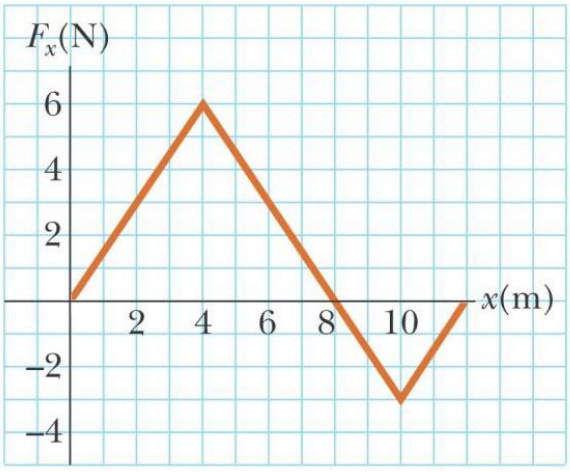
Problem Set 3

Work and Kinetic Energy: Review

1. You push your physics book 1.50 m along a horizontal tabletop with a horizontal push of 2.4 N while the opposing force of friction is 0.6 N. How much work does each of the following forces do on the book: (a) your 2.4-N push, (b) the friction force, (c) the normal force from the tabletop, and (d) gravity? (e) What is the net work done on the book?

2. A block of mass 2.50 kg is pushed 2.20 m along a frictionless horizontal table by a constant 16.0-N force directed 25.0° below the horizontal. Determine the work done on the block by (a) the applied force, (b) the normal force exerted by the table, and (c) the gravitational force. (d) Determine the total work done on the block.

3. The force acting on a particle varies as shown in Figure. Find the work done by the force on the particle as it moves (a) from $x = 0$ to $x = 8.00$ m, (b) from $x = 8.00$ m to $x = 10.0$ m, and (c) from $x = 0$ to $x = 10.0$ m.



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The Work Kinetic Energy Theorem

Summary

- The speed of a particle v is the magnitude of its instantaneous velocity $\vec{v}$.
- The kinetic energy K of a particle having mass m is defined as: $K = \frac{1}{2}mv^2$
- The work-kinetic energy states that the work done to change the speed of a particle is given by the change in its kinetic energy:

$$W = \Delta K = K_f - K_i$$

$$W = \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$$

1. A 0.3-kg ball has a speed of 15.0 m/s. (a) What is its kinetic energy? (b) **What if?** If its speed were doubled, what would be its kinetic energy?

2. A 0.6-kg particle has a speed of 2.0 m/s at point A and kinetic energy of 7.5 J at point B. What is (a) its kinetic energy at A? (b) its speed at B? (c) the total work done on the particle as it moves from A to B?

Power

Summary

- The time rate of energy transfer is called power. If an external force is applied to an object, and if the work done by this force in the time interval Δt is W, then the average power during this interval is defined as:

$$P_{av} = \frac{W}{\Delta t}$$

3. The electric motor of a toy model train accelerates the train from rest to 0.62 m/s in 21.0 ms. The total mass of the toy train is 875 g. Find the average power delivered to the train during the acceleration.