

CSD2301 Practice

**3. Kinematics in 2D and 3D**

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# Practice Question 1

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A jet plane is flying at a constant altitude. At time  $t_1 = 0$  it has components of velocity  $v_x = 90 \text{ m/s}$ ,  $v_y = 110 \text{ m/s}$ . At time  $t_2 = 30.0 \text{ s}$  the components are  $v_x = -170 \text{ m/s}$ ,  $v_y = 40 \text{ m/s}$ . a) Sketch the velocity vectors at  $t_1$  and  $t_2$ . For this time interval calculate b) the components of the average acceleration; c) the magnitude and direction of the average acceleration

## Practice Question 2

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Two crickets, Chirpy and Milada, jump from the top of a vertical cliff. Chirpy jumps horizontally and reaches the ground in 3.50s. Milada jumps with an initial velocity of 95.0 cm/s at an angle of  $32.0^\circ$  above the horizontal. How far from the base of the cliff will Milada hit the ground?



# Practice Question 3

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A Ferris wheel, which rotates counter-clockwise, is just starting up. At a given instant, a passenger on the rim of the wheel and passing through the lowest point of his circular motion is moving at  $3.00 \text{ m/s}$  and is gaining speed at a rate of  $0.500 \text{ m/s}^2$ . Radius of the wheel is  $14 \text{ m}$ . a) Find the magnitude and the direction of the passenger's acceleration at this instant. b) Sketch the Ferris wheel and passenger showing his velocity and acceleration vectors.

# Practice Question 4

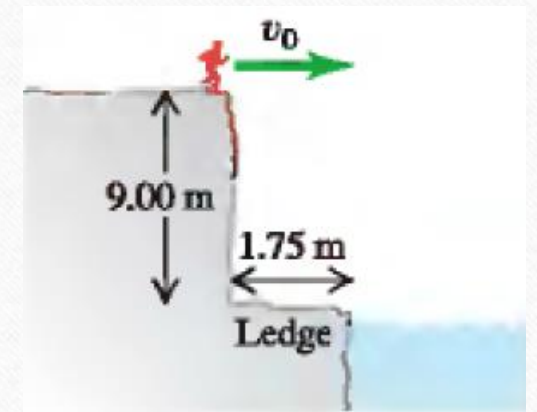
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A jungle veterinarian with a blow-gun loaded with a tranquilizer dart and a sly 1.5 kg monkey are each 25 m above the ground in trees which are 90 m apart. Just as the hunter shoots horizontally at the monkey, the monkey dops from the tree in a vain attempt to escape being hit. What must the minimum muzzle velocity of the dart have been for the hunter to hit the monkey before it reached the ground?



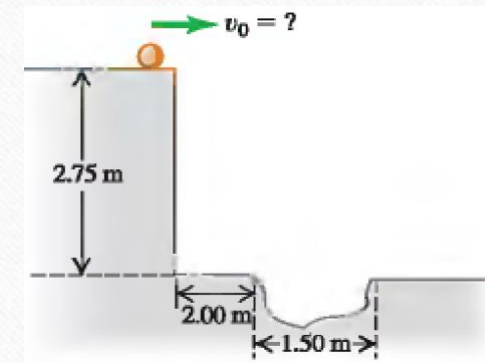
## Practice Question 5

A swimmer dives off a cliff with a running horizontal leap, as shown in the figure. What must her minimum speed be just as she leaves the top of the cliff so that she will miss the ledge at the bottom, which is 1.75 m wide and 9.00 m below the top of the cliff?



## Practice Question 6

A small marble rolls horizontally with speed  $v_0$  off the top of a platform which is 2.75 m tall. There is no air resistance and friction. On the ground, 2.00 m horizontally from the base of the platform, there is a gaping hole in the ground which is 1.50 m wide. For what range of marble speeds  $v_0$  will the marble land in the hole?





# Practice Question 7

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A young boy is oscillating back and forth at the playground swing. At the lowest point, his speed is  $0.92 \text{ m/s}$ . The distance between the boy and the swing hinge is  $4.3 \text{ m}$ . What is the magnitude of his acceleration at the lowest point?



# Practice Question 8

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To triple the centripetal acceleration, what should you do to the period of rotation during a washer spin cycle?