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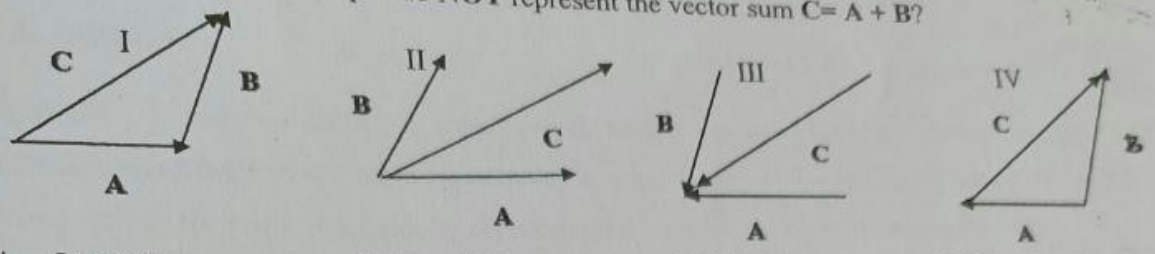


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ACADEMY

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DIRECTION I: Choose the correct answer from the given alternatives and write the letter of your choice in CAPITAL LETTER on the space provided in the answer sheet attached at the end of the questions. (1 pt. each)

1. Which of the following graphs do **NOT** represent the vector sum **C= A + B**?



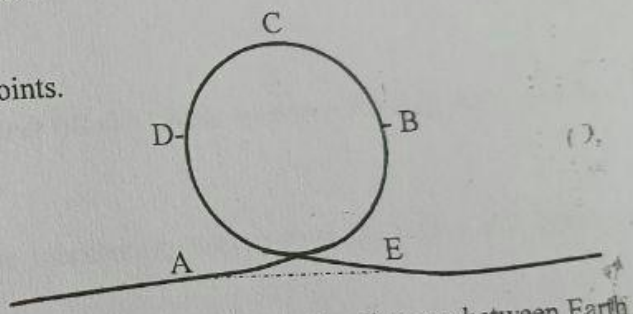
A. I and III **B.** II and IV **C.** III only **D.** IV only

2. A system of four objects, $m_1 = m_2 = m_3$ and $m_4 = 3m_1$, located at ***(0,0), (0, D), (2D, D)*** and ***(D, 2D)*** respectively. What is the location of the center of mass with respect to (0, 0)?

A. $D\hat{\imath} + \frac{3}{4}D\hat{\jmath}$ **B.** $\frac{5}{6}D\hat{\imath} + \frac{7}{4}D\hat{\jmath}$ **C.** $\frac{5}{6}D\hat{\imath} + \frac{4}{3}D\hat{\jmath}$ **D.** $D\hat{\imath} + D\hat{\jmath}$

3. Let a body is moving along the loop ABCDE, where points A and E are at zero GPE level. If the loop is frictionless, which of the following is TRUE?

A. ME at A = PE at C.
B. ME at C is maximum relative to other points.
C. PE at A = ME at C.
D. KE at B = PE at D.



4. A planet '**X**' is revolving around the Sun at a distance ***nine*** times the distance between Earth and Sun. What is the orbital period of this planet?

A. 41 yrs. **B.** 27 yrs. **C.** 4.3 yrs. **D.** 9 yrs.

5. A bullet is fired vertically and covered a maximum displacement of ***45m***. What would be the maximum horizontal displacement of the bullet if it is fired from the same gun on the same level field?

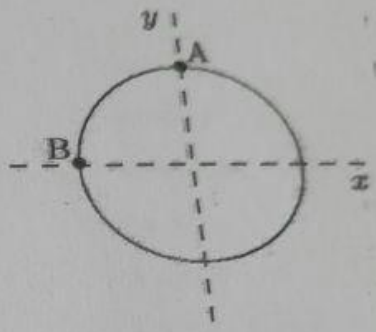
A. 45m **B.** 22.5 m **C.** 90m **D.** 15m

Two trains are moving at 30 m/s in opposite directions on the same track. The engineers see simultaneously that they are on a collision course and apply the brakes when they are 1000 m apart. Assuming both trains have the same acceleration, what must this acceleration be if the trains are to stop just before colliding?

A. -1.0 m/s^2 B. -0.9 m/s^2 C. -30.0 m/s^2 D. -0.03 m/s^2

7. A particle is moving around a circular path with a constant speed as shown below. The coordinates of the particle when it is at point **B** are $x = 5m, y = 0m$ and its velocity is $(10\ m/s)\hat{j}$. What will be the particle's velocity and acceleration when it is at point **A** respectively?

A. *(10 m/s)i and (-20 m/s^2)j*
B. *(6 m/s)i and (-12 m/s^2)j*
C. *(6 m/s)j and (12 m/s^2)i*
D. *(10 m/s)j and (20 m/s^2)i*



DIRECTION II. Give short answers that best fill the blank spaces following each question and give your answers on the answer sheet.

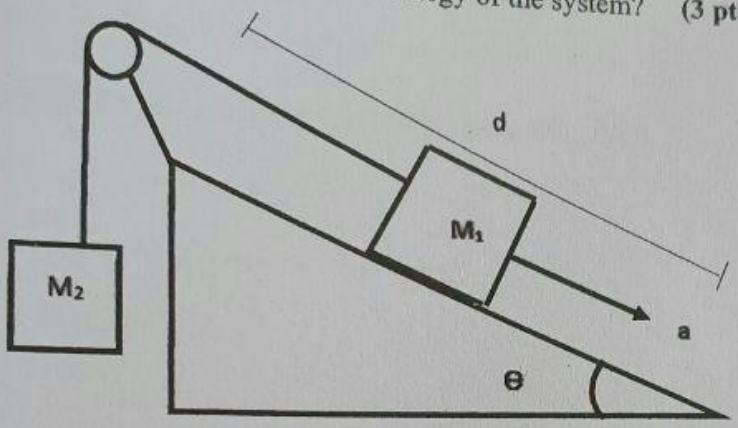
1. A unit vector in the direction of the momentum vector $P = (3i - 5j + 4k)\ kgm/s$ is _____. **(2 pts.)**
2. A missile is fired towards an enemy target with a velocity of 120m/s at an angle of 53^0 from the horizontal. Find the values for the following questions based on this information.
   a) The velocity of the missile at 4s: V(t = 4s) =____ i + ____ j **(2 pts.)**
   b) If the enemy target is at horizontal distance of 500m, will the missile hit the target? _____ justify _____ **(2 pts.)**
3. A boy is about to cross over a rail way but unfortunately a 300m long train arrived and passes by him. How long does he need to wait to cross? _____ **(2 pts.)**

IRECTION III: Workout the following problems and questions showing the necessary steps and giving best arguments (incomplete answers may not have a mark!).

1. Two planets with mases M_1 and M_2 are at a distance R each other. A meteor with mass m entered to their gravitational field. At what distance from the larger planet on the line joining the planets will the net gravitational force on the third mass m be zero? **(3 pts.)**
2. Let we have a system of two objects connected by a weightless string and frictionless pulley as shown in the figure below. If the coefficient of kinetic friction between the block and the inclined plane is μ_k, then what will be:

   A) the acceleration (a) of the system? **(3 pts.)**

   B) The change in kinetic energy of the system? **(3 pts.)**



Given:

$M_1 = 50$ kg

$M_2 = 100$ kg

$\theta = 37°$

$d = 30$ m

$\mu_k = 0.3$

3. Birtukan buys a silver bracelet from a flea market. She wants to know whether the bracelet is made of silver or not and made some experiment. She hangs the bracelet with a weightless string and measure ***10g*** and ***9g*** on air and in water respectively.

   a) Is the bracelet made of pure silver? **(3 pts.)**

   b) Find the Young's Modulus on the bracelet, if ***0.03cm*** is extended from its original length of ***15cm*** applying ***20N*** forces on both ends (assume the bracelet as a rod). The diameter of the bracelet is ***4mm***. **(3 pts.)**

GOOD LUCK!!!