

Name: \_\_\_\_\_

**Directions:** Show all work. No credit for answers without work.

1. [**2 parts, 2 points each**] The amount of water  $W$  (in millions of gallons) in a lake after  $t$  years since 2000 is given by  $W(t) = \frac{2600}{t^2+1}$ . In both answers below, be sure to include proper units.

(a) Find the average rate of change in the amount of water between 2002 and 2005.

(b) Find the relative change in the amount of water between 2002 and 2005.

2. A manufacturer makes glass cups. The total cost  $C$  (in dollars) to produce  $q$  cups is given by the cost function  $C(q) = 127000 + 2q$ . Each cup sells for 9 dollars.

(a) [**1 point**] What is the manufacturer's marginal cost?

(b) [**2 points**] How many cups must the manufacturer sell to earn a profit?

3. In 2012, the population of a town is 8.3 million. Analysts expect the town's population to shrink by 6.4% per year.

(a) [**2 points**] Give a formula for the town's population  $P$  in millions of people as a function of the number of years  $t$  since 2012.

(b) [**1 point**] How many people are expected to live in the town at the beginning of 2019?