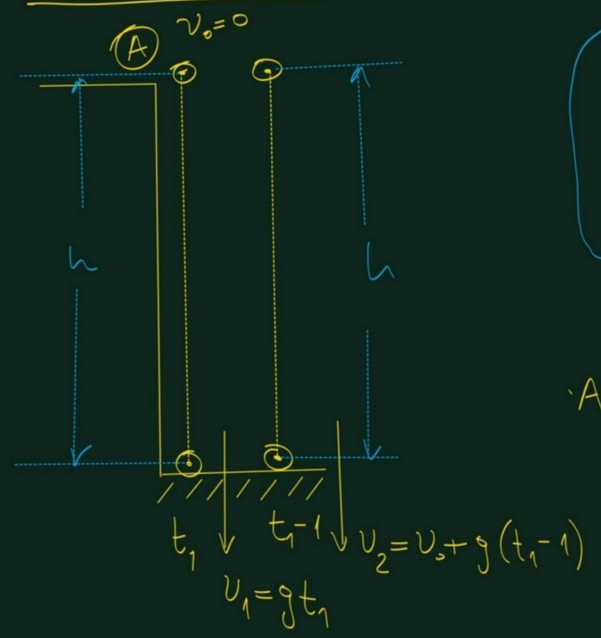
Ασκ. 18 σελ. 108



Α. Το σώμα (Α) εκτελεί ελεύθερη πτώση και φτάνει στο έδαφος σε χρόνο t_1:

$$h=\frac{1}{2}g\cdot t_1^2 \Rightarrow 45=\frac{1}{2}\cdot 10\cdot t_1^2 \Rightarrow 90=10t_1^2 \Rightarrow$$

$$t_1^2=9 \Rightarrow t_1=3\,sec.$$

Η ταχύτητα στο έδαφος είναι: $v_1=gt_1=30\,m/s$.

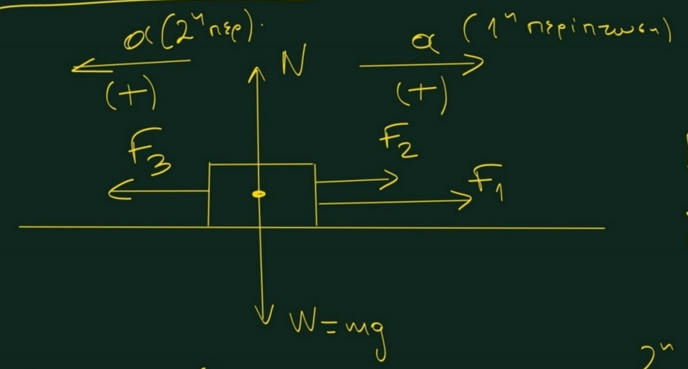
Το σώμα (Β) εκτελεί κατακόρυφη βολή προς τα κάτω, σε χρόνο (t_1-1) sec.

Άρα: $h=v_0(t_1-1)+\frac{1}{2}g(t_1-1)^2 \Rightarrow$

$$45=v_0\cdot 2+\frac{1}{2}\cdot 10\cdot 2^2 \Rightarrow 45=2v_0+20 \Rightarrow$$

$$2v_0=25 \Rightarrow v_0=12{,}5\,m/s.$$

Ασκ. 13 σελ. 108.



N = κάθετη δύναμη
(Normal force)

$W = m \cdot g$ = Βάρος (weight)

A. $S = \frac{1}{2} a t^2 \Rightarrow 24 = \frac{1}{2} a \cdot 4^2 \Rightarrow$

$48 = a \cdot 16 \Rightarrow a = 3\,m/s^2$

B. 1η περίπτωση (προς τα δεξιά)

$\Sigma F = ma \Rightarrow F_1 + F_2 - F_3 = ma \Rightarrow$

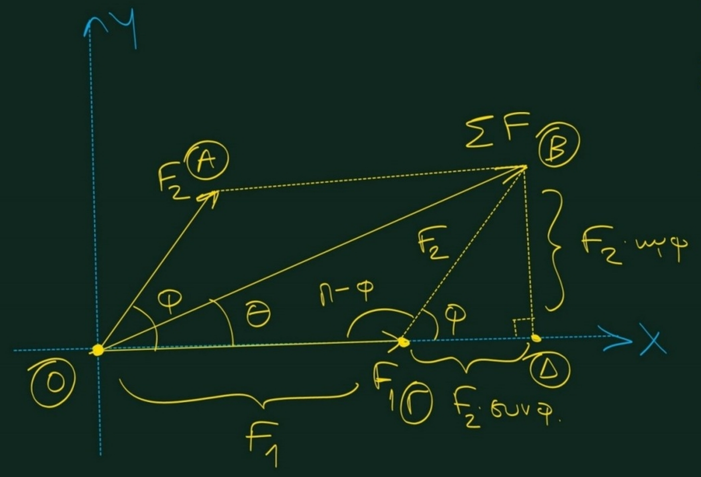
$6 + 2 - F_3 = 1 \cdot 3 \Rightarrow F_3 = 5\,N.$

2η περίπτωση (προς τα αριστερά).

$\Sigma F = ma \Rightarrow F_3 - F_2 - F_1 = ma \Rightarrow$

$F_3 - 6 - 2 = 1 \cdot 3 \Rightarrow F_3 = 11\,N.$

Σύνθεση δυνάμεων που σχηματίζουν τυχαία γωνία (κανόνας παραλληλογράμμου).



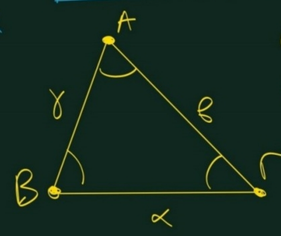
Από το νόμο των συνημιτόνων στο $O\hat{B}\Gamma$ έχουμε:

$$OB^2 = O\Gamma^2 + \Gamma B^2 - 2O\Gamma \cdot \Gamma B \cdot \sigma\upsilon\nu(\pi-\varphi) \Rightarrow$$

$$\Sigma F^2 = F_1^2 + F_2^2 - 2F_1 \cdot F_2 \cdot (-\sigma\upsilon\nu\varphi) \Rightarrow$$

$$\Sigma F^2 = F_1^2 + F_2^2 + 2F_1 \cdot F_2 \cdot \sigma\upsilon\nu\varphi \Rightarrow$$

$$\boxed{\Sigma F = \sqrt{F_1^2 + F_2^2 + 2F_1 \cdot F_2 \cdot \sigma\upsilon\nu\varphi}}$$



$$\alpha^2 = \beta^2 + \gamma^2 - 2\beta\gamma \cdot \sigma\upsilon\nu A$$

$$\beta^2 = \alpha^2 + \gamma^2 - 2\alpha \cdot \gamma \cdot \sigma\upsilon\nu B$$

$$\gamma^2 = \alpha^2 + \beta^2 - 2\alpha \cdot \beta \sigma\upsilon\nu \Gamma$$

Νόμος συνημιτόνων

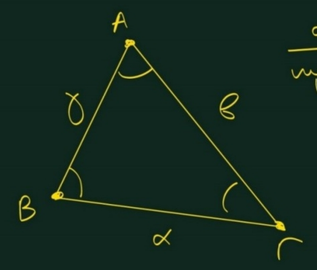
$$\varepsilon\varphi\theta = \frac{B\Delta}{O\Delta} = \frac{B\Delta}{O\Gamma + \Gamma\Delta} = \frac{F_2 \cdot \eta\mu\varphi}{F_1 + F_2 \cdot \sigma\upsilon\nu\varphi} \Rightarrow \boxed{\varepsilon\varphi\theta = \frac{F_2 \cdot \eta\mu\varphi}{F_1 + F_2 \cdot \sigma\upsilon\nu\varphi}}$$

<u>2ος τρόπος</u> εύρεσης της θ (από νόμο ημιτόνων στο $O\overset{\Delta}{B}\Gamma$)

$$\frac{OB}{\eta\mu(\pi - \varphi)} = \frac{B\Gamma}{\eta\mu\theta} \Rightarrow \frac{\Sigma F}{\eta\mu\varphi} = \frac{F_2}{\eta\mu\theta} \Rightarrow$$

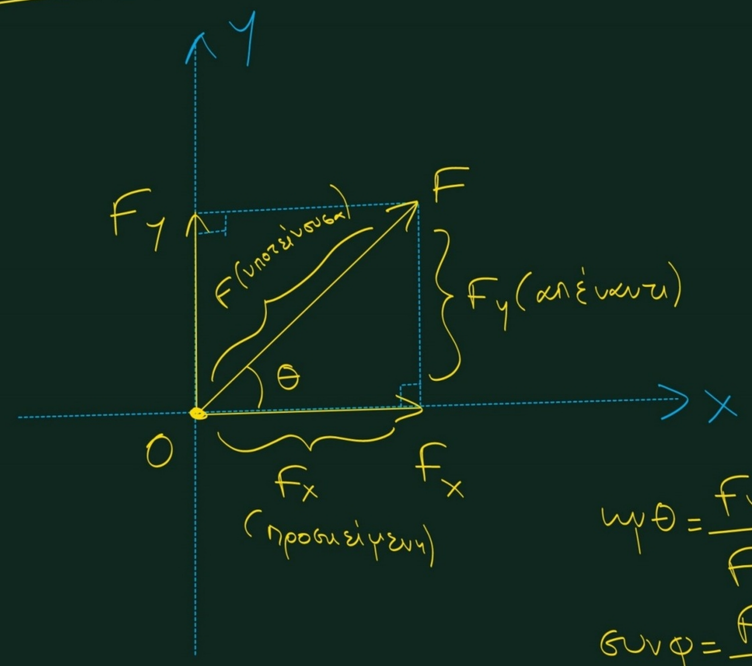
$$\boxed{\eta\mu\theta = \frac{F_2}{\Sigma F} \cdot \eta\mu\varphi}$$

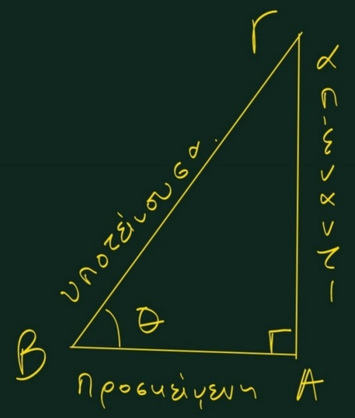
Νόμος ημιτόνων



$$\frac{\alpha}{\eta\mu A} = \frac{\beta}{\eta\mu B} = \frac{\gamma}{\eta\mu \Gamma}$$

Ανάλυση δύναμης σε συνιστώσες.





$$\eta\mu\theta = \frac{\text{απέναντι}}{\text{υποτείνουσα}}$$

$$\sigma\upsilon\nu\theta = \frac{\text{προσκείμενη}}{\text{υποτείνουσα}}$$

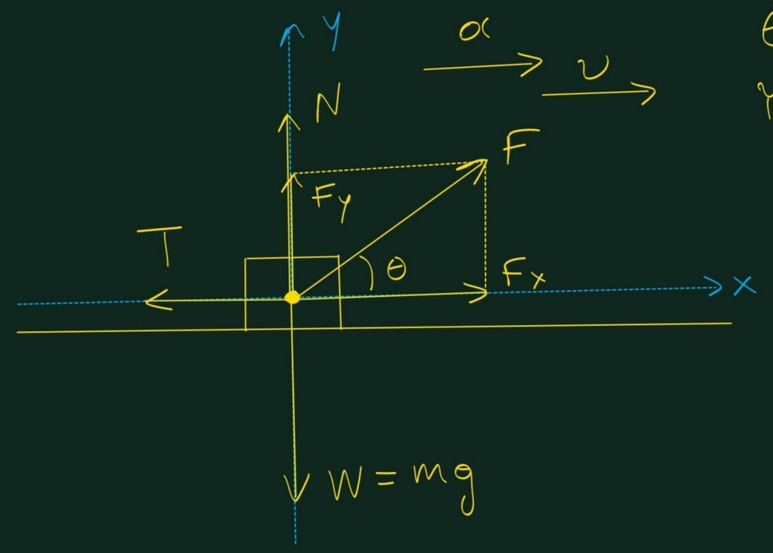
$$\varepsilon\varphi\theta = \frac{\text{απέναντι}}{\text{προσκείμενη}}.$$

$$\eta\mu\theta = \frac{F_y}{F} \Rightarrow F_y = F\cdot\eta\mu\theta$$

$$\sigma\upsilon\nu\varphi = \frac{F_x}{F} \Rightarrow F_x = F\cdot\sigma\upsilon\nu\theta$$

$$\varepsilon\varphi\theta = \frac{F_y}{F_x}$$

Παράδειγμα σελ. 128-129.



$W = mg = 10 \cdot 10 = 100\,N.$

$m = 10\,kg$

$F = 80\,N$

$\theta = 30^\circ$

$\mu = 0{,}25$

α) $T = ;$

$T = \mu \cdot N$

$\eta\mu\theta = \frac{F_y}{F} \Rightarrow \eta\mu 30^\circ = \frac{F_y}{80} \Rightarrow$

$\frac{1}{2} = \frac{F_y}{80} \Rightarrow F_y = 40\,N.$

$\sigma\upsilon\nu\theta = \frac{F_x}{F} \Rightarrow \sigma\upsilon\nu 30^\circ = \frac{F_x}{80} \Rightarrow$

$\frac{\sqrt{3}}{2} = \frac{F_x}{80} \Rightarrow \frac{2 \cdot F_x}{2} = \frac{80 \cdot \sqrt{3}}{2} \Rightarrow$

$F_x = 40\sqrt{3} \simeq 40 \cdot 1{,}7 = 68\,N$

$\sqrt{3} \simeq 1{,}7$

$\Sigma F_y = 0 \Rightarrow F_y + N - W = 0 \Rightarrow$

$40 + N - 100 = 0 \Rightarrow N = 100 - 40 \Rightarrow$

$\boxed{N = 60N}$

Normal force

Newton

$T = \mu N = 0{,}25 \cdot 60 \Rightarrow$

$\boxed{T = 15N}$

b) $\Sigma F_x = m \cdot a \Rightarrow F_x - T = ma \Rightarrow$

$68 - 15 = 10 \cdot a \Rightarrow$

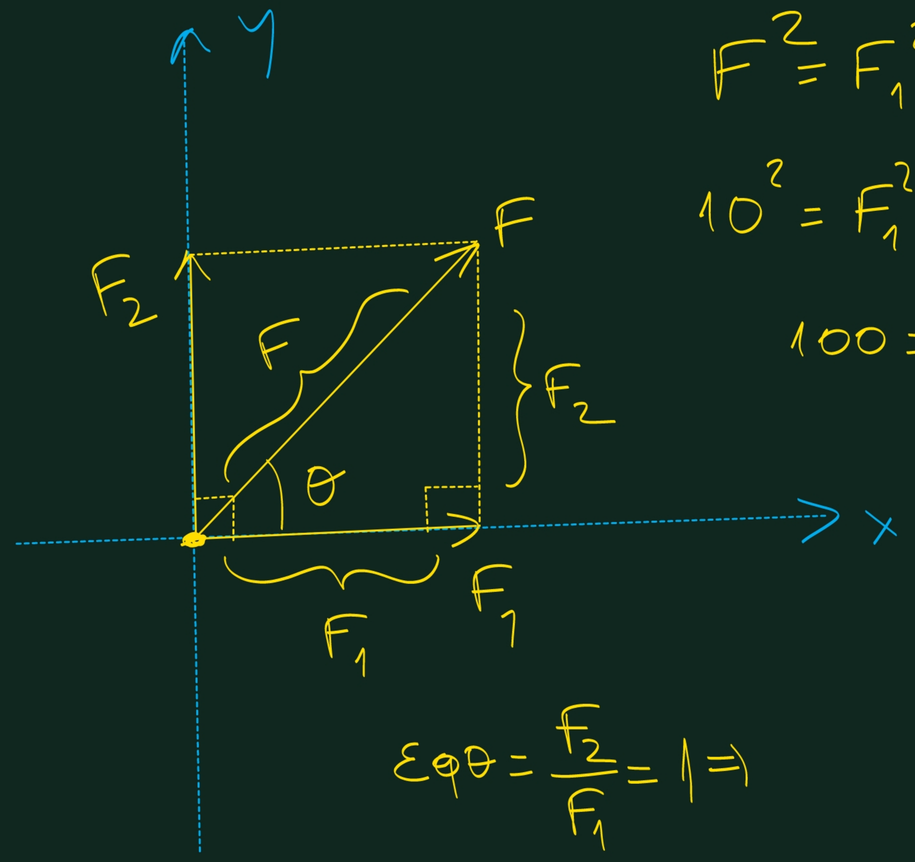
$53 = 10 \cdot a \Rightarrow \boxed{a = 5{,}3\ m/s^2}$

γ) $S = \frac{1}{2} a \cdot t^2 \Rightarrow S = \frac{1}{2} \cdot 5{,}3 \cdot 4^2 = \frac{1}{2} \cdot 5{,}3 \cdot 16 \Rightarrow$

$S = 8 \cdot 5{,}3 = 8 \cdot 5 + 8 \cdot 0{,}3 = 40 + 2{,}4 \Rightarrow$

$\boxed{S = 42{,}4\ m}$

Ασκ. 1 σελ. 157



$F_1 = F_2$

$F^2 = F_1^2 + F_2^2 \Rightarrow$

$10^2 = F_1^2 + F_1^2 \Rightarrow$

$100 = 2F_1^2 \Rightarrow$

$F_1^2 = 50 \Rightarrow$

$F_1 = \sqrt{50} \Rightarrow$

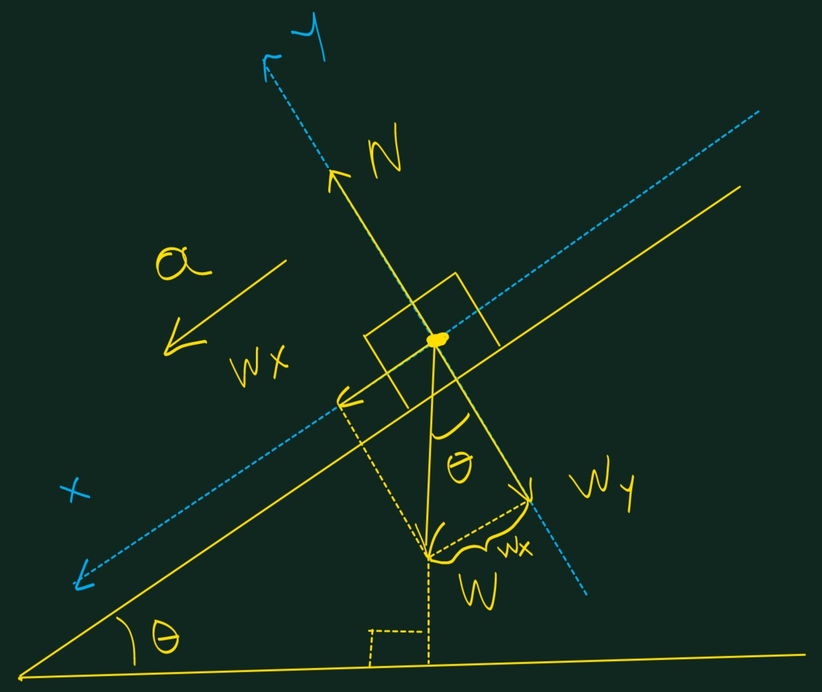
$F_1 = 5\sqrt{2}\ N$

και $F_2 = 5\sqrt{2}\ N$

$\varepsilon\varphi\theta = \frac{F_2}{F_1} = 1 \Rightarrow$

$\theta = 45°$

Ασκ. 7 σελ. 157 (Κεκλιμένο επίπεδο).



Α. Το σώμα δέχεται δύο δυνάμεις.

1) Το βάρος $\vec{W} = m\vec{g}$ από τη Γη.

2) Τη κάθετη δύναμη $\vec{N}$ από το κεκλιμένο επίπεδο.

$\Sigma F_x = ma \Rightarrow W_x = ma \Rightarrow$

W.