There are 25 points possible on this quiz. No aids (book, calculator, etc.) are permitted. Show all work for full credit.

1. [8 points] A small bug is crawling along a branch of a tree. The bug's distance, in millimeters, from the trunk after *t* seconds is given by the function

$$s(t) = 6t - \frac{9}{2}t^2 + t^3.$$

- **a**. What is the velocity of the bug at time *t*?
- **b**. When is the bug at rest?
- **c**. What is the acceleration of the bug when it's at rest?
- **d**. At time t = 3, is the bug moving toward the trunk or away from the trunk? Justify your answer.
- **2.** [2 points] Let *P* denote the population of an invasive species of fish that is growing over time, *t*. Suppose the population *P* grows at a rate proportional its size. What can you say about the function P(t)?

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3. [6 points] The edge of a cube was found to be 5 meters with a possible error in measurement of 0.1 meter. Use differentials to estimate the maximum possible error in computing the surface area of the cube. Include units with your answer.

4. [9 points] The altitude (height, h) of a triangle is increasing at at rate of 3 cm/sec while the area of the triangle is decreasing at a rate of 1 cm²/sec. At what rate is the base, b, of the triangle changing with the altitude is 20 cm and the area is 100 cm²? Include units with your answer.

