

Physics 2314, Homework #5 (due 2/28)

Multiple choice questions

M1 Potential energy of a particle is given by the equation $U = 2x^4 - 4x^2$, where x is in meters and U is in joules.

(a) What are the points where the particle is in stable equilibrium?

- A. 0
- B. ± 1 m
- C. $\pm\sqrt{2}$ m
- D. ± 2 m
- E. ± 4 m

(b) What are the points where the particle is in unstable equilibrium?

- A. 0
- B. ± 1 m
- C. $\pm\sqrt{2}$ m
- D. ± 2 m
- E. ± 4 m

M2 Which of the following forces are conservative?

- A. $\mathbf{F} = (0\mathbf{i} + 1\mathbf{j})$ N everywhere
- B. $\mathbf{F} = (1\mathbf{i} + 0\mathbf{j})$ N everywhere
- C. $\mathbf{F} = (0\mathbf{i} + 1\mathbf{j})$ N in the $y > 0$ half-plane, $\mathbf{F} = 0$ in the $y < 0$ half-plane
- D. $\mathbf{F} = (1\mathbf{i} + 0\mathbf{j})$ N in the $y > 0$ half-plane, $\mathbf{F} = 0$ in the $y < 0$ half-plane

M3 If two vectors \mathbf{A} and \mathbf{B} have the same magnitude, what is the angle between $\mathbf{A} + \mathbf{B}$ and $\mathbf{A} - \mathbf{B}$?

- A. 0°
- B. 30°
- C. 90°
- D. 180°
- E. it depends on the vectors

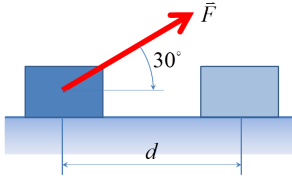
Problems

- P1 A particle is subject to a force F_x that varies with position x according to the following equations:

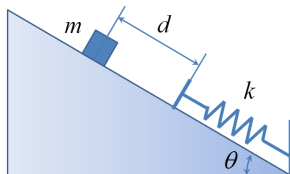
$$F_x = \begin{cases} 0, & x < 0 \\ 0.6x, & 0 \leq x < 5 \\ 3, & 5 \leq x < 10 \\ 9 - 0.6x, & 10 \leq x < 15 \\ 0, & x \geq 15 \end{cases},$$

where x is in meters and F_x is in newtons. Find the work done by the force on the particle as it moves from $x = 0$ to $x = 15$ m.

- P2 A block is being dragged by a force $F = 50$ N directed at an angle $\theta = 30^\circ$ above the horizontal. Determine the work done on the block by the applied force when the block moves a distance of 2 m.



- P3 A frictionless inclined plane of angle $\theta = 30^\circ$ has a spring of force constant $k = 50$ N/m fastened securely at the bottom so that the spring is parallel to the surface. A block of mass $m = 1$ kg is placed on the plane at a distance $d = 0.1$ m from the spring. From this position the block is released toward the spring with zero initial speed. By what distance is the spring compressed when the block momentarily comes to rest?



- P4 A block of mass $m = 1$ kg pushed with velocity $v = 1$ m/s slides a distance d after the pushing force is removed, and stops due to friction. What is the work done by the friction force?