Q1.

Convert the acceleration due to gravity from 9.80 m/s^2 to miles/hours^2. [Use the conversion factors: 1 mile = 5.28×10^3 ft, 1ft = 12.0 in, 1 in = 2.54 cm, 1 m = 100 cm, 1 hr = 3.60×10^3 s]

A) 7.89×10^4
B) 5.28×10^3
C) 1.61×10^4
D) 4.47
E) 9.80

Q2.

Which one of the following quantities has the same dimensions as kinetic energy $K = \frac{1}{2} m v^2$? [You are given: m = mass, x = distance, t = time, v = speed, a = acceleration.]

A) m a x
B) m a t
C) m a
D) m v x
E) m v t

Q3.

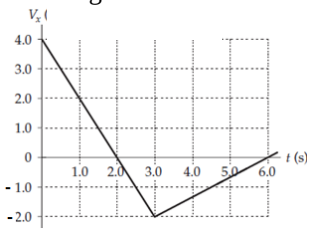
The position of a particle moving along the *x* axis is given by: x = 6.0 t^2 – 1.0 t^3, where x is in meters and t is in seconds. What is the position of the particle at the instant when its acceleration is zero?

A) 16 m
B) 12 m
C) 32 m
D) 24 m
E) 20 m

Q4.

Figure 1 shows the velocity V_x (m/s) of a particle moving along the x-axis. If x = 2.0 m at t = 1.0 s, what is the position, measured in meters, of the particle at t = 6.0 s?

Figure 1

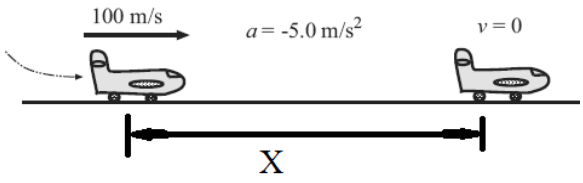


A) –1
B) –2
C) +1
D) +2
E) +6

Q5.

A jet plane lands with a speed of 100 m/s and decelerates with $a = -5.00\ \text{m/s}^2$ as it comes to rest. From the instant it touches the runway; it moves a distance X and stops, as shown in **Figure 2**. What is the distance X, measured in meters?

Figure 2



A) 1000
B) 800
C) 1100
D) 100
E) 900

Q6.

An object is launched vertically upward with an initial speed V_0. The object has an upward velocity of 18 m/s when it reaches one fourth of its maximum height, above its launch point. What is the value of V_0, in m/s?

A) 21
B) 25
C) 30
D) 35
E) 17

Q7.

Two vectors are given by:

$$\vec{A} = 2.0\,\hat{i} - 4.0\,\hat{j}, \quad \text{and} \quad \vec{B} = 3.0\,\hat{i} + 4.0\,\hat{j}.$$

Find the component of $\vec{A}$ along the direction of $\vec{B}$.

A) – 2.0
B) – 1.5
C) 2.5
D) 1.5
E) 3.3

Q8.

A vector $\vec{B}$, when added to the vector $\vec{C} = 3.0\,\hat{i} + 4.0\,\hat{j}$, yields a resultant vector that is in the positive *y* direction and has a magnitude equal to that of vector $\vec{C}$. What is the magnitude of vector $\vec{B}$?

A) 3.2
B) 1.9
C) 2.4
D) 0.2
E) 0.6

Q9.

A man walks 3.00 km due East, then 7.00 km 25° South of East, and then 12.0 km due South. What is the final location, in km, of the man from the starting point?

A) $9.34\,\hat{i} - 15.0\,\hat{j}$
B) $6.21\,\hat{i} - 13.2\,\hat{j}$
C) $-8.04\,\hat{i} + 11.1\,\hat{j}$
D) $-15.0\,\hat{i} - 8.45\,\hat{j}$
E) None of the other answers

Q10.

Consider two vectors, $\vec{A}$ and $\vec{B}$, each has magnitude L and having an angle 60^o between them. The magnitude of the product $\left(\vec{A} \times \vec{B}\right) \cdot \vec{A}$ is:

A) 0
B) $3L^2/2$
C) $L^2/2$
D) $3L^2$
E) $3L^2/4$

Q11.

A particle is at the origin of coordinates at time t = 0. For the time interval from 0 to 15 s, the particle's average velocity is:

$$\vec{V}_{average} = \left(-3.8\,\hat{i} + 4.4\,\hat{j}\right) \text{ m/s.}$$

How far is the particle from the origin at t = 15 s?

A) 87 m
B) 57 m
C) 69 m
D) 15 m
E) 72 m

Q12.

A projectile is launched from ground level with an initial velocity:

$$\vec{V}_o = \left(20\,\hat{i} + 12\,\hat{j}\right) \text{ m/s.}$$

How far, from the launch point, will it travel horizontally as it hits the ground? Ignore air resistance.

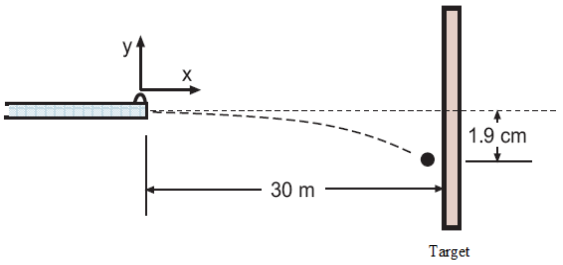
A) 49 m
B) 51 m
C) 69 m
D) 25 m
E) 92 m

Q13.

A rifle is aimed horizontally at a target 30 m away. The bullet hits the target 1.9 cm below the aiming point, as shown in **Figure 3**. At what time will the bullet hit the target after being fired?

A) 6.2×10^{-2} s
B) 2.0×10^{-2} s
C) 3.9×10^{-3} s
D) 2.9×10^{-3} s
E) 4.2×10^{-2} s

Figure 3

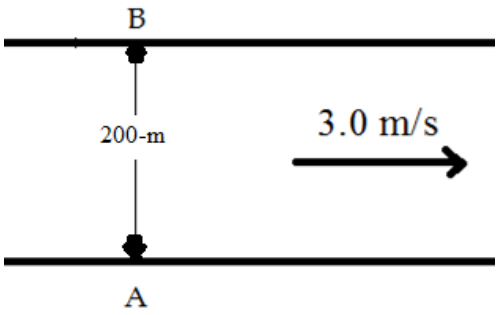


Q14.

Figure 4 shows a 200-m wide river which has a uniform flow speed of 3.0 m/s toward the east. A boat with a speed of 8.0 m/s relative to the water leaves the south bank at point A and crosses the river to point B directly north of its departure point. How long does it take the boat to cross the river?

A) 27 s
B) 23 s
C) 25 s
D) 29 s
E) 17 s

Figure 4



Q15.

A particle is moving in uniform circular motion with speed V, period T and radius *R*. What is the magnitude of the average acceleration of the particle over one period?

A) 0
B) (3V)/T
C) (2V)/T
D) V/T
E) V/(2T)