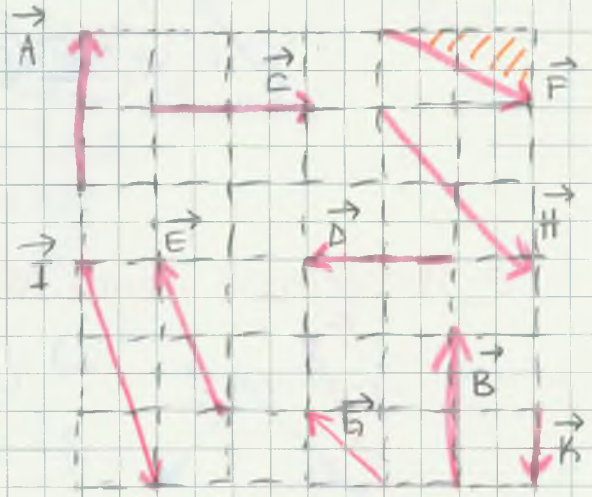


# - VEKTÖRLER -

| Vektörel                  | Skaler       |
|---------------------------|--------------|
| 1- Başlangıç noktası      | 1- Büyüklük  |
| 2- Doğrultu               | 2- Birim     |
| 3- Yönü                   | → Hız        |
| 4- Şiddeti                | → Kütle      |
| → Hız                     | → Alınan yol |
| → Ağırlık ( $m \cdot g$ ) | → Enerji     |
| → Yer değiştirme          | → Güç        |
| → Kuvvet                  | → Zaman      |
| → İvme                    | → Basınç     |
| → Momentum                | → Akım       |
| → İtme                    |              |



$\vec{A} = \vec{B}$  (Eşit vektör)  
Başlangıç noktası ve yeri farklı olabilir.

Zıt vektör  $\begin{cases} \vec{C} = -\vec{D} \\ -\vec{C} = \vec{D} \end{cases}$   $|\vec{C}| = |\vec{D}|$   
Büyüklük

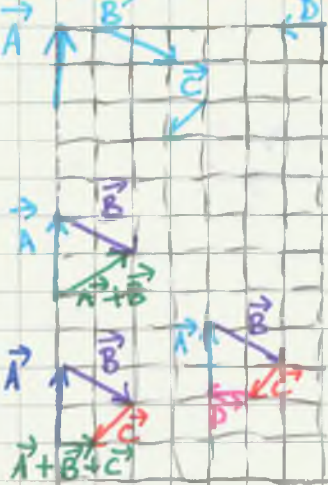
$|\vec{A}| = |\vec{D}| = |\vec{C}|$   $|\vec{E}| = |\vec{F}| = \sqrt{5}$

$|\vec{I}| = \sqrt{10}$   $\vec{H} = -2\vec{G}$   $|\vec{H}| = |2\vec{G}|$

$-2\vec{K} = \vec{B} = \vec{A}$   $|2\vec{K}| = |\vec{A}| = |\vec{D}| = |\vec{C}|$

## - VEKTÖRLERDE TOPLAMA İŞLEMİ -

### 1- İÇİ İÇİ EKLEME YÖNTEMİ

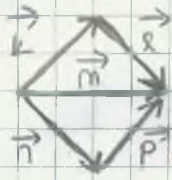


1-  $\vec{A} + \vec{B} = (\vec{A} + \vec{B}) = \vec{C}$

2-  $\vec{A} + \vec{B} + \vec{C} = (\vec{A} + \vec{B} + \vec{C}) = -\vec{D}$

3-  $\vec{A} + \vec{B} + \vec{C} + \vec{D} = 0$

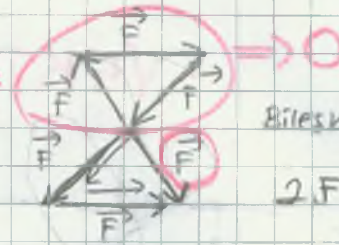
Örnek:



Bileşke = ?  $\vec{k} + \vec{m} + \vec{n} + \vec{p} + \vec{l} = ?$

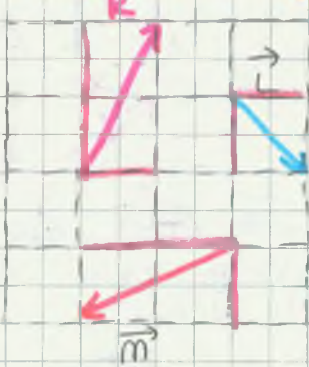
$\vec{m}$   
 $3\vec{m}$

Örnek:



Bileşke = ?  
 $2F$

## 2- Bileşenlerine Ayırma Yöntemi



1)  $\vec{k} + \vec{l} + \vec{m}$

X Y

$\vec{k} \begin{Bmatrix} 1 \\ 2 \end{Bmatrix}$

$\vec{l} \begin{Bmatrix} 1 \\ -1 \end{Bmatrix}$

$+\vec{m} \begin{Bmatrix} -2 \\ -1 \end{Bmatrix}$

$\underline{\underline{R \quad 0 \quad 0}}$

(Bileşke)

2)  $\vec{k} - \vec{l} = \vec{k} + (-\vec{l})$

K: 1, 2

-L: -1, +1

+

$K-L: 0, 3$

3)  $\vec{k} + \vec{l} - 2\vec{m}$

K: 1, 2

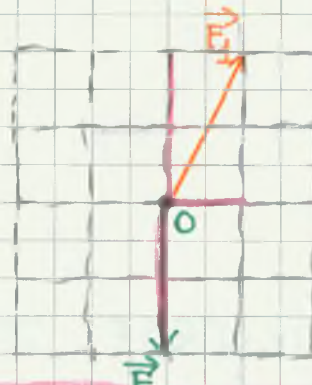
L: 1, -1

-2m: +4, +2

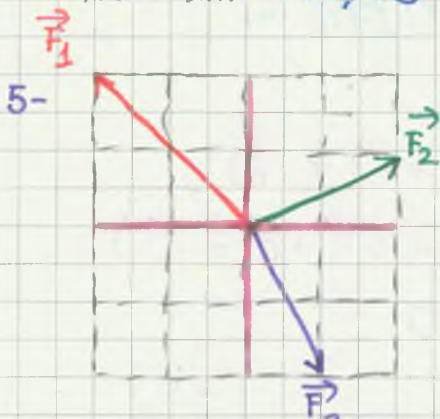
+

$K+L-2m = +6, +3$

4)



1- Noktasal O cismi  
dengede akt. göre;  
2- // //  
sabit hızla hareket  
ettiğine göre  
 $F_3$  nedir?



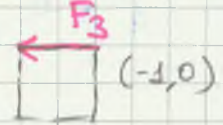
Dengede = sabit Hız  $\Rightarrow \vec{R} = 0$  olur

$F_1: 1, 2$

$F_2: 0, -2$

$F_3: x, y$

$\underline{\underline{R: 00}}$



Sekildeki kuvvetlerin dengeleyeni nedir?

$\vec{R} = 0$

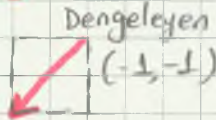
$F_1: -2, 2$

$F_2: 2, 1$

$F_3: 1, -2$

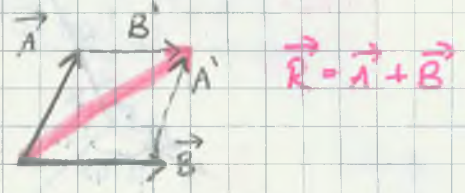
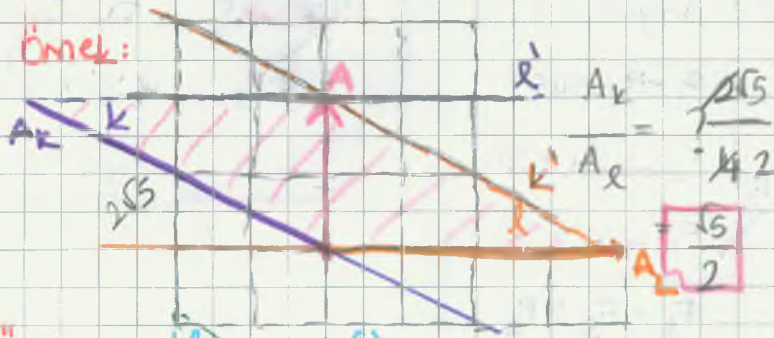
Dengeleyen:  $-1, -1$

$\underline{\underline{00}}$

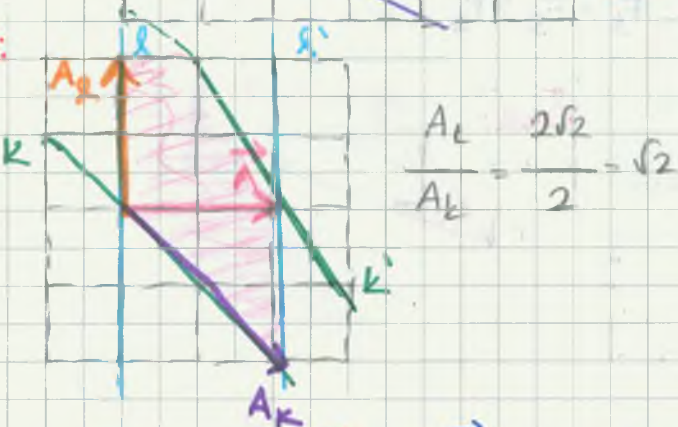


### 3) Paralel Kenar Yöntemi

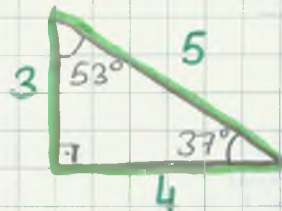
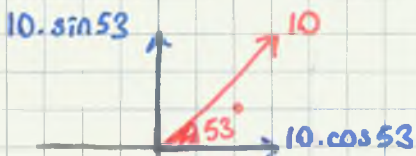
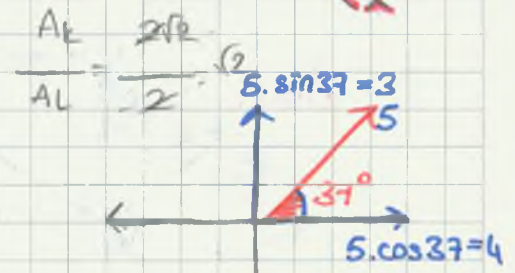
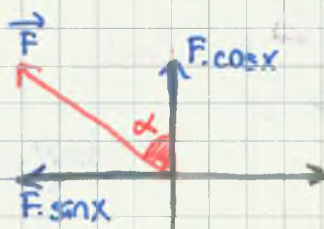
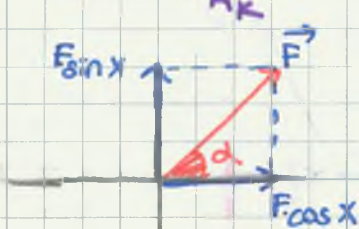
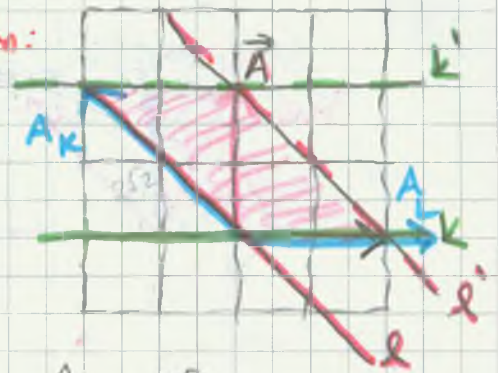
Örnek:



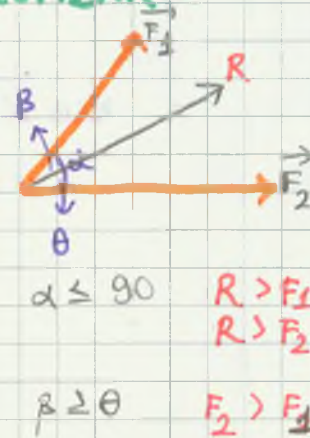
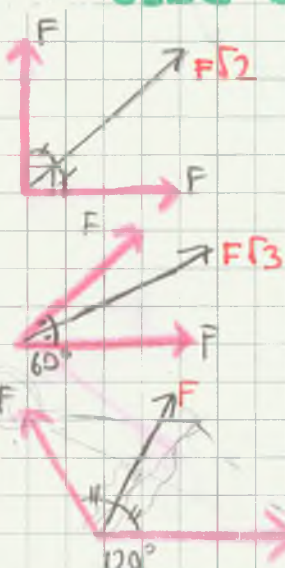
Örn:



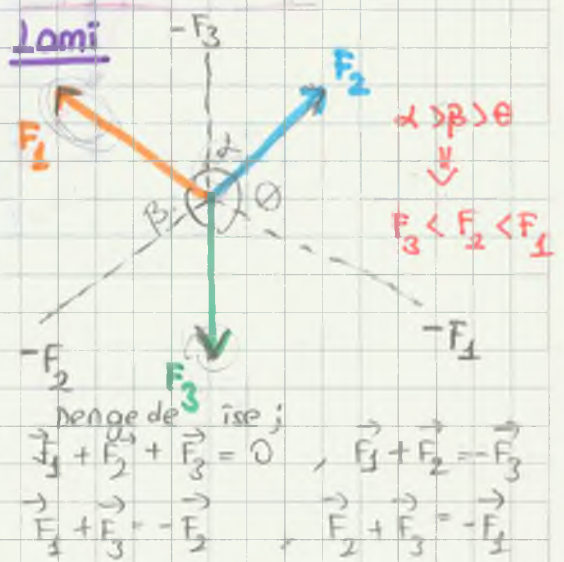
Örn:



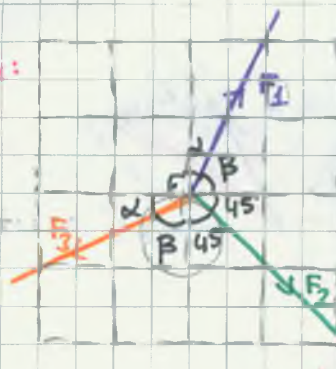
### ÖZEL DURUMLAR



### Lami



Örnek:



(Değerlerdir)

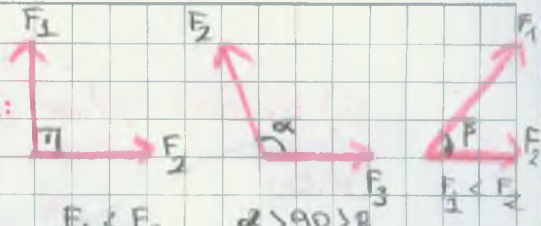
$$F_1 \rightarrow \beta + 45$$

$$F_2 \rightarrow 2\alpha + 90$$

$$F_3 \rightarrow \beta + 45$$

$$F_1 = F_3 > F_2$$

Örnek:



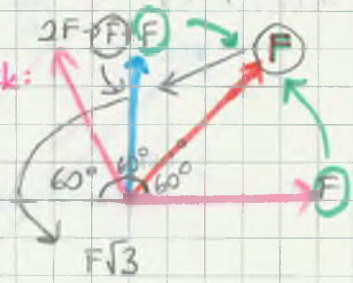
$$F_2 < F_3$$

$$\alpha > 90^\circ$$

$$F_3 < F_2$$

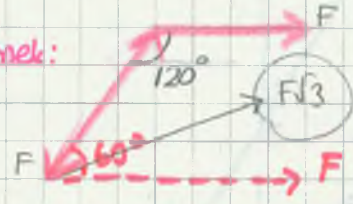
$$F_2 > F_3 > F_1$$

Örnek:

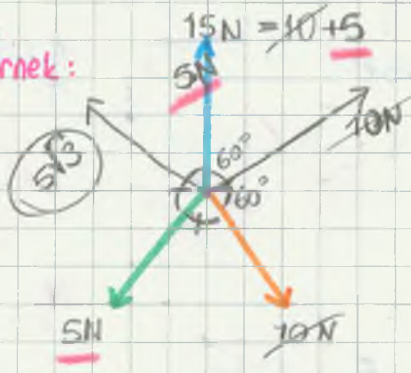


$$F\sqrt{3}$$

Örnek:

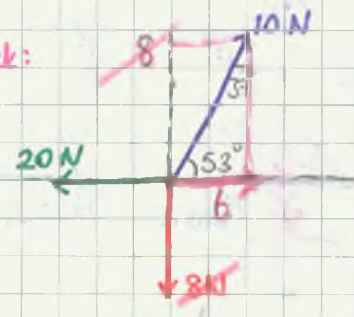


Örnek:



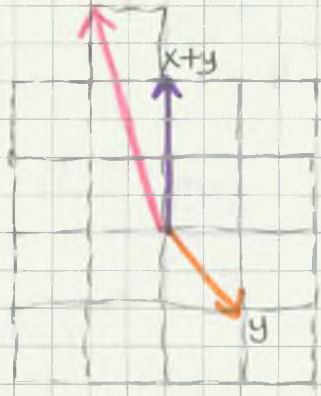
$$15N = 10 + 5$$

Örnek:



$$20 - 6 = 14$$

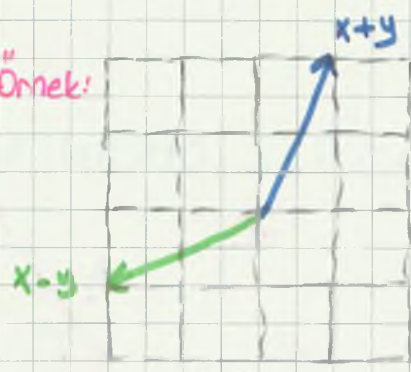
Örnek:



$$x = ?$$

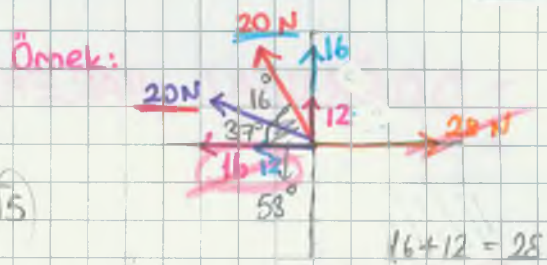
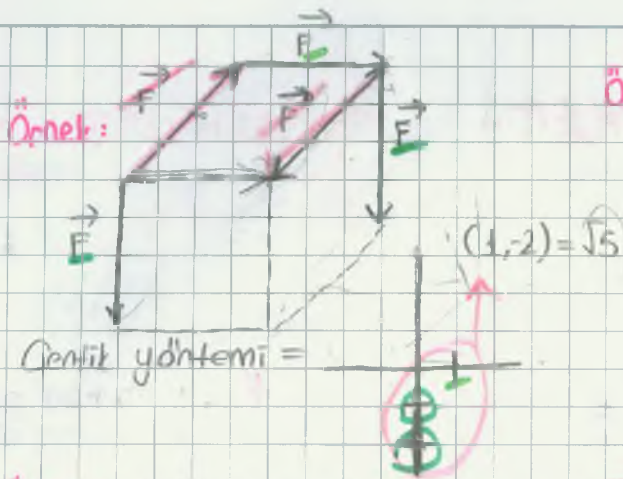
$$\begin{array}{r} x+y = 0,2 \\ -y = +1,-1 \\ \hline x = -1,3 \end{array}$$

Örnek:

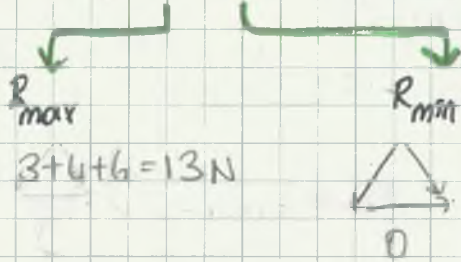


$$x = ?$$

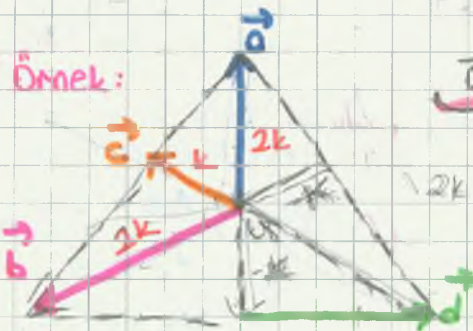
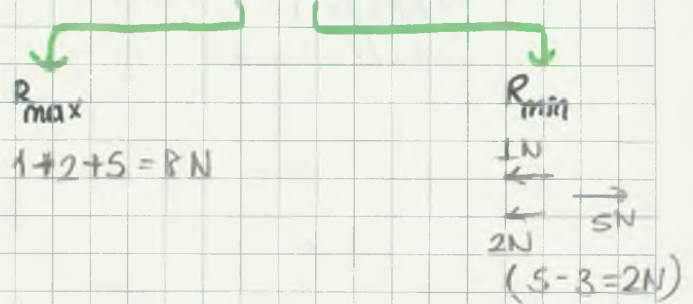
$$\begin{array}{r} x+y = 4,2 \\ x-y = -2,-1 \\ \hline 2x = -3,1 \\ x = -\frac{1}{2}, \frac{1}{2} \end{array}$$



Örnek: 3N, 4N ve 6N luk vektörlerin

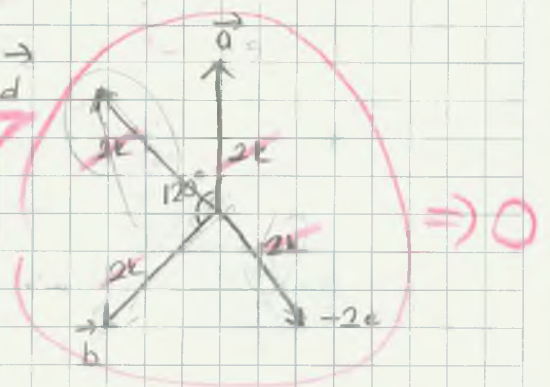


Örnek: 1N, 2N, 5N luk vektörlerin



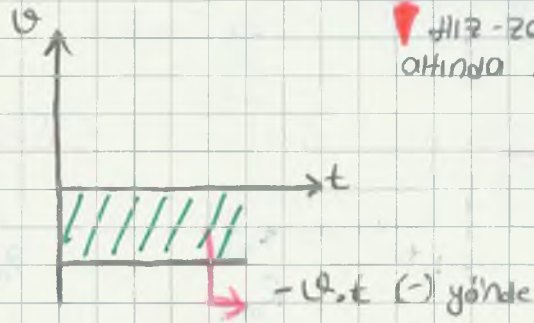
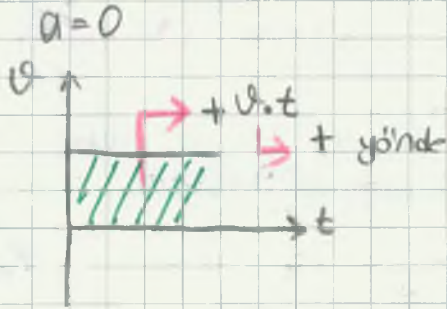
$$\vec{a} + \vec{b} - 2\vec{c} + \vec{d} = ? = \vec{d}$$

$2k - 2k$

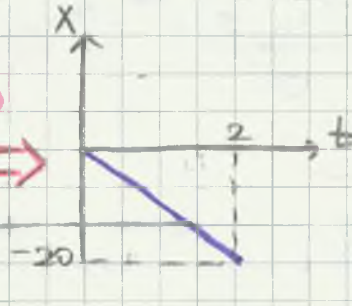
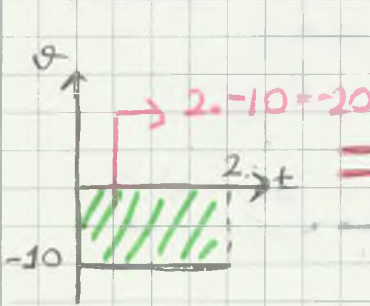
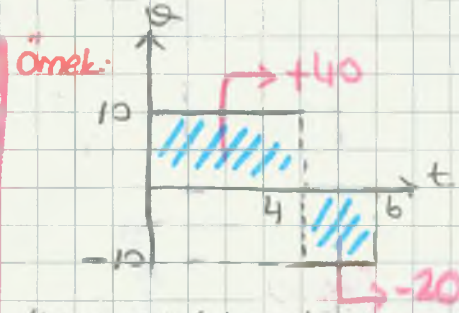
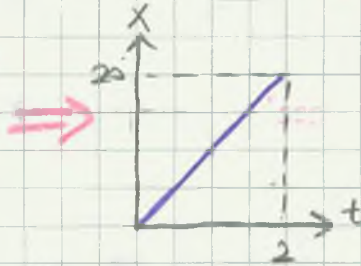
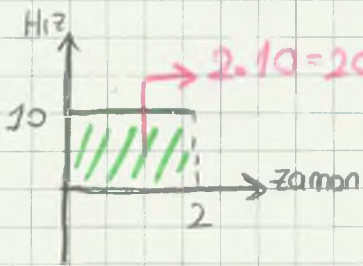


# - DOĞRUSAL HAREKET -

## - Sabit Hız -



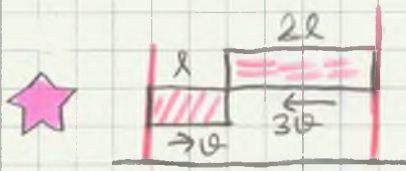
! Hız-zaman grafiği altında kalan alan;  $\Delta x$



Alınan yol: (skaler) = 60 m:  $\Delta x$   
yer değiştirme (vektörel): 20 =  $\Delta x$

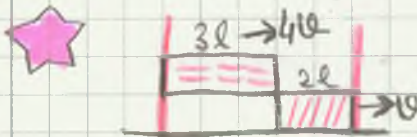
Ort. Hız:  $\frac{\Delta x}{t} = \frac{60}{6} \text{ m/s}$

Ort. Hız:  $\frac{\Delta x}{\Delta t} = \frac{20}{6} \text{ m/s}$



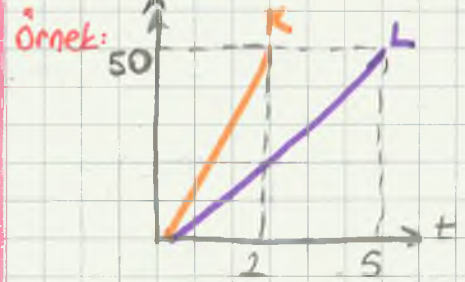
Birbirlerini tamamen geçmeleri için;

$$3l = 4v.t$$



Birbirlerini tamamen geçmeleri için;

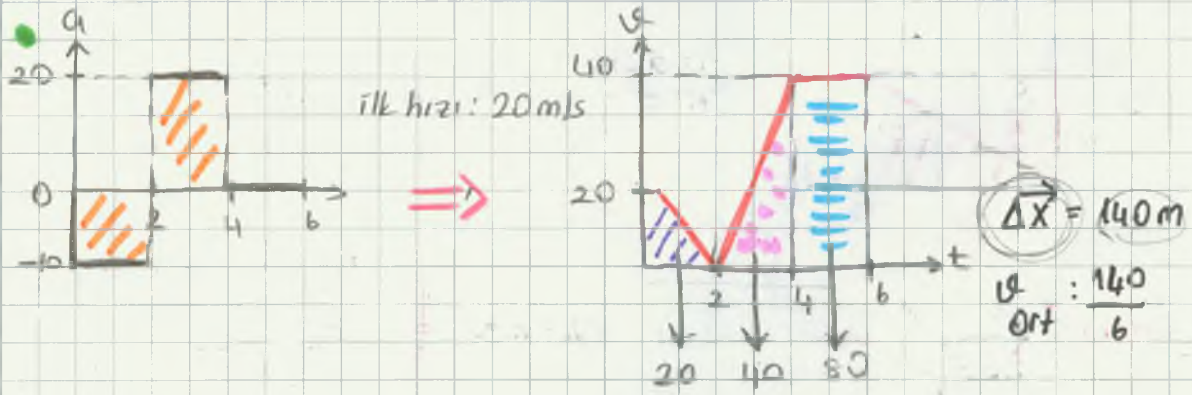
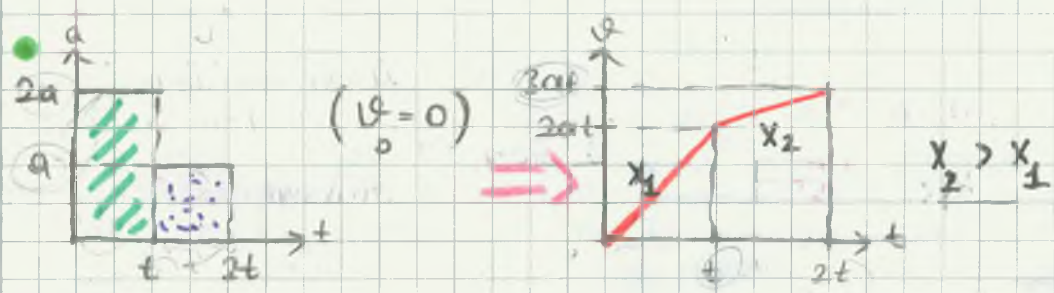
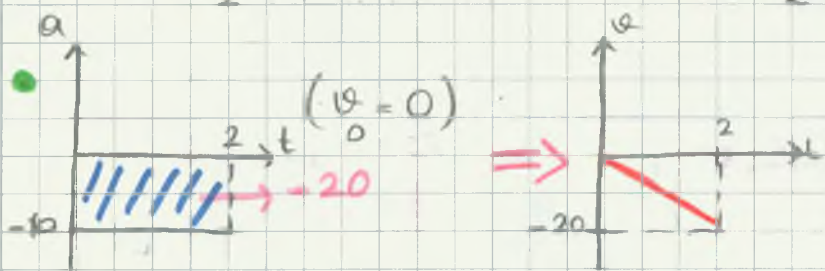
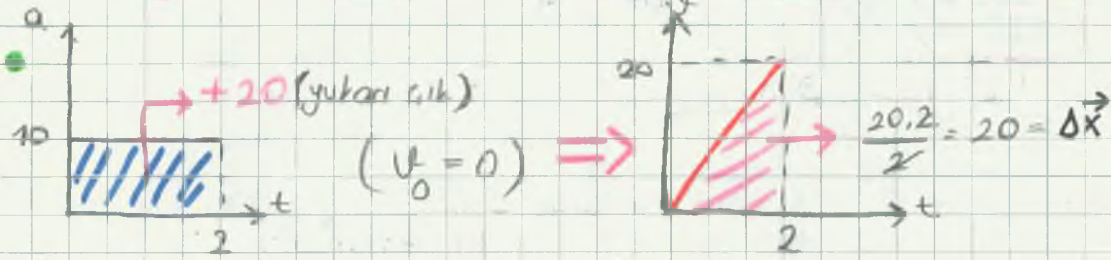
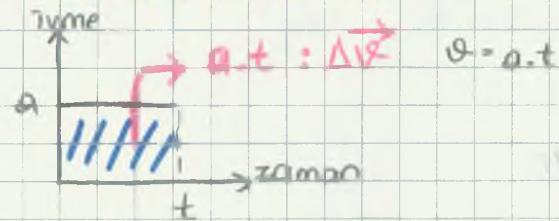
$$5l = 3v.t$$



$$v_k = \frac{50}{2}$$

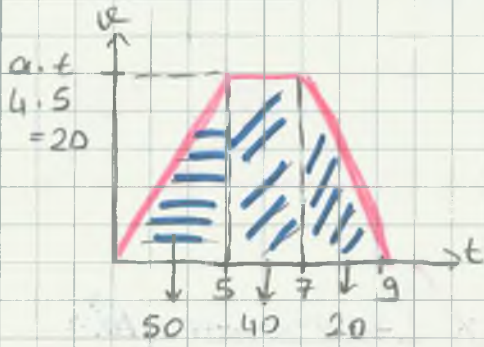
$$v = \frac{50}{5}$$

# - İVMELİ HAREKET -





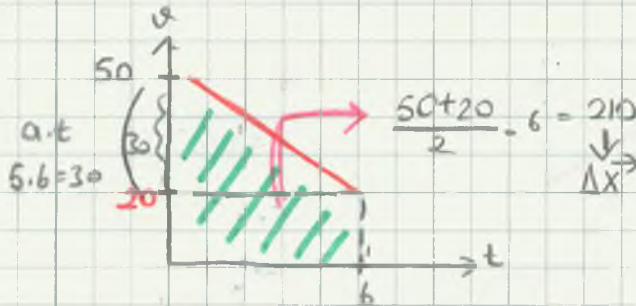
**Örnek:** İlk hızı 0 olan bir araç 5 sn boyunca  $4 \text{ m/s}^2$  lik ivmeyle hızlanıp 2 sn sabit hızla gittikten sonra 2 sn de duruyor.



$$\Delta x = 110$$

$$v_{\text{ort}} = \frac{110}{9}$$

**Örnek:** İlk hızı 50 m/s olan bir araç  $5 \text{ m/s}^2$  lik ivmeyle 6 sn yavaşlıyor.  
a) son hızı? b) Ortalama hızı? c) yer değıştirmesi?



$$v_{\text{son}} = 20 \text{ m/s}$$

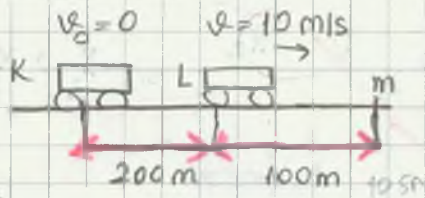
$$v_{\text{ort}} = \frac{210}{6}$$

$$x = \frac{1}{2} a t^2$$

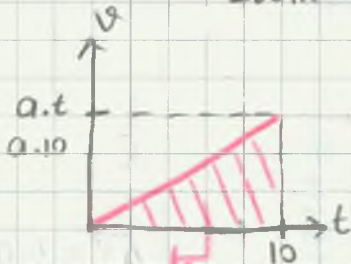
$$100 = 0 + 2 \cdot a \cdot 300$$

$$10t + \frac{1}{2} a t^2 = 100$$

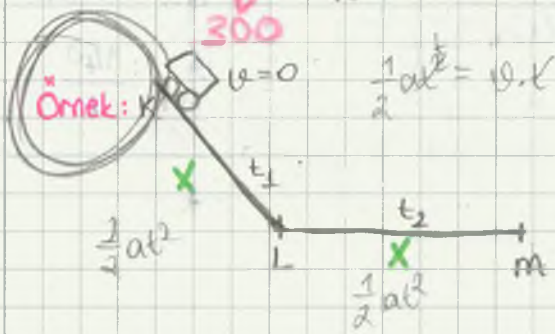
**Örnek:**



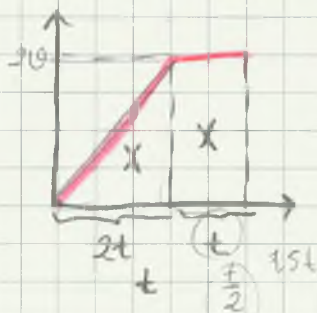
L aracı 10 m/s sabit hızla giderken K aracı a ivmesiyle hızlanıp L aracını M noktasında yakalar. Buna göre a=?



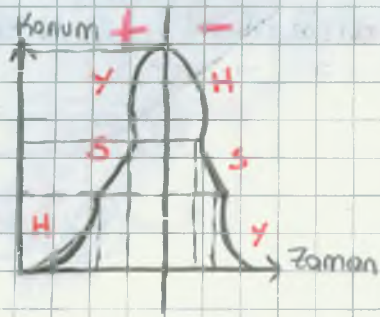
$$\frac{10 \cdot a \cdot 10}{2} = 300 \quad a = 6 \text{ m/s}^2$$



$$KL = 200 \Rightarrow \frac{t_1}{t_2} = ? = \frac{2t}{t} = 2$$

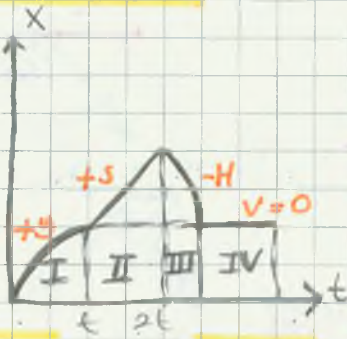




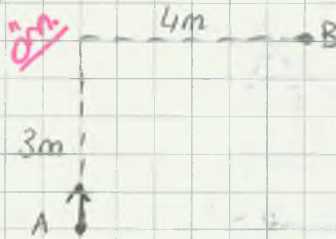
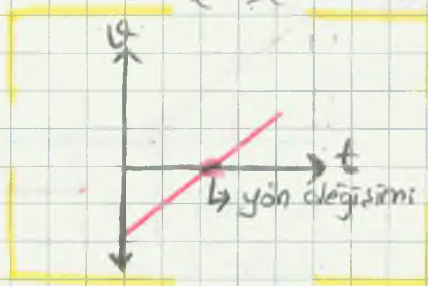


Hızlanıyorsa = Hız ve ivme vektörleri aynı yönlü  
 Yavaşlıyorsa // // // // zıt yönlü

Örnek:



- ✓ I - İlk hızı vardır.
- ✓ II - III aralığında hız ve ivme aynı yönlüdür.
- ✓ III -  $2t$  anında yön değiştirmiştir.
- ✗ IV - IV aralığında sabit hızdır.



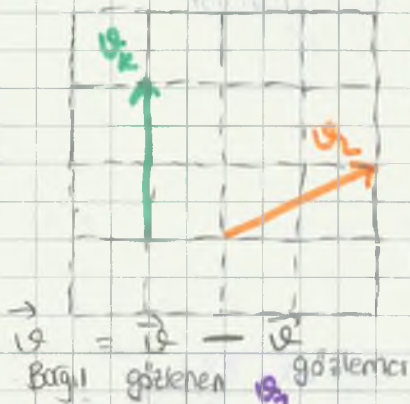
$$\Delta x = 7$$

$$\Delta \vec{x} = 5$$

$$v = 7/2$$

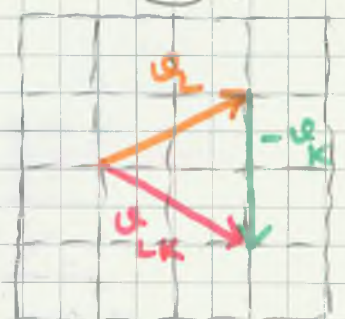
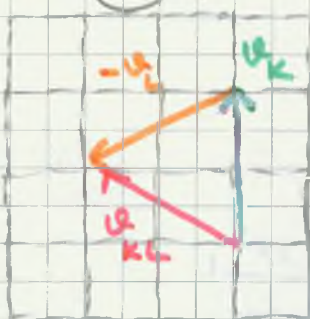
$$\vec{v} = 5/2$$

## - BAĞIL HAREKET -



1- K'nin (L'ye göre hızı:

2- L'nin (K'ye göre hızı:



Örnek:

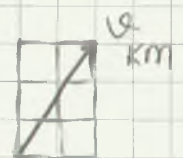


K'nin (L'ye göre hızı:  $v_1$ , L'nin (M'ye göre hızı:  $v_2$ , K'nin (M'ye göre hızı: ?

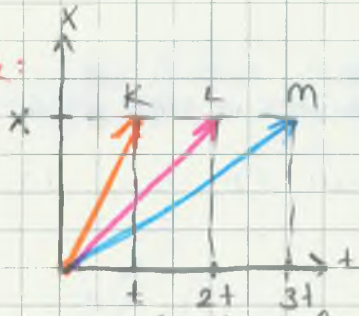
$$K-L = 0,2$$

$$L-M = 2,1$$

$$K-M = 2,3$$



Örnek:

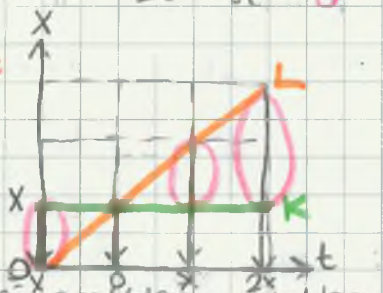


K'nin L'ye göre hızı & ise M'nin L'ye göre hızı kaç & dir?

$$K-L = \frac{x}{t} - \frac{x}{2t} = \frac{x}{2t} = \frac{v}{2}$$

$$M-L = \frac{x}{3t} - \frac{x}{2t} = \frac{-x}{6t} = \frac{-v}{3}$$

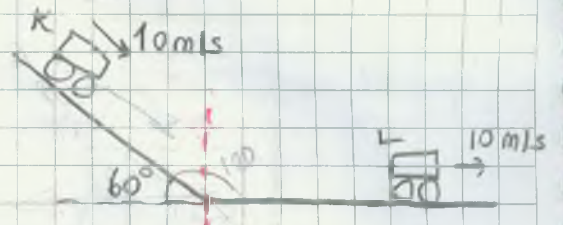
Örnek:



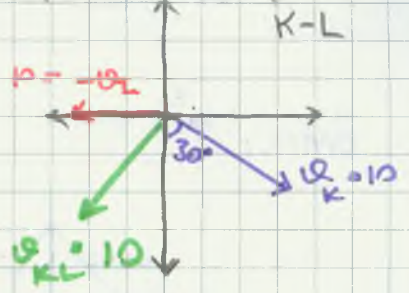
Hangi aralıklarda yaklaşıyorlar / uzaklaşıyorlar?

- I yaklaşıyor,
- II, III uzaklaşıyor.

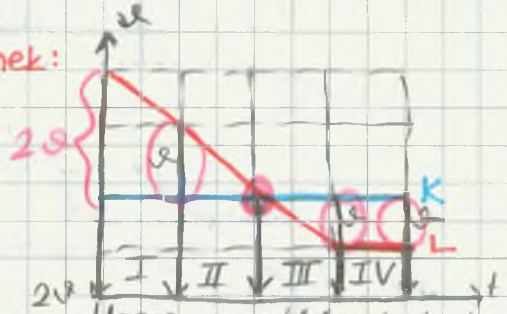
Örnek:



K'nin L'ye göre hızı?



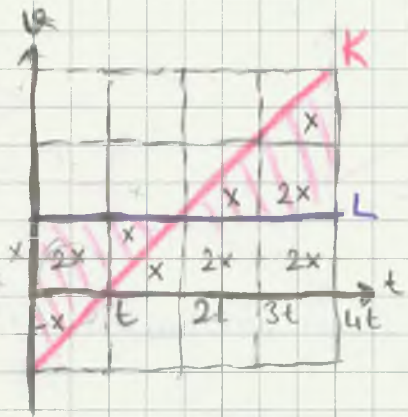
Örnek:



Hangi aralıklarda hızlanıyor / yavaşlıyor / görüyor?

- I ve II yavaşlıyor
- III hızlanıyor
- IV sabit

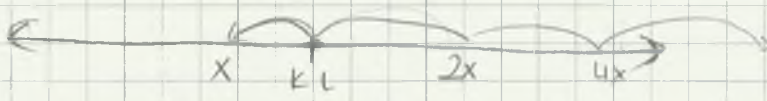
Örnek:



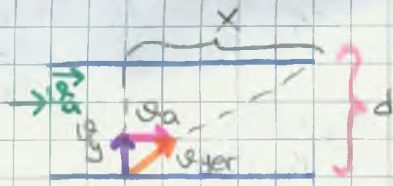
Başlangıçta yan yana olan K, L aralıkları hangi aralıklarda yaklaşıyor, uzaklaşıyor?

|   |    |    |    |    |    |            |
|---|----|----|----|----|----|------------|
|   | 0  | t  | 2t | 3t | 4t |            |
| K | -x | 0  | 3x | 8x |    | → yan yana |
| L | 2x | 4x | 6x | 8x |    |            |
|   | 0  | 3x | 1x | 3x | 0  |            |

uzaklaşıyor uzaklaşıyor yaklaşıyor yaklaşıyor



## - NEHİR PROBLEMLERİ -



Nehrin genişliği :  $d$  Akıntı hızı :  $v_a$   
 $v_y$  : yüzücünün suya göre hızı

$v_{yer}$  : yere göre hız

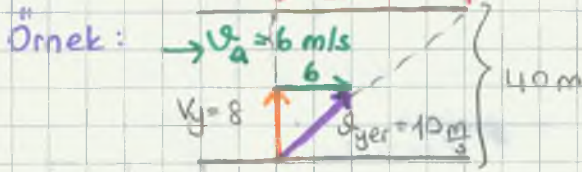
$$\vec{v}_a + \vec{v}_y = \vec{v}_{yer}$$

$x$  : sürüklenme miktarı

Karşıya geçme süresi :

$$d = v_{düşey} \cdot t$$

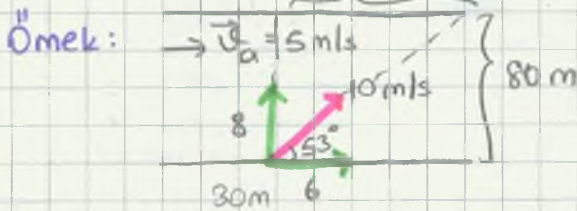
$$X = v_{yatay} \cdot t$$



8 m/s = suya göre hız  
 10 m/s = yere // "

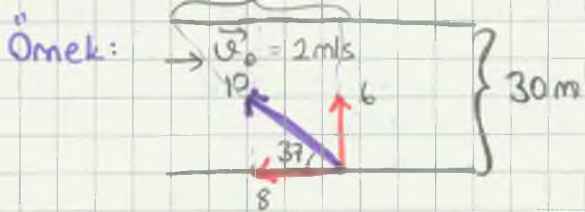
$$d = v_{düşey} \cdot t \quad X = v_{yatay} \cdot t$$

$\downarrow$  5sn



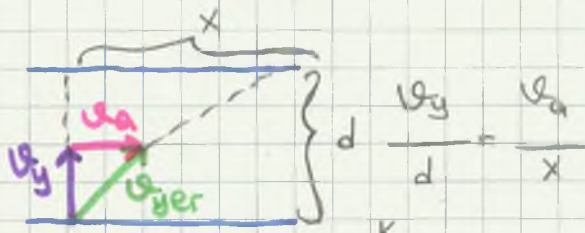
$$d = v_{düşey} \cdot t \quad X = v_{yatay} \cdot t$$

$\downarrow$  10       $\downarrow$  6t5       $\downarrow$  10

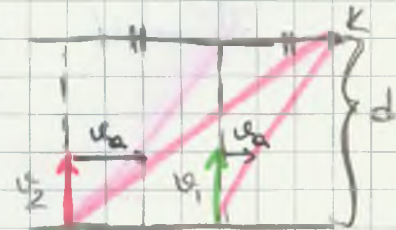


$$d = v_{düşey} \cdot t \quad X = v_{yatay} \cdot t$$

$30 = 6 \cdot t = 5 \quad X = (8-2) \cdot 5 = 30$



Örnek:



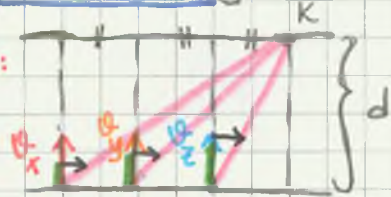
$x$  ve  $y$   $K$  noktasında kıyıya  
 çıkıyorlar. Buna göre  $\frac{v_1}{v_2}$  ?

y)  $\frac{v_2}{d} = \frac{v_a}{x} \quad v_2 = \frac{v_a \cdot d}{x}$

x)  $\frac{v_1}{d} = \frac{v_a}{2x} = v_1 = \frac{v_a \cdot d}{2x}$

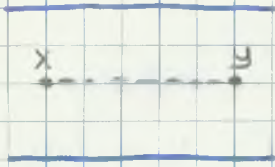
$$\frac{v_1}{v_2} = \frac{1}{2}$$

Örnek:



$$v_x > v_y > v_x$$

Örnek:



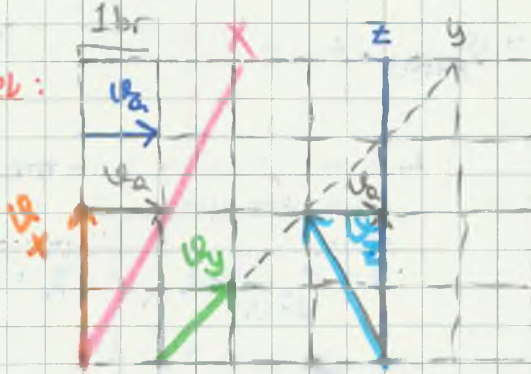
X noktasından yüzmeye başlayan bir yüzücü 3 sn de y nokt. varıp 5 sn de tekrar X nokt. geri dönmektedir. Buna göre  $v_y = ?$   
 $v_a$

$$\begin{aligned} X \rightarrow Y & l = (v_y + v_a) \cdot 3 \\ Y \rightarrow X & l = (v_y - v_a) \cdot 5 \end{aligned}$$

$$l = 3v_y + 3v_a = 5v_y - 5v_a$$

$$8v_a = 2v_y \quad \frac{v_y}{v_a} = 4$$

Örnek:



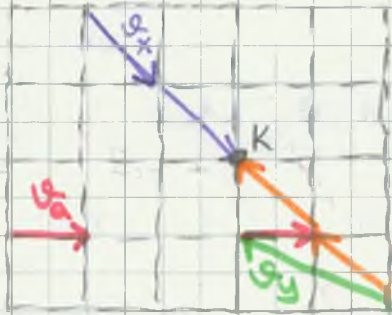
$v_x$  ve  $v_a$  suya göre ( $v_a$  yı ekle)  
 $v_y$  yere göre, (direk karşıya çık)

1- Karşı kıyıya çıktıkları noktalar?

2- // // ulaşma süreleri arasındaki ilişki? (düşey hız)

$$\left. \begin{aligned} X &= 2 \\ Y &= 1 \\ Z &= 2 \end{aligned} \right\} t_x = t_z < t_y$$

Örnek:



$v_x$ : yere göre  $v_y$ : suya göre  
hızlar oldu. na göre X ve Y nerde karşılaşırlar?

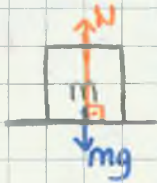
K, 2s sonra karşılaşırlar.

# -DİNAMİK-

## 1- Eylemsizlik

## 2- Etki - Tepki

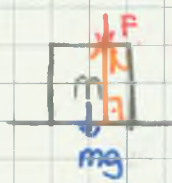
Etki ve tepki her zaman birbirlerine eşit büyüklükte fakat **zıt yönlüdür.**  
Tepki kuvveti her zaman yüzeyden dışarı doğur ve diktir.



$$mg = N$$

$$f_s = N \cdot k$$

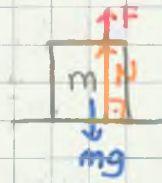
$$= mg \cdot k$$



$$F + mg = N$$

$$f_s = N \cdot k$$

$$= (F + mg) \cdot k$$

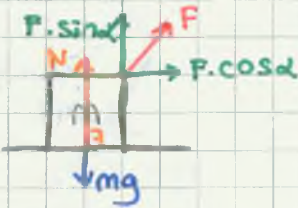


$$N + F = mg$$

$$mg - F = N$$

$$f_s = N \cdot k$$

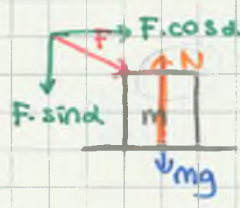
$$= (mg - F) \cdot k$$



$$N + F \sin \alpha = mg$$

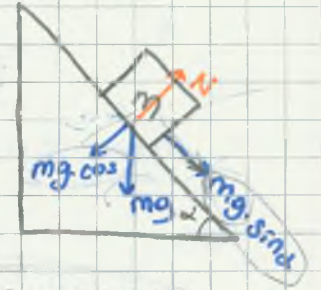
$$N = mg - F \sin \alpha$$

$$f_s = (mg - F \sin \alpha) \cdot k$$



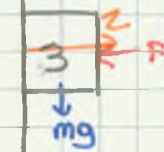
$$mg + F \sin \alpha = N$$

$$f_s = (mg + F \sin \alpha) \cdot k$$



$$N = mg \cdot \cos \alpha$$

$$f_s = mg \cos \alpha \cdot k$$



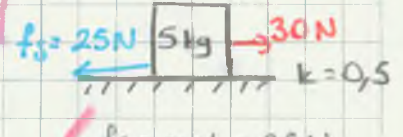
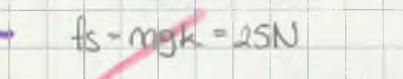
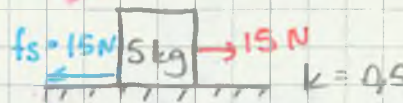
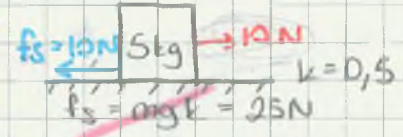
$$N = F \quad f_s = F \cdot k$$

$$f_s = N \cdot k$$

↓  
tepki

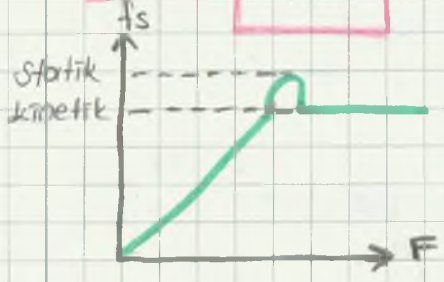
↓  
sürt. kat.

statik  
sürtünme  
kuvveti



$$f_s = mgk = 25N$$

kinetik sürtünme  
kuvveti

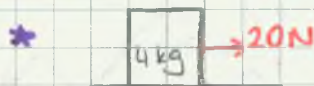


⇒  $k_s \text{ statik} > k_{\text{kinetik}}$

### 3-Dinamiğin Temel Prensipleri

$$\vec{F}_{net} = m \cdot \vec{a}$$

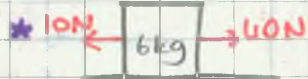
Hareket yönüne etkili eden kuvvetler — ters yöndeki kuvvetler.



$$a = ?$$

$$F_{net} = m \cdot a$$

$$20 = 4 \cdot a \Rightarrow 5 \text{ m/s}^2$$



$$a = ?$$

$$40 - 10 = m \cdot a$$

$$30 = 6 \cdot a \Rightarrow 5 \text{ m/s}^2$$



$$a = ?$$

$$f_s = \mu \cdot k \cdot N = 5 \cdot 0.5 = 2.5 \text{ N}$$

$$15 = 5 \cdot a \Rightarrow 3 \text{ m/s}^2$$



$$F_{net} = m \cdot a$$

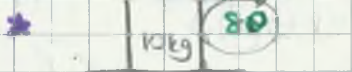
$$F = m \cdot a_1$$



$$F_{net} = 3F = 4m \cdot a_2$$

$$\frac{a_1}{a_2} = \frac{F}{3F} = \frac{m \cdot a_1}{4m \cdot a_2}$$

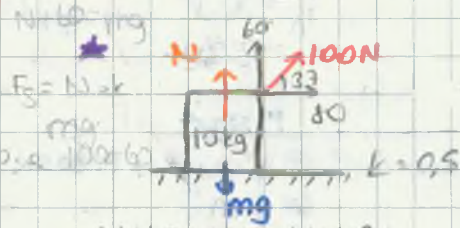
$$\frac{1}{2} = \frac{1}{4} \Rightarrow 3a_1 = 2a_2$$



$$a = ?$$

$$F_{net} = m \cdot a$$

$$80 = 10 \cdot a \Rightarrow a = 8 \text{ m/s}^2$$

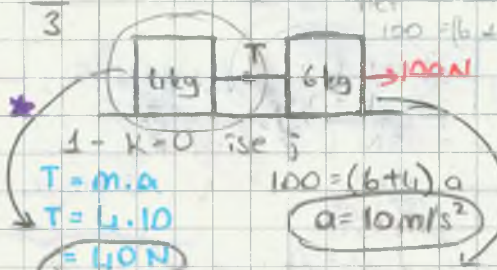


$$N + 60 = 100 \Rightarrow N = 40$$

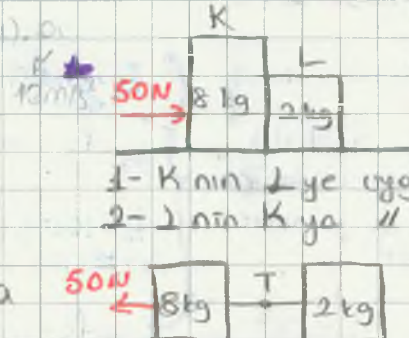
$$f_s = 10 \cdot 0.5 = 20 \text{ N}$$

$$F_{net} = m \cdot a$$

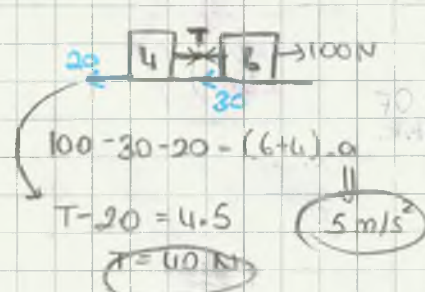
$$80 - 20 = 10 \cdot a \Rightarrow a = 6 \text{ m/s}^2$$



1-  $k=0$  ise  $T = m \cdot a$   
 $T = 4 \cdot 10 = 40 \text{ N}$   
 $100 = (6+6) \cdot a \Rightarrow a = 10 \text{ m/s}^2$



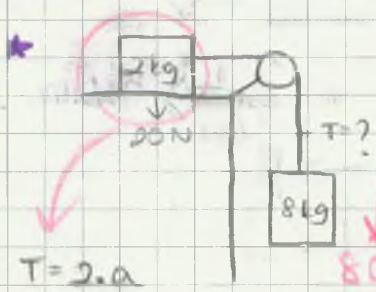
1- K'nin altına uyg. kuvvet?  $T=10$   
 2- 2'nin K'ya // // ?  $T=10$   
 $T = m \cdot a$



$$100 - 30 - 20 = (6+4) \cdot a$$

$$50 = 10 \cdot a \Rightarrow a = 5 \text{ m/s}^2$$

$$T - 20 = 4 \cdot 5 \Rightarrow T = 40 \text{ N}$$



$$80 = (8+4) \cdot a \Rightarrow a = 8 \text{ m/s}^2$$

$$80 - T = 8 \cdot a$$

$$T = 16 \text{ N}$$

$$F_{net} = m \cdot a$$

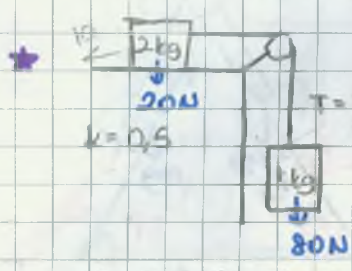
$$80 = 10 \cdot a \Rightarrow a = 8 \text{ m/s}^2$$

$$80 - T = 8 \cdot a$$

$$f_s = mgk$$

$$20 \cdot 0,5 = 10$$

$$70 = 10 \cdot a \Rightarrow a = 7 \text{ m/s}^2$$

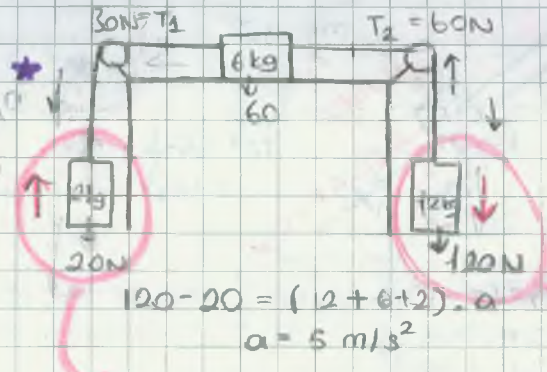


$$80 - 10 = (8 + 2) \cdot a$$

$$a = 7 \text{ m/s}^2$$

$$80 - T = 8 \cdot 7$$

$$T = 24 \text{ N}$$



$$120 - 20 = (2 + 6 + 2) \cdot a$$

$$a = 5 \text{ m/s}^2$$

$$T_1 - 20 = 2 \cdot 5$$

$$T_1 = 30 \text{ N}$$

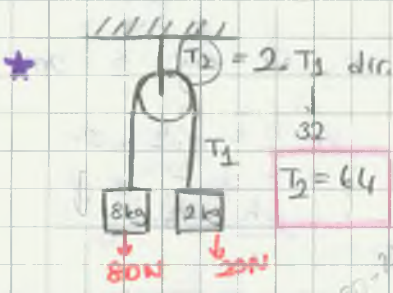
$$120 - T_2 = 12 \cdot 5$$

$$T_2 = 60 \text{ N}$$

$$100 = m \cdot a$$

$$\downarrow$$

$$20 \cdot a = 5 \text{ m/s}^2$$

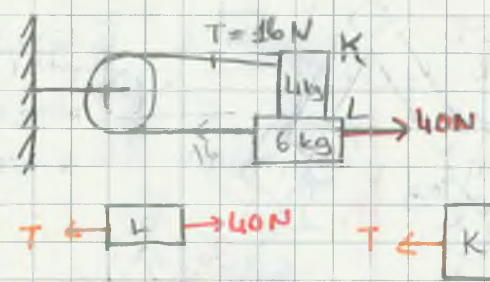


$$80 - 20 = 10 \cdot a$$

$$a = 6 \text{ m/s}^2$$

$$T_1 - 20 = 2 \cdot 6$$

$$T_1 = 32$$



$$40 - T = 6 \cdot a$$

$$10 - 4a = 6a$$

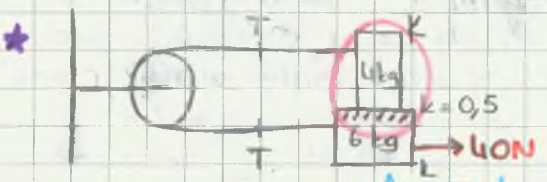
$$40 = 10a$$

$$a = 4 \text{ m/s}^2$$

$$T = ?$$

$$m \cdot a = T$$

$$10 - T = 10 \cdot a$$



$$T = ?$$

$$f_s \leftarrow L \rightarrow 60 \text{ N}$$

$$T \leftarrow K \rightarrow f_s$$

$$60 - (T + 20) = 6 \cdot a$$

$$f_s = mgk$$

$$= 4 \cdot 10 \cdot 0,5$$

$$= 20 \text{ N}$$

$$60 - (4a + 20 + 20) = 6a$$

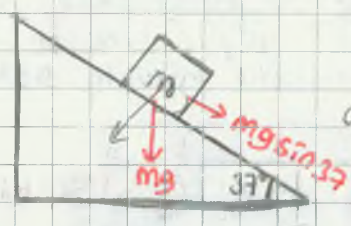
$$60 - 40 - 4a = 6a$$

$$20 = 10a$$

$$a = 2 \text{ m/s}^2$$

$$T = 4 \cdot 2 + 20$$

$$= 28 \text{ N}$$

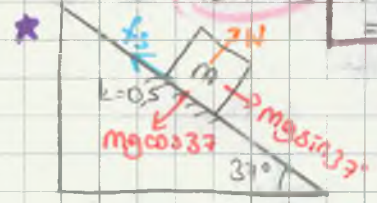


$$f_{\text{net}} = m \cdot a$$

$$mg \sin 37 = m \cdot a$$

$$10 \cdot 0,6 = a$$

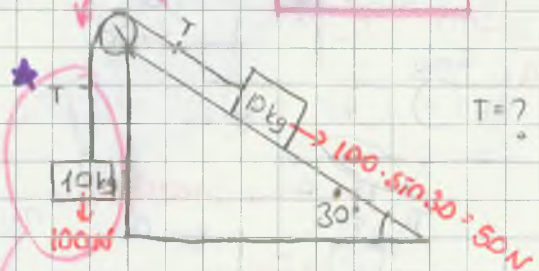
$$a = 6 \text{ m/s}^2$$



$$mg \sin 37 = f_s = m \cdot a$$

$$mg \sin 37 - mg \cos 37 \cdot k = m \cdot a$$

$$6 - 4 = a = 2 \text{ m/s}^2$$

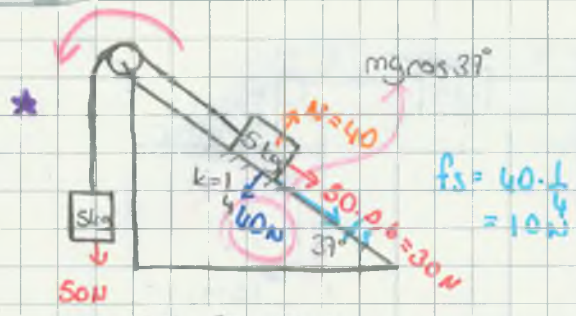


$$100 - 50 = (10 + 10) \cdot a$$

$$a = 2,5 \text{ m/s}^2$$

$$100 - T = 10 \cdot 2,5$$

$$T = 75 \text{ N}$$



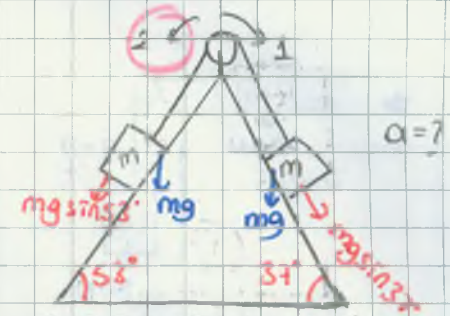
$$50 - 30 - f_s = 10 \cdot a$$

$$10 = 10 \cdot a$$

$$a = 1 \text{ m/s}^2$$

$$50 - T + 5 \cdot 1$$

$$T = 45 \text{ N}$$

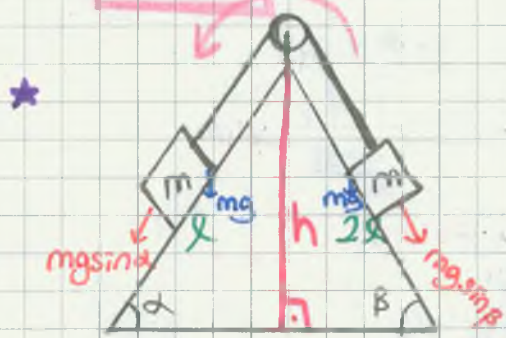


$$mg \sin 53^\circ - mg \sin 37^\circ = 2m \cdot a$$

$$0,2g - 0,1g = 2a$$

$$0,1g = 2a$$

$$a = 1 \text{ m/s}^2$$



$$\sin \alpha = \frac{h}{l}$$

$$\sin \beta = \frac{h}{2l}$$

$$mg \sin \alpha - mg \sin \beta = 2m \cdot a$$

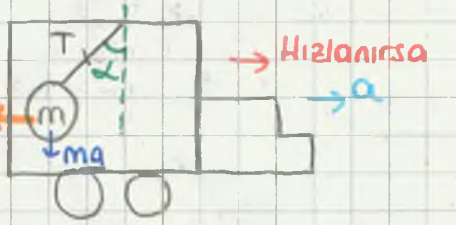
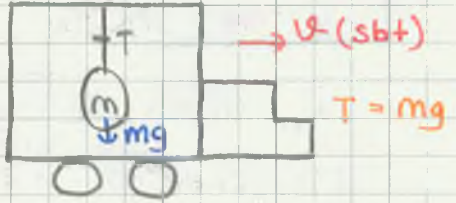
$$g \cdot \frac{h}{l} - g \cdot \frac{h}{2l} = 2a$$

$$\frac{gh}{2l} = 2a$$

$$\frac{10h}{4l} = a = 2,5 \frac{h}{l}$$

### - EYLEMSİZLİK KUVVETİ -

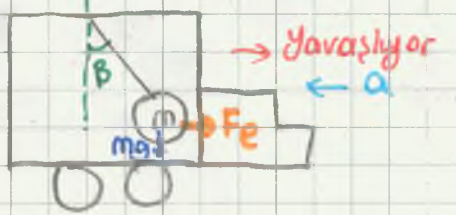
Bir cisme eylemsizlik kuvveti etki etmesi için o cismin ivmeli hareket yapar başka bir sistem içinde veya üzerinde olması gerekir. Eylemsizlik kuvveti sistemin ivmesine ters yönlü olarak cisme etki eder.



$$T \sin \alpha = F_e$$

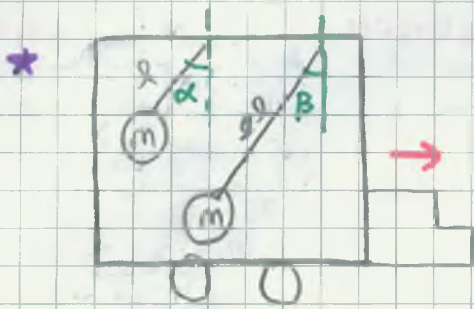
$$T \cos \alpha = mg$$

$$\tan \alpha = \frac{F_e}{mg} = \frac{m \cdot a}{mg} = \frac{a}{g}$$

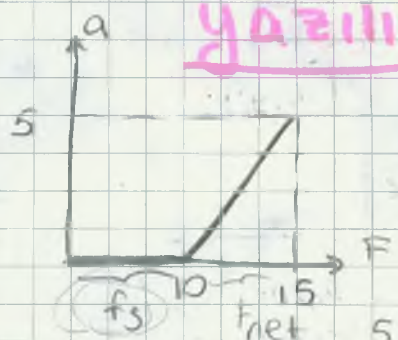


$$\tan \alpha = \frac{F_e}{mg} = \frac{m \cdot a}{mg} = \frac{a}{g}$$

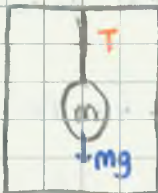




$$\frac{F}{P} = ? - 1$$

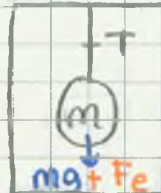


- Asansörler -



↑ (v sabit)

$$T = mg$$



↑ hızlanıyor

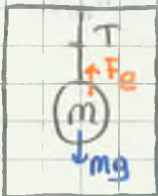
$$T + Fe = m(g + a)$$

$f_s = 10$   
 $mg = 10$   
 $10 \cdot k = 10$   
 $k = 1$

$$T = mg + Fe = m(g + a)$$

$$5 = m \cdot 5$$

$$m = 1$$



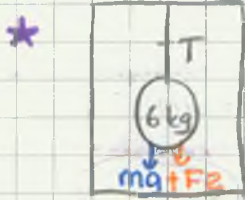
Yukarı a ivmesi ile yavaşlıyor.

↓ a

$$T + Fe = mg$$

$$T = mg - Fe = m(g - a)$$

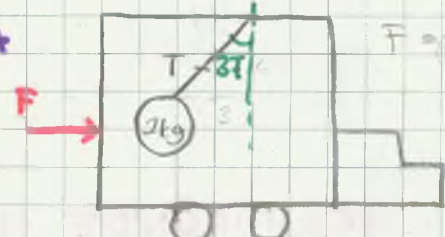
$$\frac{a}{10} = \frac{3}{4}$$



Asansör aşağı  $4 \text{ m/s}^2$  lik ivme ile yavaşlarsa  $T = ?$

$$T = mg + Fe$$

$$T = 6(10 + 4) = 64 \text{ N}$$



$$F = m \cdot a$$

$$8 \cdot a = 75$$

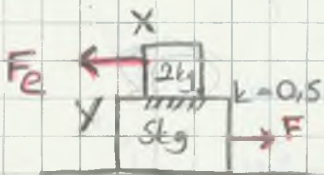
Araba = 8 kg ⇒ F = ?

$$F = m_{\text{top}} \cdot a = (8 + 2) \cdot a$$

$$\tan 37^\circ = \frac{a}{g} = \frac{3}{4}$$

$$a = 7.5 \text{ m/s}^2$$

$$F = 10 \cdot 7.5 = 75 \text{ N}$$



$$F = m \cdot a$$

X'in Y üzerinde kaymadan hareket edebilmesi (birlikte hareket) için F'in en fazla kaç olması gerekir? Birlikte hareket için:

$$F_e = f_s \quad F = m_{\text{top}} \cdot a = 7.5 = 35 \text{ N}$$

$$m a = m g k$$

$$a = g k$$

$$a = 10 \cdot 0.5 = 5 \text{ m/s}^2$$