Chapter 3 Test

1. Determine the second derivative of each of the following:
   a. $y = 7x^2 - 9x + 22$
   b. $f(x) = -9x^5 - 4x^3 + 6x - 12$
   c. $y = 5x^{-3} + 10x^3$
   d. $f(x) = (4x - 8)^3$
2. For each of the following displacement functions, calculate the velocity and acceleration at the indicated time:
   a. $s(t) = -3t^3 + 5t^2 - 6t, t = 3$
   b. $s(t) = (2t - 5)^3, t = 2$
3. The position function of an object moving horizontally along a straight line as a function of time is $s(t) = t^2 - 3t + 2, t \geq 0$, in metres, at time t, in seconds.
   a. Determine the velocity and acceleration of the object.
   b. Determine the position of the object when the velocity is 0.
   c. Determine the speed of the object when the position is 0.
   d. When does the object move to the left?
   e. Determine the average velocity from $t = 2$ to $t = 5$.
4. Determine the maximum and minimum of each function on the given interval.
   a. $f(x) = x^3 - 12x + 2, -5 \leq x \leq 5$
   b. $f(x) = x + \frac{9}{x}, x \in [1, 6]$
5. After a football is punted, its height, h, in metres above the ground at t seconds, can be modelled by $h(t) = -4.9t^2 + 21t + 0.45, t \geq 0$.
   a. When does the football reach its maximum height?
   b. What is the football's maximum height?
6. A man purchased 2000 m of used wire fencing at an auction. He and his wife want to use the fencing to create three adjacent rectangular paddocks. Find the dimensions of the paddocks so that the fence encloses the largest possible area.
7. An engineer working on a new generation of computer called The Beaver is using compact VLSI circuits. The container design for the CPU is to be determined by marketing considerations and must be rectangular in shape. It must contain exactly 10 000 cm^3 of interior space, and the length must be twice the height. If the cost of the base is \$0.02/cm^2, the cost of the side walls is \$0.05/cm^2, and the cost of the upper face is \$0.10/cm^2, find the dimensions to the nearest millimetre that will keep the cost of the container to a minimum.
8. The landlord of a 50-unit apartment building is planning to increase the rent. Currently, residents pay \$850 per month, and all the units are occupied. A real estate agency advises that every \$100 increase in rent will result in 10 vacant units. What rent should the landlord charge to maximize revenue?