

Warm-up problems to be done BEFORE recitation #6
Physics 271, October 12 and 13, 2017

FORCE EXERTED BY A STREAM OF PARTICLES

- 29 Suppose a gangster sprays Superman's chest with 3 g bullets at the rate of 100 bullets/min, and the speed of each bullet is 500 m/s. Suppose too that the bullets rebound straight back with no change in speed. What is the magnitude of the average force on Superman's chest?

WORK DONE BY CONSTANT FORCE (2D - VECTORS)

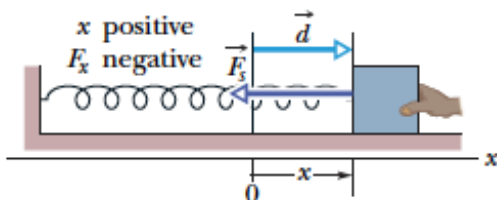
- 8 A ice block floating in a river is pushed through a displacement $\vec{d} = (15 \text{ m})\hat{i} - (12 \text{ m})\hat{j}$ along a straight embankment by rushing water, which exerts a force $\vec{F} = (210 \text{ N})\hat{i} - (150 \text{ N})\hat{j}$ on the block. How much work does the force do on the block during the displacement?

WORK DONE BY CONSTANT FORCE (1D - GRAVITY AT EARTH'S SURFACE)

- 17 **SSM** **WWW** A helicopter lifts a 72 kg astronaut 15 m vertically from the ocean by means of a cable. The acceleration of the astronaut is $g/10$. How much work is done on the astronaut by (a) the force from the helicopter and (b) the gravitational force on her? Just before she reaches the helicopter, what are her (c) kinetic energy and (d) speed?

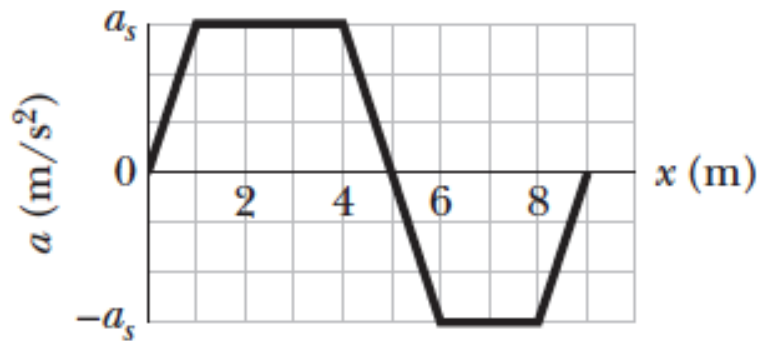
WORK DONE BY SPRING FORCE

- 27 A spring and block are in the arrangement of Fig. 7-9. When the block is pulled out to $x = +4.0 \text{ cm}$, we must apply a force of magnitude 360 N to hold it there. We pull the block to $x = 11 \text{ cm}$ and then release it. How much work does the spring do on the block as the block moves from $x_i = +5.0 \text{ cm}$ to (a) $x = +3.0 \text{ cm}$, (b) $x = -3.0 \text{ cm}$, (c) $x = -5.0 \text{ cm}$, and (d) $x = -9.0 \text{ cm}$?



WORK DONE BY VARIABLE FORCE

••37 Figure 7-39 gives the acceleration of a 2.00 kg particle as an applied force \vec{F}_a moves it from rest along an x axis from $x = 0$ to $x = 9.0$ m. The scale of the figure's vertical axis is set by $a_s = 6.0$ m/s². How much work has the force done on the particle when the particle reaches (a) $x = 4.0$ m, (b) $x = 7.0$ m, and (c) $x = 9.0$ m? What is the particle's speed and direction of travel when it reaches (d) $x = 4.0$ m, (e) $x = 7.0$ m, and (f) $x = 9.0$ m?



ESCAPE VELOCITY

••39 SSM (a) What is the escape speed on a spherical asteroid whose radius is 500 km and whose gravitational acceleration at the surface is 3.0 m/s²? (b) How far from the surface will a particle go if it leaves the asteroid's surface with a radial speed of 1000 m/s? (c) With what speed will an object hit the asteroid if it is dropped from 1000 km above the surface?