UNIVERSITY of ARKANSAS
1871 ®

MEEG 2013 **Name:** _____

(Underline your **last name**.)

Test I ( ) **ID#:** _____

1. (30%) The velocity of a particle in rectilinear motion is shown. If the particle is at $x = -20$ m when $t = 0$, (*a*) draw the *a*-*t* (acceleration versus time) and *x*-*t* (position versus time) curves for the interval $0 \le t \le 13$ s, (*b*) determine the times t_1 and t_2 at which the particle passes through the origin, (*c*) determine the total distance traveled x_T by the particle during the interval $0 \le t \le 11$ s.

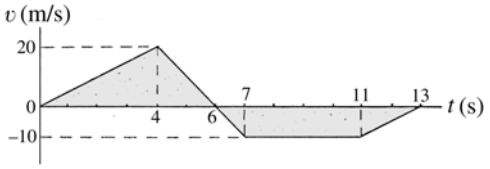

Fig. P1

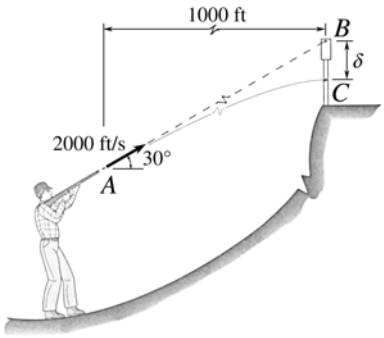

Fig. P2

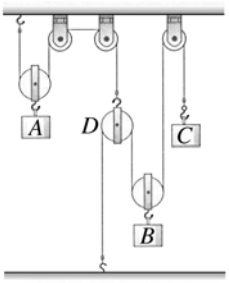

Fig. P3 *A* & *B*

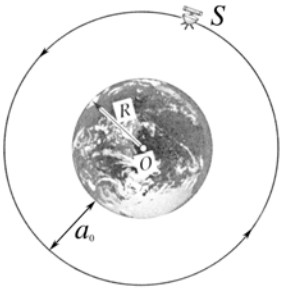

Fig. P3 *C*

2. (30%) The barrel of a rifle is aimed at *B* but the bullet with a muzzle velocity of 2000 ft/s strikes at *C* as shown. Determine (*a*) the flight time t_{AC} of the bullet from *A* to *C*, (*b*) the distance δ between *B* and *C*, (*c*) the speed v_C of the bullet as it strikes at *C*.

3. (20%) *Circle on this test sheet* the correct or nearest item for each of the following:

A. At the instant shown, $\mathbf{v}_A = 2$ m/s ↑, $\mathbf{v}_B = 5$ m/s ↓. Thus, at this instant, $\mathbf{v}_C$ is
(*a*) 2 m/s ↓. (*b*) 2 m/s ↑. (*c*) 3 m/s ↑. (*d*) 6 m/s ↓. (*e*) 6 m/s ↑.

B. At the instant shown, $\mathbf{v}_B = 5$ m/s ↓, $\mathbf{v}_C = 2$ m/s ↓ Thus, at this instant, $\mathbf{v}_D$ is
(*a*) 4 m/s ↓. (*b*) 4 m/s ↑. (*c*) 6 m/s ↓. (*d*) 6 m/s ↑. (*e*) 8 m/s ↓.

C. A spacecraft *S* is in free flight around the earth at an altitude of $a_0 = 300$ mi. Its period of orbit is
(*a*) 92.5 min. (*b*) 92.8 min. (*c*) 93.2 min. (*d*) 93.5 min. (*e*) 93.8 min. (*f*) 94.2 min. (*g*) 94.5 min.

D. The radial component of acceleration of a particle is
(*a*) v^2/ρ. (*b*) $r\ddot{\theta} + 2\dot{r}\dot{\theta}$. (*c*) $\ddot{r} + r\dot{\theta}^2$. (*d*) $\ddot{\theta}$. (*e*) dv/dt. (*f*) $\ddot{r} - r\dot{\theta}^2$. (*g*) $\ddot{r}$.

4. (20%) Non-numerical problem.

A. Including a sketch, define *transverse* component of acceleration of a particle.

B. Including a sketch, define *normal* component of acceleration of a particle.

C. Including a sketch, define *radial* component of acceleration of a particle.

D. Including a sketch, define *tangential* component of acceleration of a particle.

E. Define *effective force* versus *inertia force*.