EXAM II Physics 218 2017

Last Name.....First Name.....Section Number.....

USEFUL INFORMATION

$$If \quad f(x) = kx^n \qquad \frac{df}{dx} = nkx^{n-1}$$

$$If \quad f(x) = kx^n \qquad \int_A^B f(x)dx = \frac{1}{n+1}k(B^{n+1} - A^{n+1})$$

$$If \quad f(x) = kx^n \qquad \int f(x)dx = \frac{1}{n+1}kx^{n+1} + C$$

$$\int_{\vec{r}_1}^{\vec{r}_2} \vec{F}_{tot} \cdot d\vec{r} = \frac{1}{2}mv^2(\vec{r}_2) - \frac{1}{2}mv^2(\vec{r}_1)$$

If $\vec{F}$ is conservative:

$$\int_{\vec{r}_1}^{\vec{r}_2} \vec{F} \cdot d\vec{r} = -[U(\vec{r}_2) - U(\vec{r}_1)]$$

and

$$F_x = -\frac{\partial U}{\partial x} \qquad F_y = -\frac{\partial U}{\partial y}$$

Errors on Free Body Diagrams will have serious consequences

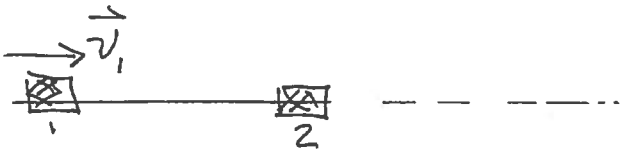
1.

2.

3.

4.

1. A block of mass m_1 is sliding on a frictionless, horizontal surface with velocity of magnitude v_1. It hits another block, mass m_2, which is initially at rest. The blocks go off with velocities that are both equal to $\frac{v_1}{2}$. Obtain enough equations that **could** be solved for the angles that these velocities make with the original direction of motion. **Solve** for these angles for the special case where the masses are equal, i.e. where $m_1 = m_2$.



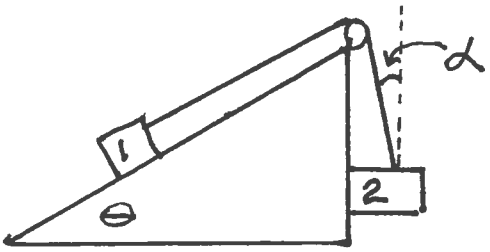
Free Body Diagram (If appropriate). Law or Definition

Application

Result

2. Two blocks are connected by a massless, unstretchable rope which goes over a frictionless pulley. Block 1, mass m_1, moves up the plane where there is friction between the plane and block, with coefficient of friction μ_1. Block 2, mass m_2 has a coefficient of friction between it and the vertical surface of the plane μ_2 (All masses, θ and the angel α are known.) Find the accelerations of the blocks when they are at the position shown. (No algebra please. Stop when you have as many equations as are needed to solve for the accelerations.)

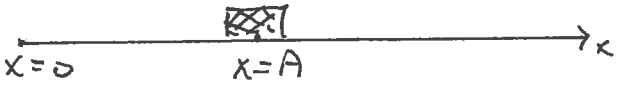
Free Body Diagrams (If appropriate). Law or Definition



Application

Result

3. A small block of mass m on a horizontal surface starts at the point marked $x = A$ with velocity of magnitude v_1 to the right. The coefficient of friction between the block and the surface is a function of x given by $\mu(x) = \mu_0(1 + \frac{x^2}{L^2})$. Here L is a known constant. A springlike force is exerted on the block which points to the left and has magnitude kx, where k ia a known constant. Where will the block have zero velocity? (No algebra please. Quit when you have one equation and one unknown.)



Free Body Diagrams (If appropriate). Law or Definition

Application

Result

4. The motion of a small object of mass m is observed as it moves along the x axis. Its kinetic energy is measured and found to vary with x according to $\frac{1}{2}mv_x^2 = c_1 + c_2x^4$ where c_1 and c_2 are known positive constants. There are two forces acting on the object. One is given by $F_{1x} = c_3x^3$, where c_3 is a known constant. What is the other force, which is known to be conservative?

Free Body Diagram (If appropriate). Law or Definition

Application

Result