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

$A(t) = A_0 (b)^{t/k}$

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

$0.4 = 0.5^{t/188}$

$t = 116$ years

It will take 116 years for the sample of plutonium-23 to decay to 18g.

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

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

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

$= \$2,177$

Value of laptop is \$2,177 after 4 months.

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

$1500 = 3800(0.87)^m$

$m \approx 6.7$ months

Laptop values will fall below \$1500 after 6.7 months.

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 $\boxed{T(t) = 68(0.5)^{(t/14)}}$

... T is the temperature in degrees Celsius and t is the time in minutes. Determine th

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 $\boxed{T(t) = 68(0.5)^{(t/14)} + 13}$ 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°?

$T(15) = 68(0.5)^{(15/14)} + 13$

$T(15) = 45.36°C$

Rounded to nearest degree, the temperature of the roast is 45°C after 15 min.

$31 = 68(0.5)^{(t/14)} + 13$

$18 = 68(0.5)^{t/14}$

$t = 26.85$ min.

It took approx. 26 min and 51 seconds.

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?

$= P(1 \pm r)^t$

$P(t) = 15,212(1 + 0.027)^t$

$30,424 = 15,212(1.027)^t$

$2 = 1.027^t$

$t \approx 26.01$ years

It will take approximately 26.01 years for the population of 15,212 people to double at an annual growth rate of 2.7%.

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.

$A(t) = P(1 \pm r)^t$ $\quad P(t) = 242(1+1)^{t/6}$ $\quad \boxed{P(t) = 242(2)^{t/6}}$

b.) Determine the population at 9 p.m. 3 a.m. → 9 p.m. = 18 hours

$P(18) = 242(2)^{18/6} = 242(2^3) = 1936$ spores

Population of mold will be 1,936 spo[res] at 9 p.m.

$A(t) = P(1 \pm r)^t$ $A(t) = 120(2)^{t/2}$

6. A population of yeast cells can double in 2 h. Assume an initial population of 120 cells.
a) What is the growth rate, in percent per hour, of this colony of yeast cells? 41.4% per
b) Write an equation that can be used to determine the population of cells at thours.
c) Use your equation to determine the population after 12 hours.
d) Use your equation to determine the population after 210 min.
e) Approximately how many hours would it take for the population to reach 500 000 c
f) What are the domain and range for this situation?

a) growth factor $= (2)^{t/2} = (2^{1/2})^t$ If $t = 1$ Then $(\sqrt{2})^1 = 1.414$
Growth rate $= 1.414 - 1 = 0.414$ or 41.4%

b) $A(t) = 120(2)^{t/2}$ c) $A(12) = 120(2)^{12/2}$ = $\boxed{7,680 \text{ cells after 12 hrs.}}$

d) t is in hours. $210 \text{ min} \times \frac{1 \text{ hr}}{60 \text{ min}} = 3.5 \text{ hrs}$
$A(3.5) = 120(2)^{3.5/2}$ = $\boxed{403 \text{ cells after 210 min}}$

e) $500,000 = 120(2)^{t/2}$
$\boxed{t = 24.1 \text{ hours for population to reach 500,000 cells}}$

f) D: $t \geq 0$
R: $A(t) \geq 0$

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

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.

$A(t) = P(1 \pm r)^t$

$19{,}000 = 12{,}600(1+r)^{12}$

$(1.508)^{1/12} = ((1+r)^{12})^{1/12}$

$1 + r = 1.0348$

$r = 0.0348$

$\boxed{\text{The average annual growth of the town's population is } 3.48\%.}$

8. The partial graph below shows the value of a car t years after purchase.

a.) Does this represent growth or decay? Explain. Decay

b.) Determine an equation that represents the car's value after t years. Hint: Use a system of equations. $y = 21{,}651(0.669)^x$

c.) What is the initial value of the car? What is the decay rate?

b)

t	V(t)
3yrs	\$6,483
4.92yrs	\$2,999

$V(t) = ab^t$

$$\frac{2{,}999 = \cancel{a}b^{4.92}}{6{,}483 = \cancel{a}b^{3}}$$

$\left(\frac{2{,}999}{6{,}483}\right) = b^{(4.92-3)}$

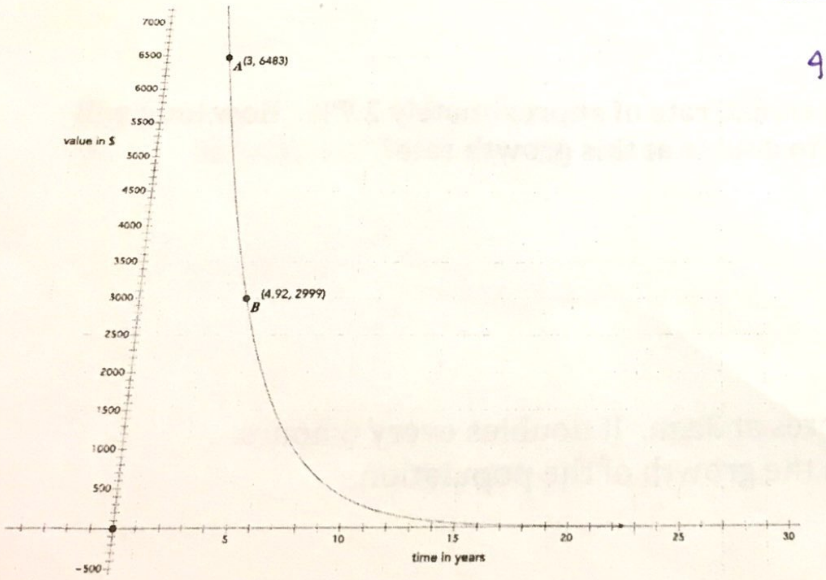
$\left(\frac{2999}{6{,}483}\right)^{1/1.92} = \left(b^{1.92}\right)^{1/1.92}$

$0.669 = b$

Substitute $b = 0.669$ to find a

$6483 = a(0.669)^3$

$a = \$21{,}651$



c) Initial value of the car is \$21,651.

Decay rate is ~~[illegible]~~ per year. 33.1%.

$0.669 = 1 + r$

$r = 0.669 - 1 = -0.331$

b) Write an equation that can be used to determine the population of cells at t hours.
c) Use your equation to determine the population after 12 hours.
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e) Approximately how many hours would it take for the population to reach 500 000 cells?
f) What are the domain and range for this situation?

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$A(t) = P(1 \pm r)^t$

$19000 = 12{,}600\,(1 + r)^{12}$

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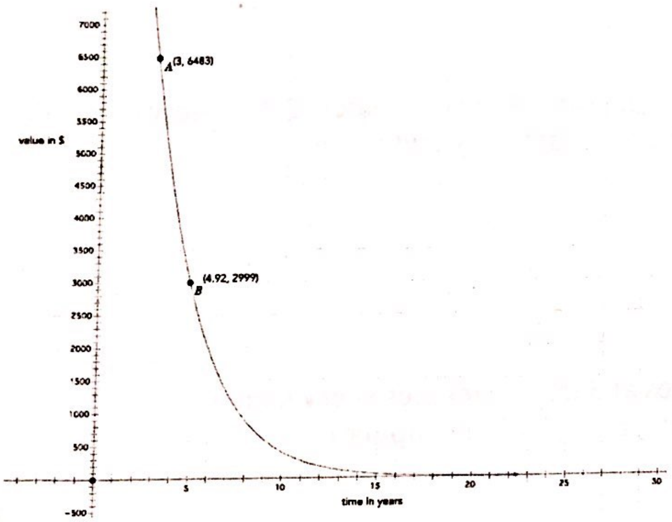

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Using Exponential Equations Name: ____________________

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