad F_{4y} = F_4 * \cos 30 = 10 * \cos 30 = 8,66 \text{ kN}$$

$$R_x = \Sigma F_x = F_{1x} - F_{4x} = 4,24 - 5 = -0,76 \text{ kN}$$

$$R_y = \Sigma F_y = F_{1y} - F_2 - F_3 - F_{4y} = 4,24 - 11 - 5 - 8,66 = -20,42 \text{ kN}$$

$$R = \sqrt{(R_x^2 + R_y^2)} = \sqrt{(0,76^2 + 20,42^2)} = 20,43 \text{ kN}$$

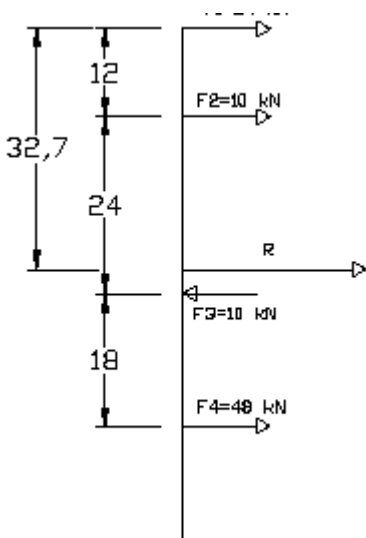
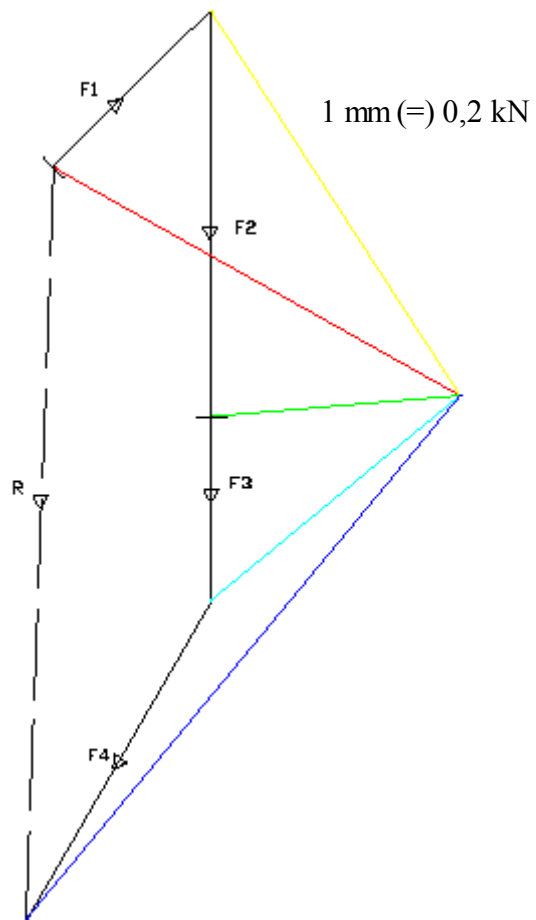
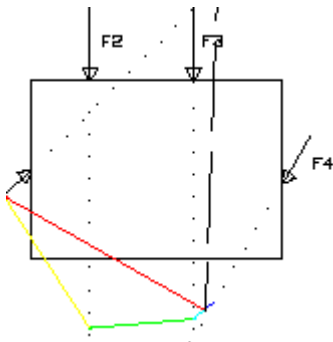
$$\Sigma M_O = -F_{1x} * 1,2 + F_2 * 0,8 + F_3 * 2,2 + F_{4x} * 1,4 + F_{4y} * 3,4$$

$$-4,24 * 1,2 + 11 * 0,8 + 5 * 2,2 + 5 * 1,4 + 8,66 * 3,4 = 51,156 \text{ kNm}$$

$$\Sigma M_O = R_y * x_R \Rightarrow x_R = \frac{\Sigma M_O}{R_y} = \frac{51,156}{20,42} = 2,5 \text{ m}$$

$$\Sigma M_O = R_x * y_R \Rightarrow y_R = \frac{\Sigma M_O}{R_x} = \frac{51,156}{0,76} = 67,31 \text{ m}$$

Megoldás szerkesztéssel



$$R = F_1 + F_2 - F_3 + F_4 = 24 + 10 - 10 + 48 = 72 \text{ kN}$$

$$\Sigma M_o = -F_2 * 1,2 + F_3 * 3,6 - F_4 * 5,4 = 235,2 \text{ kNm}$$

$$y_R = \Sigma \frac{M_o}{R} = \frac{235,2}{72} = 3,27 \text{ m}$$

