Mechanics Based Problems

1. Given that $f'(x) = 2x^3 + 6$ and $f(1) = 8$ find $f(x)$.

$$f(x) = \frac{x^4}{2} + 6x + \frac{3}{2}$$

2. Given that $g'(t) = \sin(t) + \sqrt{t} + 3$ and $g(0) = 1$ find $g(t)$.

$$g(t) = -\cos t + \frac{2}{3}t^{3/2} + 3t + 2$$

3. Given that $y'(x) = e^x + \cos(x) + 2x^{-5}$ and $y(2) = 2$ find $y(x)$.

$$y(x) = e^x + \sin x - \frac{x^{-4}}{2} - 6.3296$$

Problem Solving Problems

1. The acceleration function (in m/s^2) and the initial velocity are given for a particle moving along a line. Find the velocity, denoted $v(t)$, at any time t and the distance traveled during the given time interval. In both cases, state whether or not the displacement of the object over the time interval is equal to the total distance traveled.

(a) $a(t) = t + 4 \qquad v(0) = 5, \qquad 0 \le t \le 10$

$v(t) = \frac{t^2}{2} + 4t + 5$

416.667 meters (total dist. traveled)

(b) $a(t) = 2t + 3 \qquad v(0) = -4, \qquad 1 \le t \le 3$

$v(t) = t^2 + 3t - 4$

12.666 meters

(displacement = dist. traveled $1 \le t \le 3$

2. Suppose h is a function such that $h(1) = -2$, $h'(1) = 2$, $h''(1) = 3$, $h(2) = 6$, $h'(2) = 5$, $h''(2) = 13$, and h'' is continuous everywhere. Evaluate:

$$\int_1^2 h''(u)du$$

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