

- 1) Suppose  $x(t) = t^3 - 9t^2 + 15t + 4$  is a position of a particle moving along the x-axis on the interval  $[0,10]$ .
- Find the average velocity for the first 3 seconds.
  - Find the velocity at  $t = 4$ .
  - When is the particle moving to the left?
  - When is the particle moving to the right?
  - When is the velocity increasing?
  - When is the velocity decreasing?
  - When is the particle speeding up?
  - When is the particle slowing down?

- 2) [Calculator Active] A particle is moving along the x-axis and its velocity function at time  $t$  is given by the equation  $v(t) = -t \sin t + \cos t$ , where  $0 \leq t \leq 2\pi$
- Find the average acceleration over the first 2 sections.
  - Find the velocity at  $t = 1$ .
  - Find the acceleration at  $t = 1$ .
  - At  $t = 1$  is the particle speeding up or slowing down?
  - When is the particle moving to the left?
  - When is the particle moving to the right?
  - When is the velocity of the particle increasing?
  - When is the acceleration of the particle negative?
  - When is the particle speeding up?
  - When is the particle slowing down?

- 3) Given below is the velocity and acceleration of a particle moving along the x-axis.

$t$	0	2	4	6	8
$x(t)$	1	4	-3	6	12
$v(t)$	4	-1	-2	-1	10
$a(t)$	-3	4	5	0	-2

- Find the average velocity at between  $t = 0$  and  $t = 8$ .
- Find the average acceleration at between  $t = 0$  and  $t = 8$ .
- Estimate  $v'(5)$ .
- Estimate  $a'(5)$ .
- At  $t = 8$  is the particle moving left or right?
- At  $t = 8$  is the velocity decreasing or increasing?
- At  $t = 8$  is the particle speeding up or slowing down?
- At least how many times does the particle change direction?

- 4) Use the table to find  $h'(3)$  for each.

$x$	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
3	5	-3	2	4

- $h(x) = 2f(x) + 3g(x)$
- $h(x) = f(x)g(x)$
- $h(x) = \frac{f(x)}{x^2}$

Find  $\frac{dy}{dx}$ .

5)  $y = \frac{2x^2 - 4x - 1}{x}$

6)  $y = \frac{9x^2 + 2x - 1}{\sqrt[3]{x}}$

7)  $y = \sqrt{x}(x^2 - 2x - 3)$

8)  $y = \left(\frac{4}{x} + x\right)(x + 1)$

9)  $y = \frac{3}{x^2 + 4}$

10)  $y = \frac{3x^2 - 2x - 5}{x^2 + 1}$

11)  $y = 4x^2 \sec x$

12)  $y = \frac{\cos x}{x - 4}$

**Answer each question.**

13) Find the instantaneous rate of change of  $y = 3\sin x$  when  $x = \frac{\pi}{3}$

14) Find the average rate of change of  $y = \sin 2x$  from  $x = 0$  to  $x = \frac{\pi}{2}$ .

15) Write the equation of the line tangent to the function  $y = 2x^4 + x$  at  $x = 1$ .

16) Find the equation of the normal line to the function  $y = 2x^2 - x + 3$  at the point when  $x = 2$ .