

Homework 5 — Due 10/4/2010 in class

This cover sheet must be attached as the top page of your homework.

1. Let $s(t) = t^4 - 4t^3 + 8t$ describe the position at time t of an object moving along a line.
 - (a) Find the velocity at time t .
 - (b) Find the acceleration at time t .
 - (c) Describe the motion of the object from time $t = 0$ to time $t = 4$. When is it advancing? When is it retreating? Compute the total distance traveled by the object over the given time.
 - (d) When is the object accelerating and when is it decelerating?
2. A bucket containing 5 gallons of water has a leak. After t seconds, there are

$$Q(t) = 5 \left(1 - \frac{t}{25}\right)^2$$

gallons of water in the bucket.

- (a) At what rate (to nearest hundredth gallon) is water leaking from the bucket after 2 seconds?
 - (b) How long does it take to for all of the water to leak out of the bucket?
 - (c) At what rate is the water leaking when the last drop leaks out?
3. Find the derivatives of the following functions:
 - (a) $f(x) = (x^3 - 3x)^{13}$
 - (b) $g(x) = \ln(4x^4 + x^2 - 2)$
 - (c) $h(t) = \ln(\sec x + \tan x)$
 - (d) $F(s) = \sin(x^2) \cos(x^2)$
 - (e) $G(x) = \tan^{-1}\left(\frac{1}{x}\right)$
 4. Find an equation for the tangent line to the graph of $y(x)$ at the point $(1, 0)$, where $y(x)$ is given implicitly by the following equation:

$$\sin^{-1}(xy) + \frac{\pi}{2} = \cos^{-1}(y).$$

5. Find $\frac{dy}{dx}$ for $y(x)$ given implicitly by the following equation:

$$3^x + \log_2(xy) = 10$$