Differentiation (introduction)

This assignment is to gain an understanding and application of differentiation.

1. Differentiation of displacement (given as a function of time) w.r.t. time gives _____
2. Differentiation of velocity (given as a function of time) w.r.t. time gives _____
3. Differentiate the following w.r.t. x
   (a) $3x^2 + 2x - 10$
   (b) $20x - x^3$
   (c) $\sin(x) - 2\cos(x)$
   (d) $1/x + x^2 + \sin(x)$
   (e) $\sin(2x) + \cos(-3x)$
4. Differentiate the following w.r.t. time (t)
   (a) $-5t^2 + t - 4$
   (b) $2t - 7t^3$
   (c) $-6\cos(2t)$
   (d) $5/t + 3t^2 + \sin(t)$
   (e) $\sin(\pi t) + \cos(-2\pi t)$
   (f) 20.5
5. Displacement of a body is given by the relation $x = 5t - 10$.
   (a) Find the velocity of the body.
   (b) Plot a graph for displacement as a function of time
   (c) Plot a graph for velocity as a function of time
6. Velocity of a body is given by the relation $v = -t + 4$.
   (a) Find the acceleration of the body.
   (b) Plot a graph for velocity as a function of time
   (c) Plot a graph for acceleration as a function of time
7. Displacement of a body is given by the relation $x = -2\sin(t) + \cos(6t)$. Find the velocity of the body. Is the velocity constant?
8. Displacement of a body is given by the relation $y = 6t^2 - 2t$. Find
   (a) Initial displacement

(b) Initial velocity

(c) Instant of time when its velocity becomes zero

(d) Displacement of the body at that instant of time

9. Velocity of a body is given by the relation $v = -10t^2 + 4t + 10$. Find

(a) Initial velocity of the body

(b) Initial acceleration

(c) Instant of time when its acceleration becomes zero

(d) Velocity of the body when its acceleration becomes zero

10. Displacement of a body is given by the relation $y = t^2 + 4t - 20$.

(a) Find the instant of time when the body crosses the origin

(b) What is the velocity of the body when it crosses the origin?

(c) What is the acceleration of the body when it crosses the origin?

(d) Find the velocity of the body at an instant when its acceleration becomes zero (if at all).

(e) Find the acceleration of the body at an instant when its velocity becomes zero (if at all).

Answers

1. velocity

2. acceleration

3. (a) $6x + 2$

   (b) $20 - 3x^2$

   (c) $\cos(x) + 2\sin(x)$

   (d) $-1/ x^2 + 2x + \cos(x)$

   (e) $2\cos(2x) + 3\sin(3x)$

4. (a) $-10t + 1$

   (b) $2 - 21t^2$

   (c) $12\sin(2t)$

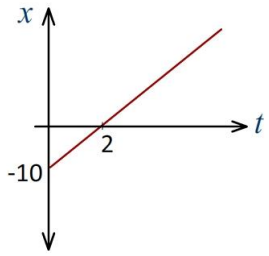
   (d) $-5/t^2 + 6t + \cos(t)$

   (e) $\pi\cos(\pi t) + 2\pi\sin(2\pi t)$

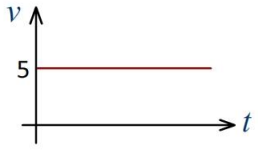
   (f) 0

5. (a) 5 ms^{-1}

   (b)

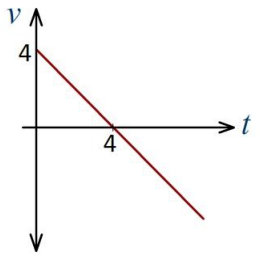


   (c)



6. (a) -1 ms^{-2}

(b)



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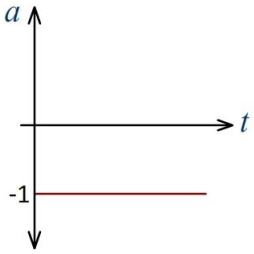

7. (a) $2\cos(\pi t) - 6\sin(6t)$

   (b) No

8. (a) Zero

   (b) $-2\ ms^{-1}$

   (c) 1/6 s

   (d) – 1/6 m

9. (a) $10\ ms^{-1}$

   (b) $4\ ms^{-2}$

   (c) 1/5 s

   (d) $9.76\ ms^{-1}$

10. (a) 4 s

    (b) $12\ ms^{-1}$

    (c) $2ms^{-2}$

    (d) acceleration is constant and does not become zero

    (d) velocity remains positive and does not become zero