Practice problems, Physics 102 Common Exam 1, Fall 2024
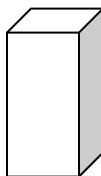
1) A train travels at a constant speed of 60.4 miles per hour for 101.5 minutes. What distance does the train cover?
   A) 100 miles
   B) 102.2 miles
   C) 102 miles
   D) 102.18 miles

2) One inch is equal to 0.0254 m. A box with the dimensions of 2.1 inch × 3 inch × 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 <u>instantaneous</u> velocity at $t_1 = 0.5$ s compare with that at $t_2 = 1.5$ 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.
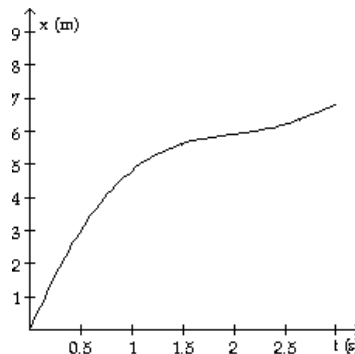
4) An airplane starts from rest and accelerates at 10.8 m/s². What is its speed at the end of a 400 m-long runway?
   A) 37.0 m/s
   B) 93.0 m/s
   C) 65.7 m/s
   D) 4320 m/s

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/s². 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

choice	Northward component	Eastward component
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 <u>component method</u>, find the <u>components</u> of the <u>sum (resultant)</u> of these four vectors.

choice	*x*-component	*y*-component
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
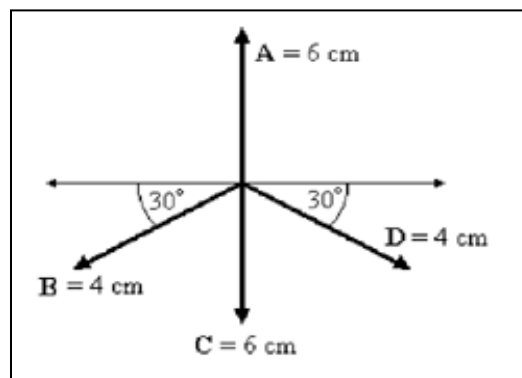
   A) Choice 1
   B) Choice 2
   C) Choice 3
   D) Choice 4

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? ($g = 9.8$ 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 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) 41.4^0
B) 48.2^0
C) 53.0^0
D) 58.6^0
E) 30.0^0

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 +-axis, with counterclockwise angles taken to be positive.

A) Magnitude 0.38, Angle -38.7
B) Magnitude 1.49, Angle 218.7
C) **Magnitude 1.34, Angle 38.7**
D) Magnitude 1.34, Angle 218.7
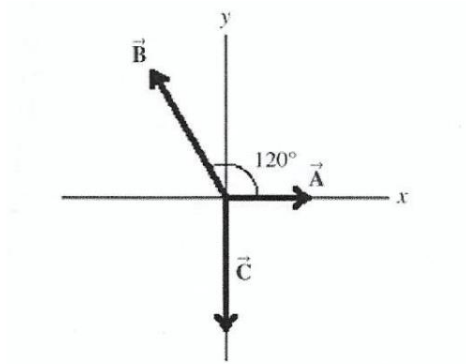
15) A large cannon is fired from ground level over level ground at an angle of 30° above the horizontal. The muzzle speed is 10 m/s. Neglecting air resistance,
(a)   How long does it take until the projectile hits the ground? **Ans. 1 s**
(b)   Find the maximum height. **Ans. 1.3 m**

16) A race car starting from rest accelerates at a constant rate of 5.0 m/s^2.
a) What is the velocity of the car after it has traveled 30.5 m? **Ans. 18 m/s**
b) How much time does it take to reach that distance? **Ans. 3.5 s**

17) A car slows down from +31 m/s to +15 m/s in a distance of 54 m along a straight road. What was its acceleration, assuming constant? **Ans. -6.8 m/s²**

18) Vector $\vec{\mathbf{A}}$ points north and vector $\vec{\mathbf{B}}$ points east. If $\vec{\mathbf{C}} = \vec{\mathbf{B}} - \vec{\mathbf{A}}$, then vector $\vec{\mathbf{C}}$ points:
A) north of west.
B) south of west.
C) north of east.
D) south of east