*Closed book. No work needs to be shown for multiple-choice questions.*

**1**. A rock is thrown straight up with an initial velocity of 19.6 m/s. What time interval elapses between the rock's being thrown and its return to the original launch point? (Acceleration due to gravity is 9.80 m/s2.)?

a. 4s.
b. 5s.
c. 8s.
d. 10s.
e. 12s.

**2**. Two automobiles are 150 kilometers apart and traveling toward each other. One automobile is moving 60.0 km/hr and the other is moving at 40.0 km/hr. In how many hours will they meet?

a. 2.5 hours.
b. 2.00 hours.
c. 1.75 hours.
d. 1.5 hours.
e. 1.25 hours.

**3**. Use the method of components to add the following vectors. The angles are defined with respect to the X-axis of conventional rectangular axes. **A** = 8 units, 20°**B** = 12 units, 300° and **C** = 5 units, 60°. The resulting vector makes an angle of

a. 24° above the positive x axis
b. 24° below the positive x axis
c. 12° above the positive x axis
d. 12° below the positive x axis
e. 24° with the positive y axis

**4**. A plane traveling at 400 mph is flying with a bearing of 40°. There is a wind of 50 mph from the South. If no correction is made for the wind, what are the final ground speed of the plane (treat each velocity as a vector)?

a. 403 mph.
b. 350 mph.
c. 440 mph.
d. 450 mph.
e. 306 mph.

**5**. A car travels 40 kilometers at an average speed of 80 km/hr and then travels 40 kilometers at an average speed of 40 km/hr. The average speed of the car for this 80 km trip is:

a. 40 km/hr.
b. 45 km/hr.
c. 48 km/hr.
d. 53 km/hr.
e. 60 km/hr.

**6**. A bullet is fired horizontally from a handgun at a target 20.0 m away. If the initial speed of the bullet as it leaves the gun is 100 m/s, how far vertically will the bullet have dropped by the time it hits the target? Ignore air resistance and remember that only velocities in the vertical affect vertical displacements.

a. 0.0980 m.
b. 0.196 m.
c. 0.392 m.
d. 0.294 m.
e. 0.490 m.

**7**. Vector $\vec{\mathbf{A}}$ points north and vector $\vec{\mathbf{B}}$ points west. If $\vec{\mathbf{C}} = \vec{\mathbf{B}} - \vec{\mathbf{A}}$, then vector $\vec{\mathbf{C}}$ points:

a. north of east.
b. south of east.
c. north of west.
d. south of west.
e. directly south.

**8**. At the same moment, one rock is dropped and one is thrown downward with an initial velocity of 17.0 m/s from the top of a 300 m tall building. How much earlier does the thrown rock strike the ground? Neglect air resistance.

a. 1.54 s.
b. 1.40 s.
c. 1.09 s.
d. 2.02 s.
e. They land at exactly the same time.

*Equations and constants:*

$$\left\{\begin{array}{l} x = r\cos\theta \\ y = r\sin\theta \end{array}\right\};\quad \left\{\begin{array}{l} r = \sqrt{x^2 + y^2} \\ \theta = \tan^{-1}\left(\dfrac{y}{x}\right) \end{array}\right\};\quad \left\{\begin{array}{l} v_x = v_{ox} + a_x t \\ \Delta x = \frac{1}{2}\left(v_{ox} + v_x\right)t \\ \Delta x = v_{ox}t + \frac{1}{2}a_x t^2 \\ v_x^2 = \left(v_{ox}\right)^2 + 2a_x\Delta x \end{array}\right\};\quad \left\{\begin{array}{l} v_y = v_{oy} + a_y t \\ \Delta y = \frac{1}{2}\left(v_{oy} + v_y\right)t \\ \Delta y = v_{oy}t + \frac{1}{2}a_y t^2 \\ v_y^2 = \left(v_{oy}\right)^2 + 2a_y\Delta y \end{array}\right\};\quad \left\{\begin{array}{l} \Delta x = x_f - x_i \\ \\ speed_{avg} = \dfrac{d}{\Delta t} \end{array}\right\};$$

$$\left\{\begin{array}{l} a_{avg} = \dfrac{\Delta v}{\Delta t} \\ \\ v_{avg} = \dfrac{\Delta x}{\Delta t} \end{array}\right\};\quad \left\{\begin{array}{l} a = \lim\limits_{\Delta t \to 0}\dfrac{\Delta v}{\Delta t} \\ \\ v = \lim\limits_{\Delta t \to 0}\dfrac{\Delta x}{\Delta t} \end{array}\right\};\quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a};\quad \vec{\mathrm{v}}_{\mathrm{AC}} = \vec{\mathrm{v}}_{\mathrm{AB}} + \vec{\mathrm{v}}_{\mathrm{BC}};\quad g = 9.80\ \mathrm{m/s^2};$$

60 s = 1 min; 60 min = 1 hr; 24 hr = 1 day; 365.24 days = 1 yr; 52 weeks = 1 yr;

2.54 cm = 1 in; 12 in = 1 ft; 5,280 ft = 1 mi; 1,609 m = 1 mi; 0.3048 m = 1 ft.