

Using Exponential Equations

Name: _____

1. A 45 g sample of plutonium-238 has a half life of 88 years. How long will it take for this sample to decay to 18 grams?

$$18 = 45 \left(\frac{1}{2}\right)^{\frac{x}{88}}$$

$$.4 = .5^{\frac{x}{88}}$$

$$x = 116 \text{ years}$$

2. A computer loses its value each month after its purchased. Its value as a function of time, in months, is modeled by $V(m) = 3800(0.87)^m$.

- a.) What is the value of the laptop after 4 months?

$$V(4) = 3800(0.87)^4$$

$$= \$2177$$

- b.) In which month will the laptops value fall below \$1500?

$$1500 = 3800(0.87)^x$$

$$x = 6.7 \text{ years}$$

3. A chef requires the internal temperature of a roast that has been left to cool on a counter. The room temperature is 13° C. An equation that models the situation is $T(t) = 68(0.5)^{(t/14)} + 13$ where T is the temperature in degrees Celsius and t is the time in minutes. Determine the temperature, to the nearest degree, of the roast after 15 minutes. How much time did it take for the pie to reach an internal temperature of 31°?

$$T(15) = 68 \left(\frac{1}{2}\right)^{15/14} + 13 \Rightarrow 45.36^\circ$$

4. The population of a town has grown at an annual rate of approximately 2.7%. How long will it take for its population of 15,212 people to double at this growth rate?

$$30424 = 15,212(1.027)^t$$

$$2 = 1.027^t$$

$$t = 26.01 \text{ years}$$

$$31 = 68 \left(\frac{1}{2}\right)^{t/14} + 13$$

$$t = 26.85 \text{ min}$$

5. A type of mold has a population of 242 spores at 3a.m. It doubles every 6 hours.

- a.) Determine an equation that models the growth of the population.

$$A = 242(2)^{\frac{t}{6}}$$

- b.) Determine the population at 9 p.m.

3-0	6-0	9-0	12-0	3-0	6-0
			1816		

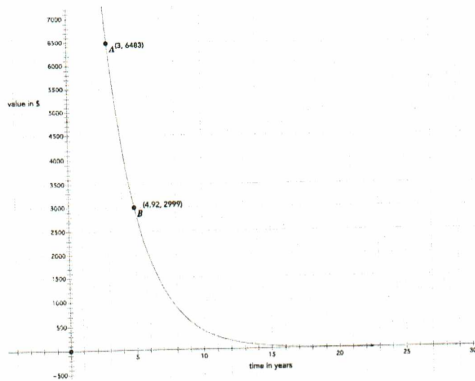
6. A population of yeast cells can double in 2 h. Assume an initial population of 120 cells.
- What is the growth rate, in percent per hour, of this colony of yeast cells?
 - Write an equation that can be used to determine the population of cells at hours.
 - Use your equation to determine the population after 12 hours.
 - Use your equation to determine the population after 210 min.
 - Approximately how many hours would it take for the population to reach 500 000 cells?
 - What are the domain and range for this situation?

$A = 120(2)^{x/2}$
 a.) $2^x = 12$ $\Rightarrow 1.414$ or $41.4\% = gr$
 b.) $A(x) = 120(2)^{x/2}$
 c.) $A(12) = 120(2)^{12/2} = 7680$ cells
 d.) $A(\frac{210}{60}) = 120(2)^{3.5/2} = 403$ cells
 e.) $500,000 = 120(2)^{x/2}$ $x = 24.1$ hours
 P. $0 \leq x$
 R $A \geq 0$

7. A town has a population of 12 600 in 1995. Twelve years later, its population grew to 19000. Determine the average annual growth rate of this town's population.

$12600(1+r)^{12} = 19000$
 $(1+r)^{12} = 1.507$
 $1+r = 1.0348$
 $r = .0348$ or 3.48%

8. The partial graph below shows the value of a car t years after purchase.
- Does this represent growth or decay? Explain.
 - Determine an equation that represents the car's value after t years. Hint: Use a system of equations.
 - What is the initial value of the car? What is the decay rate?



$(3, 6483)$ $(4.92, 2999)$
 $2999 = a \cdot b^{4.92}$
 $6483 = a \cdot b$
 $(.46259 = b^{1.92})^{1/1.92}$
 $.669 \approx b$
 $a(.669^3) = 6483$
 $a = 21651$
 $21651(.669)^t$