AP Ch. 5   Category # 4

1. A particle moves along the x-axis so that, at any time $t \geq 0$, its acceleration is given by $a(t) = 6t + 6$. At time $t=0$, the velocity of the particle is -9, and its position is -27.

    A) Find $v(t)$, the velocity of the particle at any time $t \geq 0$

    B) For what values of $t \geq 0$ is the particle moving to the right?

    C) Find $x(t)$, the position of the particle at any time $t \geq 0$

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2. Determine a, b, c, and d so that the graph of

$$y = ax^3 + bx^2 + cx + d$$ has a point of inflection at the origin and a relative maximum at the point (2,4). Sketch the graph

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3. The volume V of a cylinder is increasing at the rate of 30π cubic units per second. At the instant when the radius r of the cylinder is 2 units, its volume is 12π cubic units and the radius is increasing at 1/3 units per second.

    A) At the instant when the radius of the cylinder is 2 units, what is the rate of change of the area of its base.

    B) At the instant when the radius of the cylinder is 2 units, what is the rate of change of its height h.

    C) At the instant when the radius of the cylinder is 2 units, what is the instantaneous rate of change of the area of its base with respect to its height h?

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4. At time $t=0$, a train is going at a velocity of 1000 meters per minute. The train is slowing down with a negative acceleration that is directly proportional to time t. This brings the train to a stop in 5 minutes.

    A) Write an expression for the velocity of the train at time t.

    B) What is the total distance traveled by the train in that 5 minute interval?

5. A function f is defined for all real numbers and has the following 3 properties
   - i) $f(1) = 5$
   - ii) $f(3) = 21$
   - iii) for all real values of a and b
     $f(a+b) - f(a) = kab + 2b^2$ where k is a fixed real number independent of a and b

   A) Use a=1 and b=2 to find the value of k
   B) Find $f'(x)$
   C) Find $f'(3)$

6. $f(x) = x^3 - 7x + 6$ Find the average value of y that satisfies the **Average** Value Theorem on [1,3]

7. A particle moves along the x-axis so that, at any time t≥0, its acceleration is given by $a(t) = 8t-8$
   At time t=0, the velocity of the particle is -12
   A) Find v(t), the velocity of the particle at any time t≥ 0
   B) For what values of t≥ 0 is the particle moving to the left?
   C) Find x(t), the position of the particle at any time t≥ 0, if the position is 14   when t=3
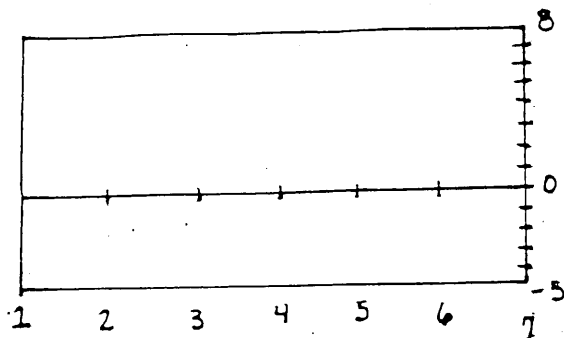
8. $f(x) = 4 \mid x-2 \mid x^2$
   A) Domain
   B) Range
   C) For what values of x is the function continuous?
   D) For what values of x is the derivative continuous?

9. A particle moves along the x-axis so its velocity at any time t≥0 is given by $v(t) = 2t^2 + 4t - 48$
   A) Find acceleration a(t)
   B) Find all values of t for which the particle is at rest
   C) Find the postion x(t) if x(0) = -1

10. Let $f(x) = 1 + x(\sin x) + (\ln x)(\cos x)$

A) Sketch in viewing window

B) Find x-intercepts

C) Find x & y coordinates of all local extrema.

D) Find the x-coordinates of the absolute extrema

11. A particle, initially at rest, moves along the **y**-axis so that its acceleration at any time $t \geq 0$ is given by $a(t) = 12t^2 - 4$. The position of the particle when $t = 1$ is $x(1) = 3$.

 (a) Find the values of t for which the particle is at rest.

 (b) Write an expression for the position $x(t)$ of the particle at any time $t \geq 0$.

 (c) Find the total distance traveled by the particle from $t = 0$ to $t = 2$.

12. . Let f be the function given by $f(x) = \sqrt{x^4 - 16x^2}$.

 (a) Find the domain of f.

 (b) Describe the symmetry, if any, of the graph of f.

 (c) Find $f'(x)$.

 (d) Find the slope of the line <u>normal</u> to the graph of f at $x = 5$.

13.   A) $\displaystyle\int_{-4}^{3} |x-1|\, dx$

   B) $\displaystyle\int_{-5}^{0} |2x+8|\, dx$

14. A particle moves on a __vertical__ axis so that its velocity at any time t is given by $v(t) = \cos 3t$.

A) At $t = 0$ the particle is at the origin.

A) When is the particle stopped $0 \le t \le \pi$

B) For $0 \le t \le \pi$ find all values of t for which the particle is moving upward.

c) Write an expression for the position of the particle at any time t

D) For $0 \le t \le \pi/2$, find average value of the position function determined in part (c).

15.   __AP   Ch. 5   Category # 5__

A particle moves along the x-axis in such a way that its acceleration at time t for $t > 0$ is given by $a(t) = \dfrac{3}{t^2}$. When $t = 1$, the position of the particle is 6 and the velocity is 2.

A) Write an equation for the velocity, $v(t)$

B) Write an equation for the position $x(t)$

C) Find the position of the particle when $t = e$.

Note: For part B: $\int \frac{1}{t} dt = \ln t + c$