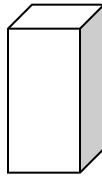


Practice problems, Physics 102 Common Exam 1, Spring 2023

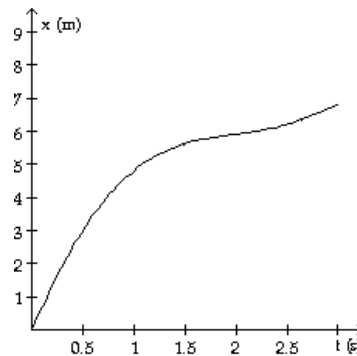
- 1) A train travels at a constant speed of 60.4 miles per hour for 101.5 minutes. What distance does the train cover?
- A) 100 miles
 - B) 102.2 miles
 - C) 102 miles
 - D) 102.18 miles

- 2) One inch is equal to 0.0254 m. A box with the dimensions of 2.1 inch \times 3 inch \times 10 inch has a volume of:

- A) 10^6 m^3
- B) 10^{-3} m^3
- C) 1 m^3
- D) 10^3 m^3
- E) 10^{-6} m^3



- 3) In the position vs. time graph shown, how does the instantaneous velocity at $t_1 = 0.5 \text{ s}$ compare with that at $t_2 = 1.5 \text{ s}$?
- A) They are equal.
 - B) The velocity at t_1 is smaller than that at t_2 .
 - C) The velocity at t_1 is greater than that at t_2 .
 - D) It is impossible to tell velocities in such a graph.



- 4) An airplane starts from rest and accelerates at 10.8 m/s^2 . What is its speed at the end of a 400 m-long runway?
A) 37.0 m/s
B) 93.0 m/s
C) 65.7 m/s
D) 4320 m/s
- 5) A car is moving with a speed of 32.0 m/s. The driver sees an accident ahead and slams on the brakes, giving the car a deceleration of 3.50 m/s^2 . How far does the car travel after the driver put on the brakes before it comes to a stop?
A) 4.57 m
B) 9.14 m
C) 112 m
D) 146 m
- 6) To determine the height of a bridge above the water, a person drops a stone and measures the time it takes for it to hit the water. If the time is 2.3 s, what is the height of the bridge?
A) 10 m
B) 14 m
C) 26 m
D) 32 m
- 7) Vector \vec{A} points north and vector \vec{B} points east. If $\vec{C} = \vec{B} - \vec{A}$, then vector \vec{C} points:
A) north of east.
B) south of east.
C) north of west.
D) south of west.
- 8) A vector is located in the x - y plane. The x - and y -components of this vector are 4.00 m and 3.00 m, respectively. Find the angle that this vector makes with the positive y -axis.
A) 53.1°
B) 36.9°
C) 126.9°
D) 22.4°

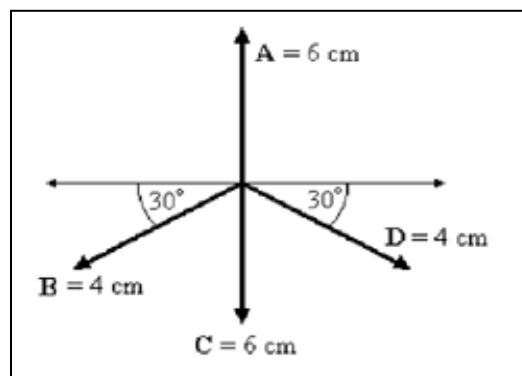
9) A displacement vector is 34.0 m in length and is directed 60.0° east of north. What are the components of this vector?

- A) Choice 1
- B) Choice 2
- C) Choice 3
- D) Choice 4

<u>choice</u>	<u>Northward component</u>	<u>Eastward component</u>
1	29.4 m	17.0 m
2	18.2 m	28.1 m
3	22.4 m	11.5 m
4	17.0 m	29.4 m

10) There are four vectors arranged as shown in the figure. Using the component method, find the components of the sum (resultant) of these four vectors.

<u>choice</u>	<u>x-component</u>	<u>y-component</u>
1	0 cm	6.0 cm
2	-3.5 cm	-2.0 cm
3	+3.5 cm	-2.0 cm
4	0 cm	-4.0 cm



- A) Choice 1
- B) Choice 2
- C) Choice 3
- D) Choice 4

11) A car is traveling with a constant speed when the driver suddenly applies the brakes, giving the car a deceleration of 3.50 m/s^2 . If the car comes to a stop in a distance of 30.0 m, what was the car's original speed?

- A) 105 m/s
- B) 210 m/s
- C) 315 m/s
- D) 10.2 m/s
- E) 14.5 m/s

12) A track star in the broad jump goes into the jump at 12 m/s and launches himself at 20° above the horizontal. How long is he in the air before returning to Earth? ($g = 9.8 \text{ m/s}^2$)

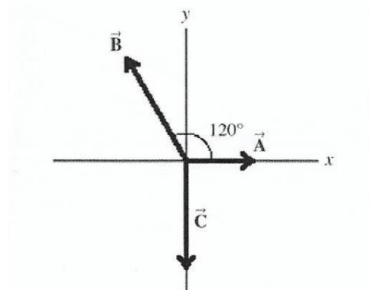
- A) 0.42 s
- B) 0.84 s**
- C) 1.25 s
- D) 1.68 s

13) A bird moves with a speed of $v = 12.0 \text{ m/s}$. The x-component of its velocity is 9.00 m/s . The angle between the direction of its motion and the x-axis must be:

- A) 41.40°
- B) 48.2°
- C) 53.0°
- D) 58.6°
- E) 30.0°

14) Find the magnitude and direction of the sum of the three vectors, **A**, **B**, and **C**, shown in the figure. These vectors have the following magnitudes: $A = 5.0$, $B = 7.9$, and $C = 6.0$. Express the direction by specifying the angle it makes with the +x-axis, with counterclockwise angles taken to be positive.

- A) Direction 0.38, Angle -38.7
- B) Direction 1.49, Angle 218.7
- C) Direction 1.34, Angle 38.7
- D) Direction 1.34, Angle 218.7



15) A large cannon is fired from ground level over level ground at an angle of 30° above the horizontal. The muzzle speed is 10 m/s . Neglecting air resistance,

- (a) How long does it take until the projectile hits the ground?
- (b) Find the maximum height.

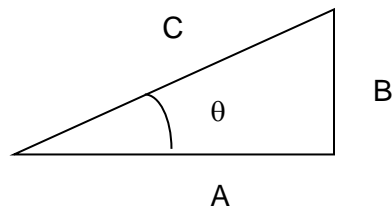
What horizontal distance the projectile will travel before striking the ground?

- 16) A race car starting from rest accelerates at a constant rate of 5.0 m/s^2 .
- What is the velocity of the car after it has traveled 30.5 m ?
 - How much time does it take to reach that distance?

17) A car slows down from $+31 \text{ m/s}$ to $+15 \text{ m/s}$ in a distance of 54 m along a straight road. What was its acceleration, assuming constant?

CONSTANTS AND TRIGONOMETRY $g = 9.80 \text{ m/s}^2$

$$\sin \theta = \frac{B}{C} \quad \cos \theta = \frac{A}{C} \quad \tan \theta = \frac{B}{A} \quad C = \sqrt{A^2 + B^2}$$

MOTION ALONG A STRAIGHT LINE $v = v_0 + at$ $x - x_0 = v_0 t + \frac{1}{2} at^2$

$$x - x_0 = \frac{1}{2}(v_0 + v)t \quad v^2 = v_0^2 + 2a(x - x_0)$$

TWO-DIMENSIONAL MOTION:

$$\mathbf{v}_x = v_{0x} t + \frac{1}{2} a_x t^2; \quad \mathbf{v}_y = v_{0y} t + \frac{1}{2} a_y t^2; \quad \mathbf{v}_x = v_{0x} + a_x t; \quad \mathbf{v}_y = v_{0y} + a_y t;$$

$$a_x = \frac{v_x - v_{0x}}{t}; \quad a_y = \frac{v_y - v_{0y}}{t}$$

PROJECTILE MOTION

$$v_{0x} = v_0 \cos \theta_0 \quad v_{0y} = v_0 \sin \theta_0 \quad \Delta x = v_{0x} t \quad v_y = v_{0y} - gt \quad \Delta y = v_{0y} t - \frac{1}{2} gt^2$$

$$v_y^2 = v_{0y}^2 - 2g(\Delta y) \quad \Delta y = \frac{v_y^2 - v_{0y}^2}{-2g} \quad \Delta y = \left(\frac{v_{0y} + v_y}{2} \right) \cdot t$$

FORCE AND MOTION

$$\mathbf{F}_{\text{net}} = m\mathbf{a} \quad F_g = mg \quad f_{s,\text{max}} = \mu_s F_N \quad f_k = \mu_k F_N$$

$$\text{Incline:} \quad F_{gx} = F_g \sin \theta \quad F_{gy} = F_g \cos \theta$$