1. The motion of a car is described as $x(t) = 3t^2 - 4t + 5$ and $y(t) = 4t^2 + 3t - 4$, where x and y are in meters and t is in seconds. What is the car's acceleration at $t = 15$ s?

   1) Zero
   2) $5\ m/s^2$
   3) $10\ m/s^2$
   4) $15\ m/s^2$
   5) $20\ m/s^2$

2. An object moves in the xy-plane according to the equations $x(t) = t^3$ and $y = \cos t$ where x and y are in meters and t is in seconds. What is the magnitude of its velocity at $t = \pi$ s?

   1) Zero
   2) 1
   3) π^3
   4) $3\pi^2$
   5) $9\pi^4$

3. An object moves in the xy-plane with a velocity given by $v(t) = 3t^2\mathrm{i} + 4\sin 2t\mathrm{j}$ where x and y are in meters and v is in meters per seconds. What is its displacement between $t = 0$ and $t = 2$ s?

   1) $8\mathrm{i} - 2(\cos 2)\mathrm{j}$
   2) $8\mathrm{i} - 2(\cos 4)\mathrm{j}$
   3) $8\mathrm{i} + 2(\cos 2)\mathrm{j}$
   4) $8\mathrm{i} + 2(\cos 4)\mathrm{j}$
   5) $12\mathrm{i} + 4(\sin 4)\mathrm{j}$

4. A particle is moving along the curve $y = x^3 + 2x$ with a constant x-component of velocity of 4 m/s. What is the y-component of its velocity at $x = 2$ m?

   1) 4 m/s
   2) 14 m/s
   3) 32 m/s
   4) 56 m/s
   5) 64 m/s

5. Two cars initially at the origin begin moving with velocities $v_1(t) = (2\mathrm{i} + 3\mathrm{j})$ and $v_2(t) = (-\mathrm{i} + \mathrm{j})$ where both velocities are in m/s. What is the rate at which the distance between the cars is increasing?

   1) `10 m/s
   2) `14 m/s
   3) 5 m/s
   4) `13 m/s
   5) 25 m/s

6. The acceleration of a particle that begins at rest at the origin is given by $a(t) = 3t\mathrm{i} + 4t\mathrm{j}$, where a is in m/s^2 and t is in seconds. The particle's distance from the origin at time $t = 2$ s is most nearly

   1) 6 m
   2) 7 m
   3) 8 m
   4) 9 m
   5) 10 m

7. The motion of a projectile is given by the two equations, $x(t) = 60t$ and $y(t) = -5t^2 + 20$, where x and y are in meters and t is in seconds. What is the projectile's speed at $t = 8$ s?

   1) 20 m/s
   2) 40 m/s
   3) 60 m/s
   4) 80 m/s
   5) 100 m/s

8. The velocity of a projectile is given by the two equations $v_y(t) = -10t + 30$ and $v_x(t) = 15$, where v_y and v_x are in m/s and t is in seconds. What horizontal distance has the projectile traveled when the projectile is at its maximum height?

   1) 3 m
   2) 15 m
   3) 45 m
   4) 90 m
   5) 120 m

9. What is the magnitude of the acceleration of an object whose position is given by the equation $x(t) = 3t^2 - 3t$ and $y(t) = 3t^2 - 3t$?

   1) 6 m/s^2
   2) 6 `2 m/s^2
   3) 12 m/s^2
   4) 12 `2 m/s^2
   5) 36 m/s^2

10. The velocity of an object is given by $v(t) = 2t\mathbf{i} + 4\mathbf{j}$. What is the acceleration of the object at $t = 3$ s if it starts at (0,2)?

    1) 2 m/s^2
    2) 4 m/s^2
    3) 8 m/s^2
    4) 12 m/s^2
    5) 16 m/s^2

11. The shape of the path of a projectile launched at some angle above the horizontal is mostly nearly

    1) circular
    2) elliptical
    3) hyperbolic
    4) parabolic
    5) linear

12. The path of an object that moves with a constant acceleration in the x-direction and zero acceleration in the y-direction is

    1) circular
    2) hyperbolic
    3) parabolic
    4) elliptical
    5) linear

13. If an object moves with non-zero, constant accelerations in two dimensions which are equal in magnitude, its path is

    1) linear
    2) hyperbolic
    3) elliptical
    4) parabolic
    5) circular

14. An object is moving in the xy-plane according to the equations $x(t) = 3sin(3t)$ and $y(t) = 4cos(3t)$. What is the maximum magnitude of the particle's acceleration?

1) 5 m/s^2

2) 15 m/s^2

3) 30 m/s^2

4) 36 m/s^2

5) 45 m/s^2

Answer Key
Two Dimensional Motion with Vectors [Mar 28, 2011]

1. 3
2. 4
3. 2
4. 2
5. 4
6. 2
7. 5
8. 3
9. 2
10. 1
11. 4
12. 3
13. 1
14. 4

Name _____ Class _____ Date _____

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