No. 16

The potential energy of a body of mass m is given by $-mgx+\frac{1}{2}kx^2$. The force acting on the body at position x is

(A) $-\frac{mgx^2}{2}+\frac{kx^3}{6}$ (B) $\frac{mgx^2}{2}-\frac{kx^3}{6}$

(C) $-mg+\frac{1}{2}kx$ (D) $-mg+kx$

(E) $mg-kx$

No. 17

A block starting from rest slides down a frictionless inclined plane of length L. When the block has attained one-half its final speed, the distance it has traveled along the plane is

(A) $\frac{L}{4}$ (B) $L(\sqrt{2}-1)$ (C) $\frac{L}{2}$

(D) $\frac{L}{\sqrt{2}}$ (E) $\frac{3L}{4}$

No. 18

The motion of a certain object is described as follows:

$$\frac{dv}{dt}=-kv^2t \quad \text{where k is a constant}$$

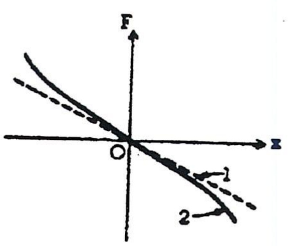
The initial velocity is v_0, when time $t=0$, The expression involving the velocity v as a function of time t is

(A) $v=\frac{kt^2}{2}+v_0$ (B) $\frac{1}{v}=-\frac{kt^2}{2}+v_0$

(C) $\frac{1}{v}=\frac{kt^2}{2}+\frac{1}{v_0}$ (D) $\frac{1}{v}=\frac{kt^2}{2}$

(E) $\frac{1}{v}=-\frac{kt^2}{2}+\frac{1}{v_0}$

No. 19



The forces produced by two springs as they are stretched are shown in the graph above. Spring I indicated by the dashed line is linear but spring 2 is not. The period of oscillation for a mass attached to spring 2 is

(A) dependent on amplitude but never greater than for spring 1
(B) dependent on amplitude but never less than for spring 1
(C) dependent on amplitude but always equal to that of spring I
(D) independent of amplitude and never greater than for spring I
(E) independent of amplitude and never less than for spring 1

No. 20

A spaceship of mass m is returning to the Earth with its engine turned off. It can be assumed to move in the Earth's gravitational field only. In moving from a distance R_1 to a distance R_2 from the center of the Earth of mass M_e, the increase in kinetic energy of the spaceship, where G to the universal gravitational constant, is

(A) $GM_em\left(\frac{1}{R_2}\right)$ (B) $GM_em\left(\frac{1}{R_2^2}\right)$

(C) $GM_em\left(\frac{R_1-R_2}{R_1^2}\right)$ (D) $GM_em\left(\frac{R_1-R_2}{R_1R_2}\right)$

(E) $GM_em\left(\frac{R_1-R_2}{R_1^2R_2^2}\right)$

No. 21

The path traced out by a particle on the rim of a wheel that rolls without slipping is a cycloid. The coordinates of the path can be written

$$x = \omega Rt - R\sin\omega t$$
$$y = R - R\cos\omega t$$

where R and ω are constants and t in time. The magnitude of the acceleration of the particle is

(A) $\frac{\omega^2}{R}$ (B) $R\omega^2$ (C) $2R\omega^2$

(D) $\sqrt{2}R\omega^2$ (E) $\frac{\omega^2}{2R}$