

# 物理学基礎 問題集2018

～力学～

略解 例題01 - 23

例題-01

作図：略  
合成変位の大きさ

$$|\vec{r}| = \sqrt{65} \text{ [km]}$$

例題-02

変位  $-10$  [m]

平均速度  $-5$  [m/s]

例題-03

1.  $a(t) = 10$  [m/s<sup>2</sup>]

2.  $5$  [m/s]

3.  $x(t) = 5t + 5t^2 + 20$  [m]

例題-04

略

方針

定義式

$$v = \frac{dx}{dt} \quad a = \frac{dv}{dt}$$

を使って加速度・変位を導く

例題-05

作図：略

運動方程式

1.  $ma = mg \sin \theta$
2.  $ma = mg \sin \theta - f$
3.  $ma = mg - kv$
4.  $ma = -f_s$
5.  $ma = mg - f_s$

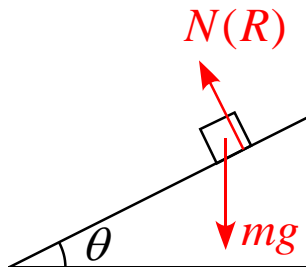
例題-06

1.  $\Delta v = \frac{k}{3m} t^3$

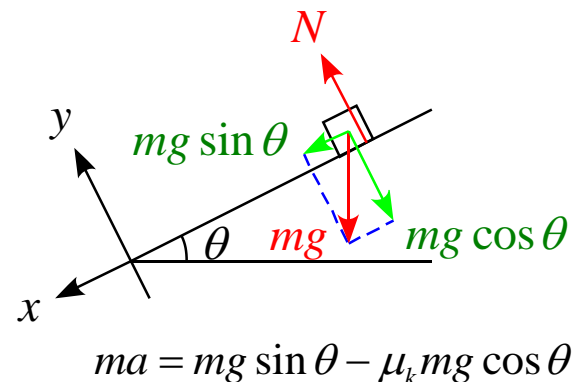
2.  $\Delta x = \frac{k}{12m} t^4 + v_0 t$

例題-07

(1) 作図



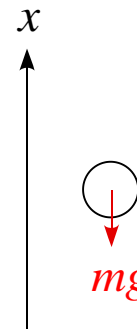
(2) 運動方程式



(3) 略

例題-08

(1) 作図



(2) 運動方程式  $ma = -mg$

(3) 略

方針

運動方程式を変形して

$$\frac{d}{dt} \left( \quad \right) = 0$$

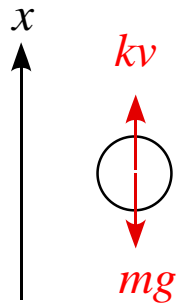
の形にする

例題-09

1.  $ma = -mg$
2.  $v(t) = -gt + v_0$
3.  $x(t) = -\frac{1}{2}gt^2 + v_0t$
4.  $t_{\max} = \frac{v_0}{g}$
5.  $x_{\max} = \frac{v_0^2}{2g}$
6.  $v(t_1) = -v$

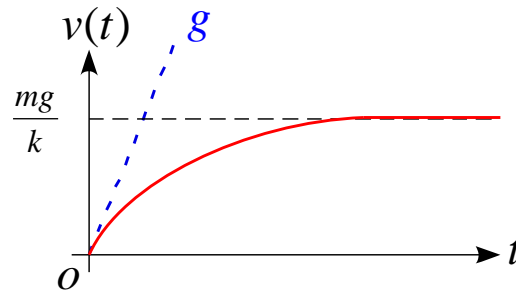
例題-10

(1) 作図



(2) 運動方程式  $ma = mg - kv$

(3) グラフ

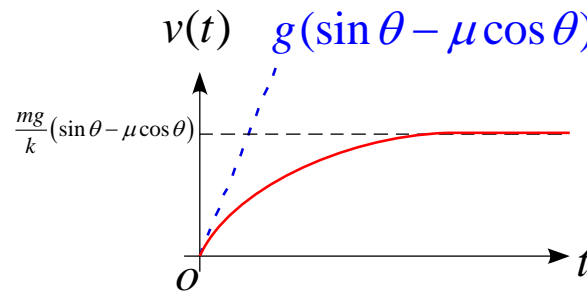


(4)  $v(\infty) = \frac{mg}{k}$

例題-11

1.  $m\alpha(t) = mg \sin \theta - kv(t) - \mu mg \cos \theta$

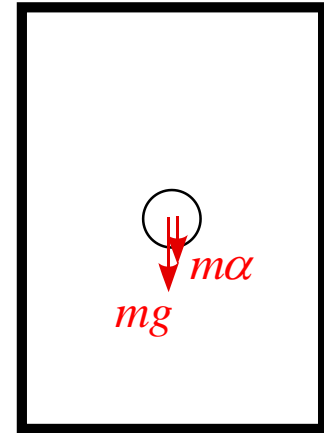
2. グラフ



3.  $v(\infty) = \frac{mg}{k}(\sin \theta - \mu \cos \theta)$

例題-12

1. 作図

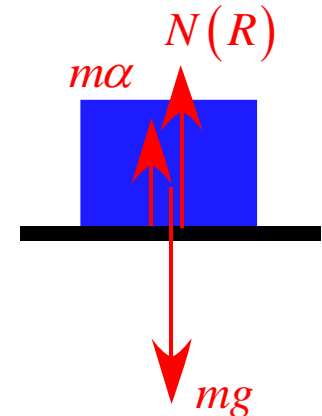


2. 運動方程式  $ma = -mg - m\alpha$

3.  $\alpha = \frac{2v_0}{t_0} - g$

例題-13

1. 作図



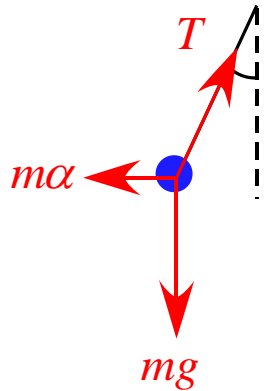
例題-13

2.  $N = m(g - \alpha)$

3.  $\alpha = g$

例題-14

1. 作圖

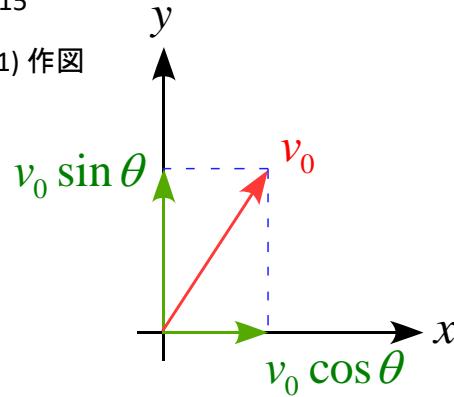


2.  $\tan \theta = \frac{\alpha}{g}$

3.  $T = m\sqrt{\alpha^2 + g^2}$

例題-15

(1) 作圖



(2) 運動方程式

$$ma_x = 0$$

$$ma_y = -g$$

(3) 速度

$$v_x(t) = v_0 \cos \theta$$

$$v_y(t) = -gt + v_0 \sin \theta$$

(4) 變位

$$x(t) = (v_0 \cos \theta) \cdot t$$

$$y(t) = -\frac{1}{2}gt^2 + (v_0 \sin \theta) \cdot t$$

(5)  $t_1 = \frac{2v_0 \sin \theta}{g}$

(6)  $x = \frac{2v_0^2 \sin \theta \cos \theta}{g}$

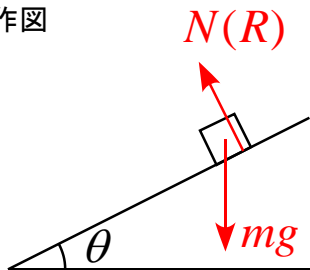
(7)  $t_2 = \frac{v_0 \sin \theta}{g}$

(8)  $(x, y) = \left( \frac{v_0^2 \sin \theta \cos \theta}{g}, \frac{v_0^2 \sin^2 \theta}{2g} \right)$

(9)  $\theta_0 = 45^\circ$

例題-16

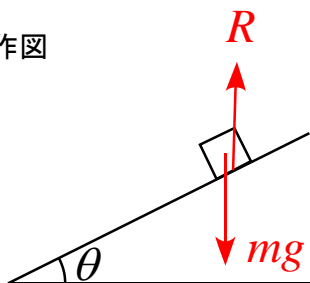
(1) 作圖



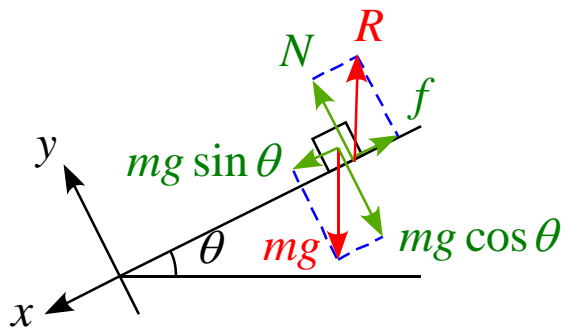
(2) 運動方程式  $ma = mg \sin \theta$

(3)  $x = \frac{1}{2} g \sin \theta \cdot t^2$

(4) 作圖



(5) 運動方程式

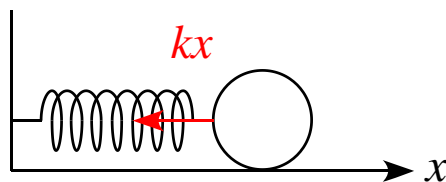


$$ma = mg \sin \theta - \mu_k mg \cos \theta$$

(6) 略

例題-17

(1) 作圖

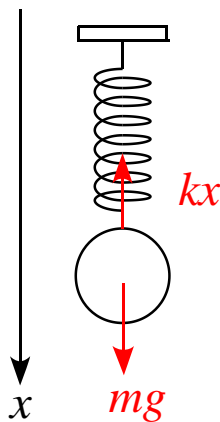


(2) 運動方程式  $ma = -kx$

(3)  $W = \frac{1}{2} kx_0^2$

(4) 略

(5) 作圖

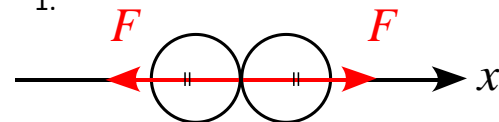


(6) 運動方程式  $ma = mg - kx$

(7) 略

例題-18

1.



2. 略

例題-19

1.  $\alpha + \beta = 90^\circ$

2.  $\frac{v}{V} = \tan \beta$

例題-20

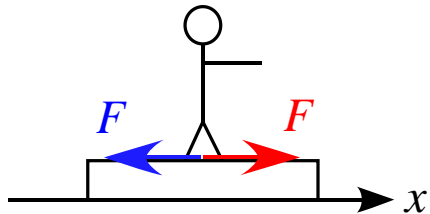
1.  $m(t) = M - m_0 t$

2.  $v(t) = \frac{M}{M - m_0 t} v_0$

3.  $x(t) = -\frac{Mv_0}{m_0} \log \frac{M - m_0 t}{M}$

例題-21

1. 作図 水平方向成分のみ



青は板が受ける力、赤は人が受ける力

2. 運動方程式

$$\text{板: } M \frac{d^2 x_1}{dt^2} = -F$$

$$\text{人: } M \frac{d^2 x_2}{dt^2} = F$$

3.  $|x| = \frac{m}{m+M} l$

例題-22

1.  $m(t) = \rho x$

2.  $\frac{d}{dt}(\rho xv) = F - mg$

3.  $F = \rho(v^2 + xa + xg)$

4.  $F = \rho(v^2 + xg)$

例題-23

(1)  $v_1 = \frac{M(1+e)}{M+m} v_0$

(2)  $v_2 = \frac{M-em}{M+m} v_0$

(3)  $M < em$

(4) 速度交換