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2- A particle moving in the xy plane with a constant acceleration has a velocity of  $\mathbf{v}_i = (3 \mathbf{i} - 2 \mathbf{j})$  m/s at  $t = 0$ . At  $t = 3$  s, the particle's velocity is  $\mathbf{v} = (9 \mathbf{i} + 7 \mathbf{j})$  m/s. Find the acceleration of the particle

a)  $(2 \mathbf{i} + 3 \mathbf{j}) \text{ m/s}^2$

b)  $(3 \mathbf{i} - 2 \mathbf{j}) \text{ m/s}^2$

c)  $(4 \mathbf{i} + 6 \mathbf{j}) \text{ m/s}^2$

d)  $(6 \mathbf{i} - 4 \mathbf{j}) \text{ m/s}^2$

e)  $(1 \mathbf{i} + 2 \mathbf{j}) \text{ m/s}^2$

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3- A ball is thrown horizontally from the top of a 35 m high building. The ball strikes the ground at a point which is 80 m from the base of the building. Find the time the ball takes during its flight.

a) 4.7 s

b) 1.5 s

c) 2.6 s

d) 5.4 s

e) 3.2 s

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Q(1): The centripetal acceleration of a car moving in a circular path of radius 500 m and a velocity of magnitude 15 m/s is:

a) 0.03

b) 2.2

c) 0.45

d) 16.7

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Q(2): The magnitude and direction of the resultant acceleration for a particle moving non-uniformly with a tangential acceleration of  $0.5 \text{ m/s}^2$  and a velocity of 20 m/s at the moment where the radius of its circular path is 350 m are:

a) 1.24 and  $-66.3^\circ$

b) 1.32 and  $-66.3^\circ$

c) 1.32 and  $66.3^\circ$

d) 1.24 and  $23.7^\circ$

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3- A jumper leaves the ground at an angle of  $23^\circ$  and travels through the air to cover a horizontal distance of 8.7 m before landing. What is the takeoff speed of the jumper?

- a) 31 m/s      b) 14 m/s      c) 8 m/s      **d) 11 m/s**      e) 23 m/s

4- A particle with velocity  $\mathbf{v}_0 = (-2 \mathbf{i} + 4 \mathbf{j})$  m/s at  $t = 0$  undergoes a constant acceleration of  $3 \text{ m/s}^2$  at an angle  $\theta = 120^\circ$  from the positive direction of the x-axis, what is its velocity at  $t = 10$  s?

- a)  $(-17 \mathbf{i} + 30 \mathbf{j})$  m/s**      b)  $(2 \mathbf{i} + 6 \mathbf{j})$  m/s      c)  $(-14 \mathbf{i} + 14 \mathbf{j})$  m/s      d)  $(12 \mathbf{i} - 11 \mathbf{j})$  m/s      e)  $(-22 \mathbf{i} - 16 \mathbf{j})$  m/s

5- A rope whose working strength is 2000 N is used to tow a 1000 kg car up a  $10^\circ$  frictionless incline. Find the maximum acceleration that can be given to the car?

- a)  $3.4 \text{ m/s}^2$       b)  $5.3 \text{ m/s}^2$       **c)  $0.3 \text{ m/s}^2$**       d)  $0.8 \text{ m/s}^2$       e)  $1.6 \text{ m/s}^2$

6- A plane is travelling horizontally at 40 m/s and at a height of 100 m above the ground. If the plane drops a package on the ground, where does the package strike the ground relative to the point at which it is released?

- a) 312 m      b) 219 m      c) 114 m      d) 253 m      **e) 179 m**

6- A tire 0.500 m in radius rotates at a constant rate of 200 rev/min. what is the radial acceleration of a small stone lodged in the tread of the tire (on its outer edge)?

- a) 250 m/s<sup>2</sup>      **b) 219 m/s<sup>2</sup>**      c) 320 m/s<sup>2</sup>      d) 78 m/s<sup>2</sup>      e) 115 m/s<sup>2</sup>

7- A boat, starting from rest, maintains a constant acceleration. After a certain time  $t$ , its displacement and velocity vectors are  $r$  and  $v$ . At time  $2t$ , what would be its displacement and velocity?

- a)  $r, v$       b)  $2r, 4v$       c)  $4r, 4v$       **d)  $4r, 2v$**       e)  $2r, 2v$

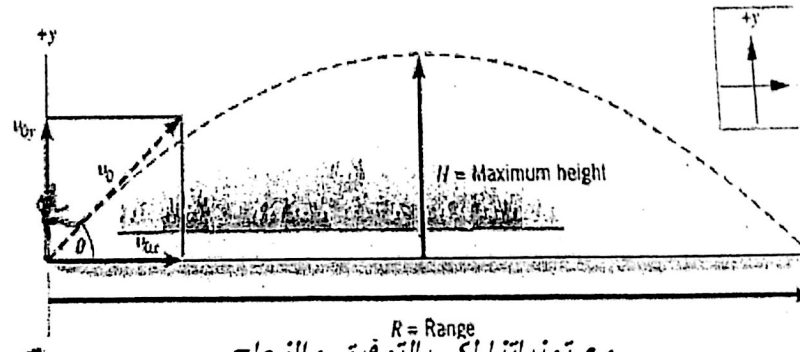
8- A motorcycle starts from rest and is moving with a constant acceleration. In a certain time interval, its displacement triples. Within the same time interval, by what factor does its velocity change?

- a) 4.23      **b) 1.73**      c) 6.62      d) 2.15      e) 3.31

Give a detailed answer for the following question

9- A football player kicks a ball at an angle of  $40^\circ$  above the horizontal axis (as in the figure). If the initial speed of the ball is 22 m/s, find the following:

- a) The range of the projectile.  
b) The total time of flight.



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Q(2): The magnitude and direction of the resultant acceleration for a particle moving non-uniformly with a tangential acceleration of  $0.5 \text{ m/s}^2$  and a velocity of 20 m/s at the moment where the radius of its circular path is 350 m are:

a) 1.24 and  $-66.3^\circ$

b) 1.32 and  $-66.3^\circ$

c) 1.32 and  $66.3^\circ$

d) 1.24 and  $23.7^\circ$

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Q(9): A projectile is given an initial velocity of 50 m/s making  $30^\circ$  with the positive x axis. The maximum height and maximum range respectively reached by this projectile are:

- a) 32 m and 221 m      b) 64 m and 221 m      c) 32 m and 111 m      d) 221 m and 32 m
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Q(10): A particle moving in a circular path (radius = 3 m) with a constant velocity of 16 m/s. If it is given a tangential acceleration of  $20 \text{ m/s}^2$ , then the resultant acceleration on the particle is:

- a)  $87.6 \text{ ms}^{-2}$       b)  $85.3 \text{ ms}^{-2}$       c)  $25.3 \text{ ms}^{-2}$       d)  $134.3 \text{ ms}^{-2}$
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2- A projectile is thrown from the top of a building with an initial velocity of 30 m/s in the horizontal direction. If the top of the building is 30 m above the ground, how long does it take the projectile to reach the ground?

a) 2.45 s

b) 9.13 s

c) 3.52 s

d) 5.43 s

e) 4.34 s

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**(3)** A particle is moving in the xy-plane from (0, 0) with an initial velocity of  $\mathbf{v} = (16\mathbf{i} - 12\mathbf{j})$  m/s. If its constant acceleration is  $\mathbf{a} = (3\mathbf{i} - 6\mathbf{j})$  m/s<sup>2</sup>, what is its speed after 2 s.?

- a) 43 m/s      **b) 33 m/s**      c) 39 m/s      d) 46 m/s      e) 52 m/s

**(4)** If a 70 kg man running at 8 m/s goes around a curve of radius 20 m, his centripetal acceleration is:

- a) 1.4 m/s<sup>2</sup>      **b) 3.2 m/s<sup>2</sup>**      c) 2.9 m/s<sup>2</sup>      d) 3.5 m/s<sup>2</sup>      e) 3.9 m/s<sup>2</sup>

**(5)** A projectile is thrown from the top of a building with an initial velocity of 30 m/s in the horizontal direction. If the top of the building is 30 m above the ground, how fast will the projectile be moving just before it strikes the ground?

- a) 54 m/s      b) 43 m/s      **c) 39 m/s**      d) 31 m/s      e) 35 m/s



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13- A projectile is fired in such a way that its horizontal range is equal to three times its maximum height. What is the angle of projection?

a)  $41.2^\circ$

b)  $33.7^\circ$

c)  $53.1^\circ$

d)  $64.8^\circ$

e)  $24.2^\circ$

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14- At  $t = 0$ , a particle moving in the  $xy$  plane with constant acceleration has a velocity of  $\mathbf{V}_i = (3\mathbf{i} - 2\mathbf{j})$  m/s and is at the origin. At  $t = 3.00$  s, the particle's velocity is  $\mathbf{V} = (9\mathbf{i} + 7\mathbf{j})$  m/s. Find the acceleration of the particle

a)  $(2\mathbf{i} + 3\mathbf{j})$  m/s<sup>2</sup>

b)  $(2\mathbf{i} - 3\mathbf{j})$  m/s<sup>2</sup>

c)  $(4\mathbf{i} + 7\mathbf{j})$  m/s<sup>2</sup>

d)  $(4\mathbf{i} - 7\mathbf{j})$  m/s<sup>2</sup>

e)  $(3\mathbf{i} + 5\mathbf{j})$  m/s<sup>2</sup>

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