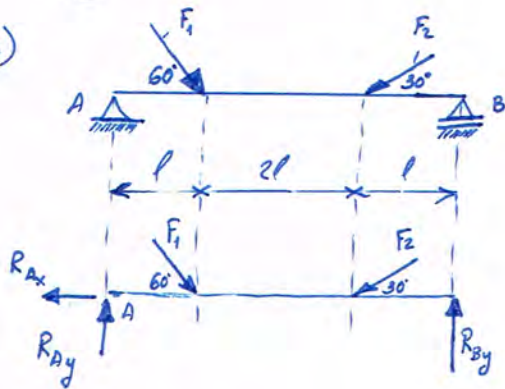


1. Za grede prikazane i opterećene kao na slici odrediti reakcije u osloncima, dato je: $F_1 = 20\sqrt{3}$; $F_2 = 40$ kN; $l = 1$ m

(8)



$$(1) \sum F_x = 0; F_1 \cdot \cos 60^\circ - F_2 \cdot \cos 30^\circ - R_{Ax} = 0$$

$$(2) \sum F_y = 0; R_{Ay} + R_{By} - F_1 \cdot \sin 60^\circ - F_2 \cdot \sin 30^\circ = 0$$

$$(3) \sum M_A = 0; R_{By} \cdot 4l - F_2 \cdot \sin 30^\circ \cdot 3l - F_1 \cdot \sin 60^\circ \cdot l = 0$$

$$(3) \Rightarrow 4 \cdot R_{By} - \frac{3 \cdot F_2}{2} - F_1 \cdot \frac{\sqrt{3}}{2} \cdot 1 = 0$$

$$R_{By} = \left(\frac{F_1 \sqrt{3}}{2} + \frac{F_2 \cdot 3}{2} \right) \cdot \frac{1}{4}$$

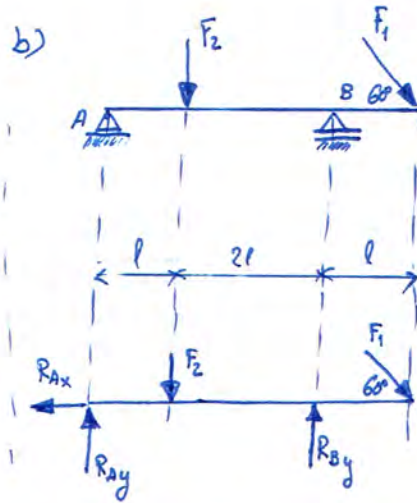
$$R_{By} = 22,5 \text{ kN}$$

$$(2) \Rightarrow R_{Ay} = F_2 \cdot \frac{1}{2} + F_1 \cdot \frac{\sqrt{3}}{2} - R_{By}$$

$$R_{Ay} = 27,5 \text{ kN}$$

$$(1) \Rightarrow R_{Ax} = \frac{F_1}{2} - F_2 \cdot \frac{\sqrt{3}}{2}$$

$$R_{Ax} = 10\sqrt{3}$$



$$(1) \sum F_x = 0; F_1 \cdot \cos 60^\circ - R_{Ax} = 0$$

$$(2) \sum F_y = 0; R_{Ay} + R_{By} - F_2 - F_1 \cdot \sin 60^\circ = 0$$

$$(3) \sum M_A = 0; F_1 \cdot \sin 60^\circ \cdot 4l - R_{By} \cdot 3l + F_2 \cdot l = 0$$

$$R_{By} = \frac{F_2 \cdot l + F_1 \cdot \frac{\sqrt{3}}{2} \cdot 4l}{3l}$$

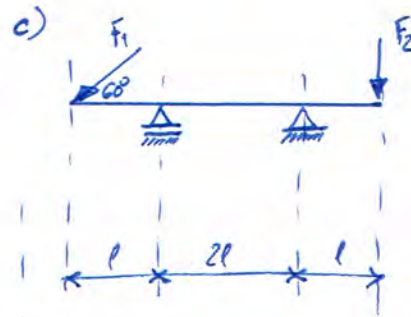
$$R_{By} = \frac{F_2 + 2F_1 \sqrt{3}}{3}; R_{By} = 53,33 \text{ kN}$$

$$(2) \Rightarrow R_{Ay} = F_1 \cdot \frac{\sqrt{3}}{2} + F_2 - R_{By}$$

$$R_{Ay} = 16,67 \text{ kN}$$

$$(1) \Rightarrow R_{Ax} = F_1 \cdot \frac{1}{2}$$

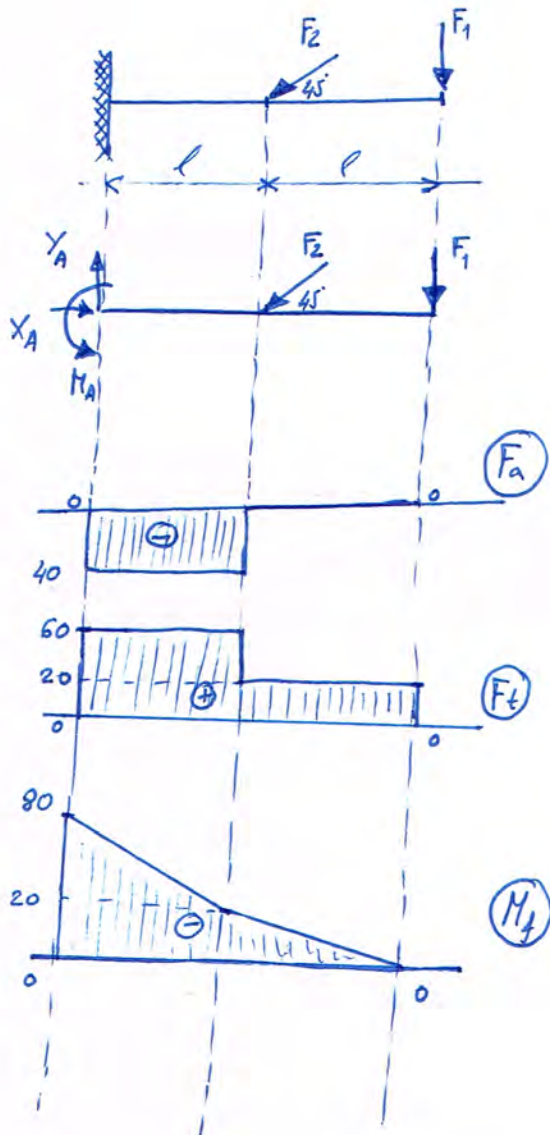
$$R_{Ax} = 10\sqrt{3}$$



2. Za gredu opterećenu kao na slici:

- a) odrediti reakcije oslonaca
 b) nacrtati statičke dijagrame

Podaci: $F_1 = 20 \text{ kN}$; $F_2 = 40\sqrt{2} \text{ kN}$; $l = 1 \text{ m}$



$$a) (1) \sum F_x = 0; \quad X_A - F_2 \cdot \cos 45^\circ = 0$$

$$(2) \sum F_y = 0; \quad Y_A - F_1 - F_2 \cdot \sin 45^\circ = 0$$

$$(3) \sum M_A = 0; \quad F_1 \cdot 2l + F_2 \cdot \sin 45^\circ \cdot l - M_A = 0$$

$$(1) \Rightarrow X_A = F_2 \cdot \cos 45^\circ \Rightarrow \boxed{X_A = 40 \text{ kN}}$$

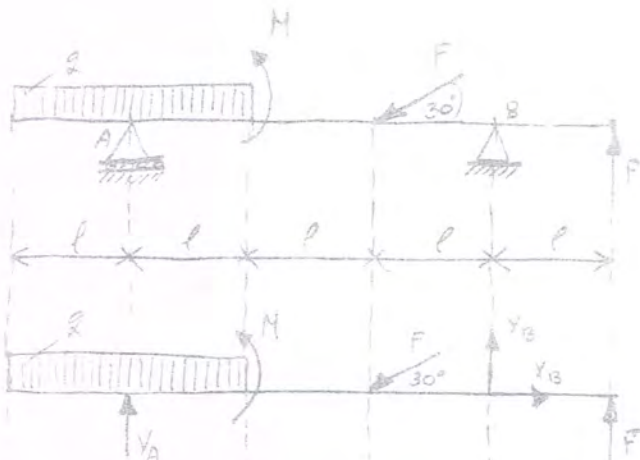
$$(2) \Rightarrow Y_A = F_2 \cdot \frac{\sqrt{2}}{2} + F_1$$

$$\boxed{Y_A = 60 \text{ kN}}$$

$$(3) \Rightarrow M_A = F_1 \cdot 2 + F_2 \cdot \frac{\sqrt{2}}{2}$$

$$\boxed{M_A = 80 \text{ kNm}}$$

4. Za grafu prikazanu na slici odrediti reakcije veza i nacrtati statičke dijagrame, ako je $l=10$; $F=10\text{ kN}$; $M=F \cdot l$; $q=F/l$



$$\sum F_x = 0;$$

$$-F \cdot \cos 30^\circ + X_B = 0$$

$$X_B = 5\sqrt{3}$$

$$\sum F_y = 0;$$

$$-q \cdot 2l + Y_A - F \cdot \sin 30^\circ + Y_B + F = 0$$

$$Y_A + Y_B = F \cdot \sin 30^\circ - F + 2F$$

$$Y_A + Y_B = \frac{2F}{2}$$

$$Y_A + Y_B = \frac{2 \cdot 10}{2}; Y_A + Y_B = 15$$

$$\sum M_A = 0;$$

$$F \cdot 4l + Y_B \cdot 2l - F \cdot \sin 30^\circ \cdot 2l + M = 0$$

$$3 \cdot Y_B = F \cdot \sin 30^\circ \cdot 2 - M - F \cdot 4$$

$$Y_B = \frac{1}{3} (10 \cdot \frac{1}{2} \cdot 2 - 10 - 10 \cdot 4)$$

$$Y_B = -\frac{60}{3}$$

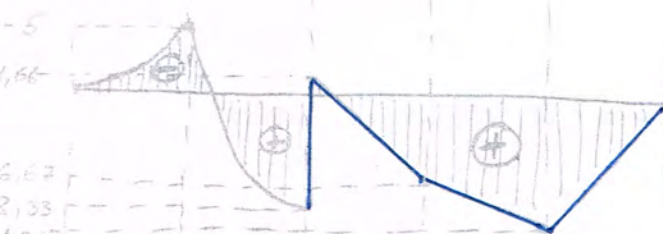
$$Y_A = \frac{85}{3}$$



(F_Q)



(M)



(M_f)

6.67
8.33
10

3. Za grednu opterećenju kao na slici:

- odredite reakcije oslonaca i nacrtajte statičke dijagrame

Podaci: $q = 20 \frac{\text{kN}}{\text{m}}$; $F = 40 \text{ kN}$

$$F_q = q \cdot l$$

$$F_q = 20 \frac{\text{kN}}{\text{m}} \cdot 2 \text{ m}$$

$$F_q = 40 \text{ kN}$$

$$(1) \sum F_x = 0 \quad X_A = 0$$

$$(2) \sum M_A = 0;$$

$$F_q \cdot 3l - Y_B \cdot 2l + F \cdot l = 0 \quad /:l$$

$$3 \cdot F_q - 2 \cdot Y_B + F = 0$$

$$2 \cdot Y_B = 3 F_q + F$$

$$Y_B = \frac{1}{2} (3 F_q + F)$$

$$Y_B = 80 \text{ kN}$$

$$(3) \sum F_y = 0;$$

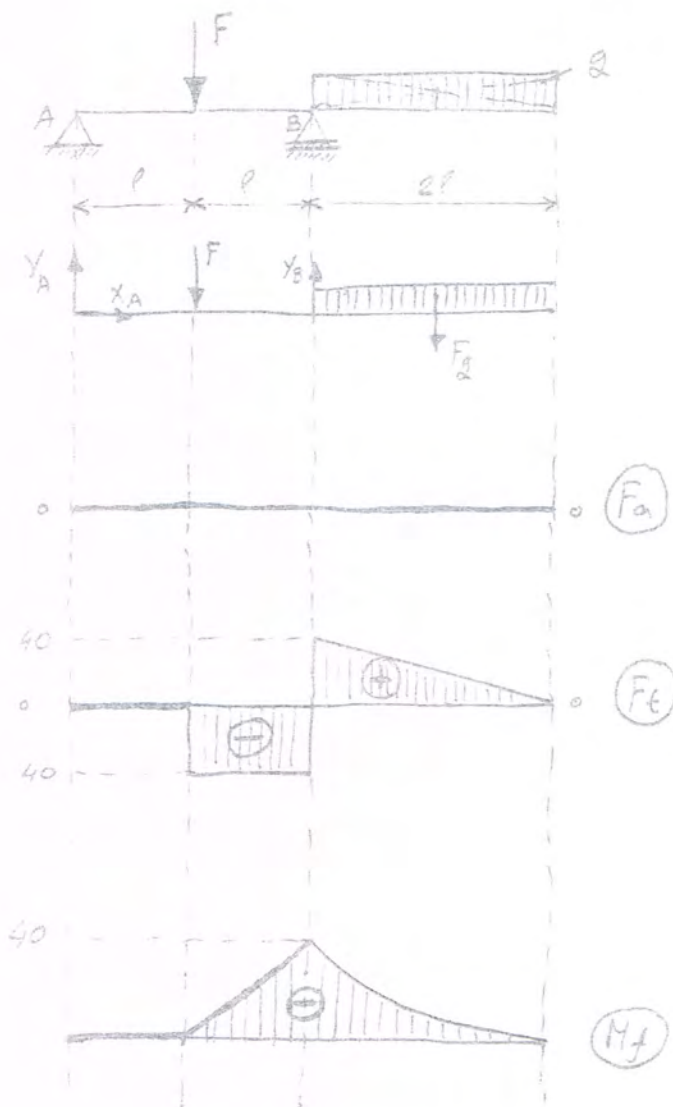
$$Y_A + Y_B - F - F_q = 0$$

$$Y_A + Y_B = F + F_q$$

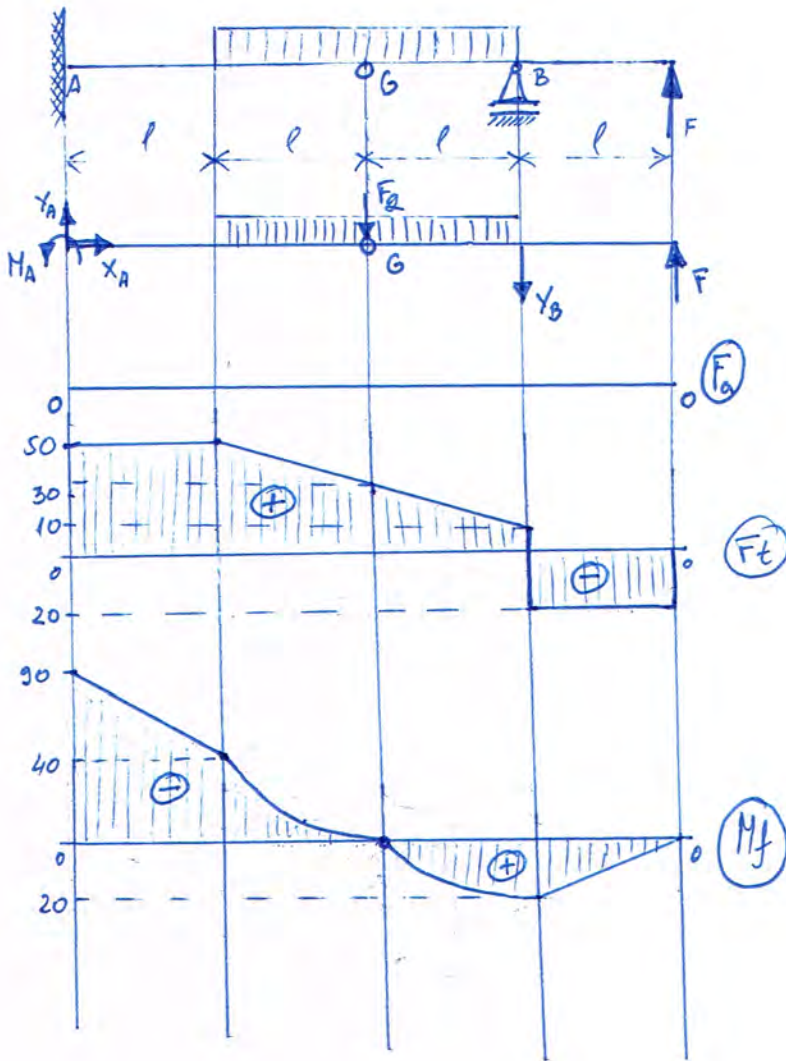
$$Y_A + Y_B = 80 \text{ kN}$$

$$Y_A = 80 - Y_B$$

$$Y_A = 0$$



1. Za konzolu prikazanu na slici odrediti reakcije oslonaca i nacrtati statičke dijagrame. Dato je: $F=20\text{ kN}$; $l=1\text{ m}$; $q=\frac{F}{l}$



$$F_q = q \cdot 2l = \frac{F}{l} \cdot 2l = 2F$$

$$\sum F_x = 0;$$

$$\sum F_y = 0; F - Y_B + Y_A - F_q = 0$$

$$Y_A - Y_B = F$$

$$\sum M_G^D = 0;$$

$$F \cdot 2l - Y_B \cdot l - q \cdot l \cdot \frac{l}{2} = 0$$

$$2F - Y_B - \frac{F}{2} = 0$$

$$Y_B = \frac{3F}{2}; \quad Y_B = 30\text{ kN}$$

$$Y_A = 50\text{ kN}$$

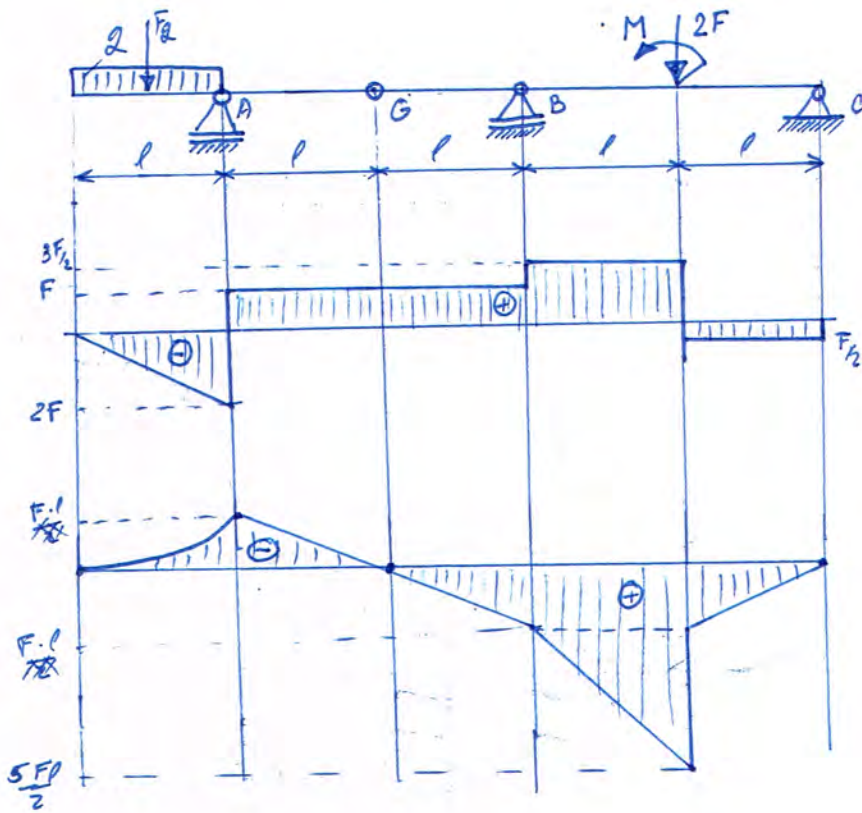
$$\sum M_A = 0;$$

$$F \cdot 4l - Y_B \cdot 3l - F_q \cdot 2l + M_A = 0$$

$$M_A = 4Fl + \frac{9Fl}{2} - 4Fl$$

$$M_A = 90\text{ kNm}$$

2. Za gredu prikazanu na slici odrediti reakcije oslonaca i nacrtati statičke dijagrame. Dato je: $F, l, M=2F \cdot l; q=\frac{2F}{l}$
 $F_g = 2 \cdot l = 2F$



$$\sum M_G^l = 0;$$

$$F_g \cdot \frac{3l}{2} - Y_A \cdot l = 0$$

$$Y_A = F_g \cdot \frac{3}{2}; \quad Y_A = \frac{3F}{2}$$

$$\sum M_C = 0;$$

$$-M + Y_A \cdot 4l + Y_B \cdot 2l - 2F \cdot l - F_g \cdot \frac{9l}{2} = 0$$

$$2 \cdot Y_B = -4 \cdot 3F + 2F + 9F + 2F$$

$$Y_B = +\frac{F}{2}$$

$$\sum F_y = 0;$$

$$Y_A + Y_B + Y_C - 2F - F_g = 0$$

$$Y_C = 2F + 2F - 3F - \frac{F}{2}$$

$$Y_C = \frac{F}{2}$$

3. Za okvirni nosač (kamu) prikazan i opterećen kao na slici, izračunati reakcije u osloncima i nacrtati statičke dijagrame.

$$\sum M_G^d = 0; R_{By} \cdot 2l - 2Fl = 0$$

$$R_{By} = F$$

$$\sum F_y = 0; R_{Ay} - R_B = 0$$

$$R_{Ay} = F$$

$$\sum F_x = 0; R_{Ax} = 0$$

$$R_{Ax} - F_g = 0$$

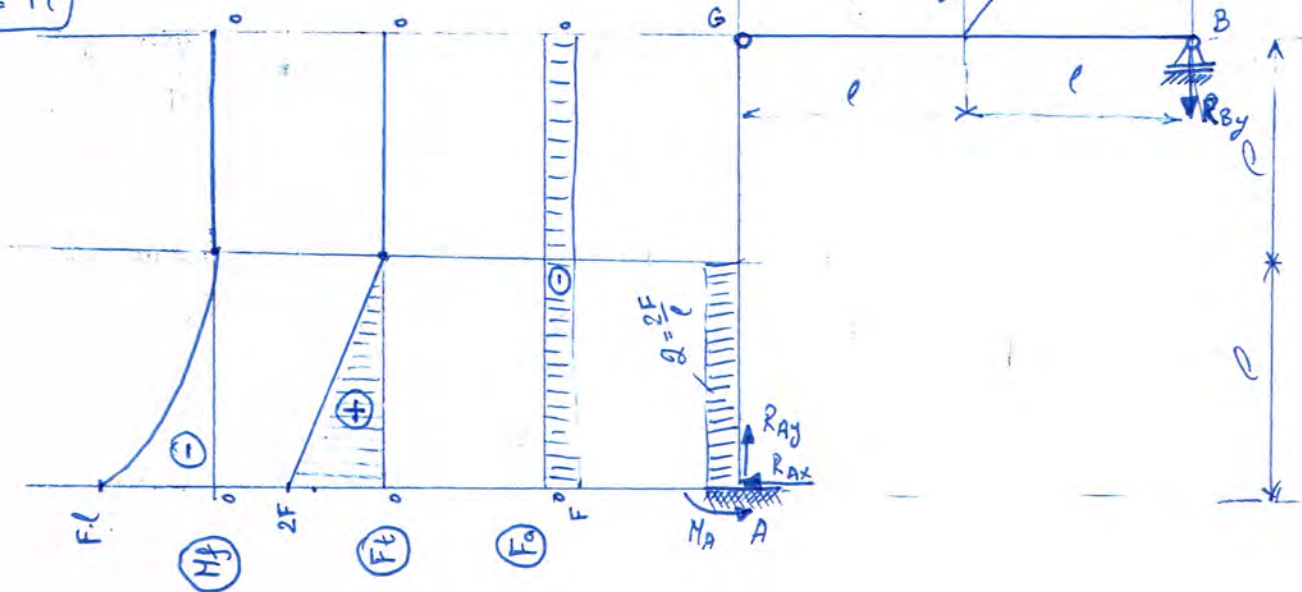
$$R_{Ax} = 2F$$

$$\sum M_G^p = 0;$$

$$M_A + F_g \cdot \frac{3l}{2} - R_{Ax} \cdot 2l = 0$$

$$M_A = 4Fl - 2F \cdot \frac{3l}{2}$$

$$M_A = Fl$$



4. Za ramu prikazanu na slici, odrediti reakcije oslonaca i nacrtati statičke dijagrame

$$\sum F_x = 0;$$

$$R_{Bx} - F = 0$$

$$R_{Bx} = F$$

$$\sum M_B = 0;$$

$$R_A \cdot l - F \cdot l - F \cdot l - \frac{2F}{l} \cdot l \cdot \frac{l}{3} = 0$$

$$R_A = 3F$$

$$\sum F_y = 0;$$

$$R_A - 2F - R_{By} = 0$$

$$R_{By} = F$$

