Exponential Growth and Decay Problems 4 **Name** Answers

1) Which of the exponential functions below show **growth** and which show **decay**?

a) $y = 5(2)^x$ growth

b) $y = 100(.5)^x$ decay

c) $y = 80(1.3)^x$ growth

d) $y = 20(0.8)^x$ decay

e) $y = 20(1+0.025)^x$ growth

f) $y = 40(1-0.4)^x$ decay

2) Since January 1980, the population of the city of Brownville has grown according to the mathematical model $y = 720{,}500(1.022)^x$, where x is the number of years since January 1980.

a) Explain what the numbers 720,500 and 1.022 represent in this model.

starting value

growth ratio

b) What would the population be in 2000 if the growth continues at the same rate.

$x = 20$, $y = 720{,}500(1.022)^{20}$

$= 1113401.754$

1,113,402 people

c) If this trend continues, use this model to predict about when the population of Brownville will reach 1,000,000.

try #s less than 20 → $720{,}500(1.022)^{15}$ too small

about 16 years

$720{,}500(1.022)^{16}$ over 1 million

3) A population of 800 beetles is growing each month at a rate of 5%.

a) Write an equation that expresses the number of beetles at time x.

$y = 800(1+.05)^x$ or $y = 800(1.05)^x$

b) About how many beetles will there be in 8 months?

$y = 800(1.05)^8$

$= 1181.964355$

1,182 beetles

4) The half-life of a medication is the amount of time for half of the drug to be eliminated from the body. The half-life of *Advil* or ibuprofen is represented by the equation $R = M(0.5)^{\frac{t}{2}}$, where R is the amount of Advil remaining in the body, M is the initial dosage, and t is time in hours.

a) A 200 milligram dosage of Advil is taken at 1:00 pm. How many milligrams of the medication will remain in the body at 6:00 pm? 5 hrs later

$R = 200(0.5)^{\frac{5}{2}}$
$= 35.35533...$

about **35 mg**

b) If a 200 milligram dosage of Advil is taken, how many milligrams of the medication will remain in the body 12 hours later?

$R = 200(0.5)^{\frac{12}{2}}$
$= 3.125$

about 3 mg

5) Your new computer cost $1500 but it depreciates in value by about 18% each year.

a) Write an equation that would indicate the value of the computer at x years.

$y = 1500(1-.18)^x$ or $y = 1500(.82)^x$

b) How much will your computer be worth in 6 years?

$y = 1500(.82)^6 \rightarrow \$456.01$

c) About how long will it take before your computer is worth close to zero dollars, according to your equation?

Do guess & check ex: $1500(.82)^{60}$ etc.
→ after 60 years, it's worth 1 cent, which is close to zero dollars

6) You invest $100,000 in an account with 1.01% interest, compounded quarterly. Assume you don't touch the money or add money other than the earned interest.

a) Write an equation that gives the amount of money, y, in the account after x years.

$y = 100{,}000\left(1 + \frac{.0101}{4}\right)^{4x}$

b) How much money will you have in the account after 10 years?

$y = 100{,}000\left(1 + \frac{.0101}{4}\right)^{(4\times10)} \rightarrow \$110{,}613.58$

c) How much money will you have in the account after 25 years?

$y = 100{,}000\left(1 + \frac{.0101}{4}\right)^{(4\times25)} \rightarrow \$128{,}682.9$