

**SHOW ALL WORK.**

Complete Parts A & B OR Parts B & C

**PART A:**

1. In 1990, the population of Austin, Texas was 494,290. During the next 10 years, the population increased by about 3% each year.

a. Write an equation modeling the population  $P$ ,  $t$  years *after* 1990.

b. What was the population in 2000?

c. Estimate when the population will reach 1,000,000.

2. You buy a new mountain bike for \$200.00. The value of the bike decreases by 25% each year.

a. Write an equation modeling the value of the bike  $V$ , after  $t$  years.

b. What is the value of the bike after 3 years?

c. Estimate when the value of the bike will be \$100.

3. In 2000, the average price of a football ticket for a Minnesota Vikings game was \$48.28. During the next 4 years, the price increased by an average of 6% each year.

a. Write an equation modeling the price of a ticket  $P$ ,  $t$  years *after* 2000.

b. How much did a ticket cost in 2005?

c. Predict what year the price will reach \$100.00.

4. At an on-line auction, the opening bid for a pair of in-line skates is \$50.00. The price of the skates increases by 10.5% per bid during the next 6 bids.

a. Write an equation giving the price  $p$  of the skates after  $n$  bids.

b. What is the price after 5 bids?

c. According to the model, what will the price be after 100 bids? Is the predicted price reasonable? Explain.

5. The amount of bacteria on your desk triples every day if not properly cleaned. If there are 10 bacteria present on March 31, how many bacteria will be present on April 30<sup>th</sup>?

### **PART B:**

6. The value of a car can be modeled by the equation  $y = 24,000(0.845)^t$ , where  $t$  is the number of years since the car was purchased.

a. What was the purchase price of the car?

b. By what percent is the value of the car decreasing each year?

c. Estimate when the value of the car will be \$10,000.

d. Use the model to predict the value of the car after 50 years. Is this a reasonable value? Explain.

7. When a plant or animal dies, it stops acquiring carbon-14 from the atmosphere. Carbon-14 decays over time with a *half-life* of about 5730 years.

a. Write an equation modeling the amount of carbon-14 ( $A$ ) that remains after  $t$  years.

b. What percent of the carbon-14 remains after 10,000 years?

c. An archaeologist found a bison bone that contained about 37% of the carbon-14 present when the bison died. Use the model to estimate the age of the bone when it was found.

8. The half-life of radium-226 is 1600 years. How many grams of a 0.25g sample will remain after 4800 years?
9. Sodium-24 has a half-life of 15 hours. How much sodium-24 will remain in an 18.0g sample after 60 hours?
10. A rock once contained 1.0mg of uranium-238, but now contains only 0.25mg. Given that the half-life of uranium-238 is  $4.5 \times 10^9$  years, how old is the rock?
11. The half-life of tritium ( $^3\text{H}$ ) is 12.3 years. If 48.0mg of tritium is released from a nuclear power plant during the course of a mishap, what mass of the nuclide will remain after 49.2 years?
12. When Mr. Wuerger started teaching at VAHS in 1997, he started losing 2% of his hair every year (students who don't complete their homework cause Mr. Wuerger a lot of stress).
- a. Write an equation modeling the percent of Mr. Wuerger's full head of hair he has remaining ( $H$ ),  $t$  years *after* 1997.
- b. Currently, what percent of Mr. Wuerger's full head of hair remains?
- c. According to the model, will Mr. Wuerger ever go completely bald? Explain.

**PART C:**

13. You buy a new stereo for \$1300 and are able to sell it 4 years later for \$275. Assume the resale value of the stereo decays exponentially with time. Write an equation giving the stereo's resale value  $V$ , as a function of time  $t$  (in years) since you bought it.
14. The yearly cost for residents to attend a state university has increased from \$5200 to \$9000 in the last 5 years.
- a. To the nearest tenth of a percent, what has been the average annual growth rate in cost?
- b. If this growth rate continues, what will be the cost in 5 more years?