## 3.2 Exponential Decay – Worksheet

MCR3U
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**1)** During medical treatment, the number of bacterial cells in a patient decreases by a factor of $\frac{1}{2}$ every day. A patient has 1 000 000 bacterial cells on Monday, the first day of treatment.

**a)** How many bacterial cells will remain on Thursday?

**b)** How many bacterial cells will remain on Sunday?

**c)** On what day will the number of remaining bacterial cells be 1950?

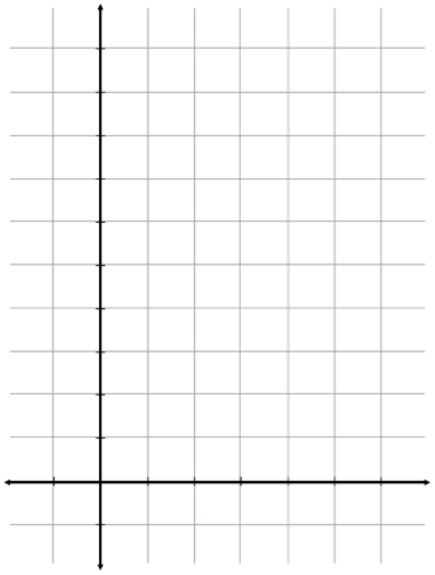
**2)** Tungsten-187 (W-187) is a radioactive isotope that has a half-life of 1 day. Suppose you start with a 100-mg sample…

**a)** make a table of values that gives the amount of tungsten remaining at the end of each day for the next 4 days.

| Time (days) | Amount of W-187 remaining |
|---|---|
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 4 | |

**b)** Write an equation in the form $f(x) = ab^x$ to relate the amount of W-187 remaining and time.

**c)** Sketch a graph of the relation



**d)** How much W-187 will remain after 1 week?

**e)** How long will it take for the W-187 to decay to 5% of its initial amount?

**3)** Shylo is very excited about her brand new car! Although she paid $20 000 for the car, its resale value will depreciate (decrease) by 30% of its current value every year.

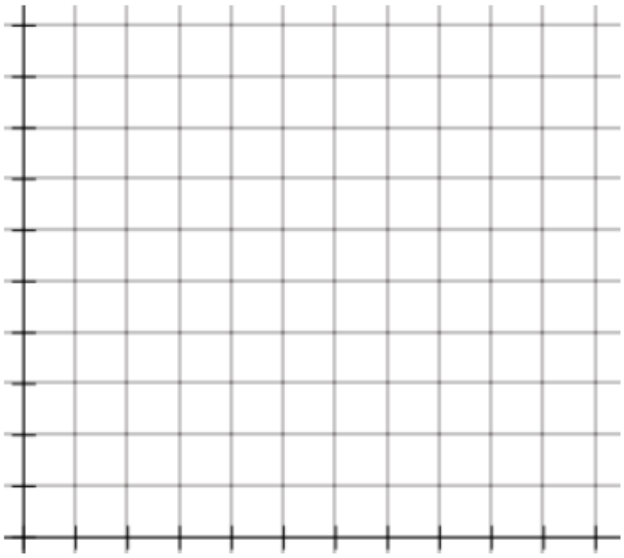
**a)** Write an equation relating the car's depreciated value, *v*, in dollars, to the time, *t*, in years since her purchase.

**b)** How much will Shylo's car be worth in…

**i)** 1 year?

**ii)** 2 years?

**c)** Graph the depreciation function.



**d)** How long will it take for Shylo's car to depreciate to 10% of its original price?

**4)** An isotope of a radioactive substance has a half-life of 23 days. Suppose that you start with an 800-mg sample of the material.

a) Find an equation that models this data

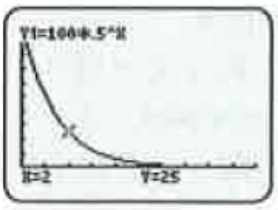
**b)** Use the equation to determine the amount of substance left after 100 days

## Answers

**1) a)** 125 000 **b)** 15 625 **c)** next Wednesday

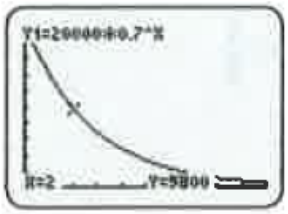
**2) a)**

| Time (days) | Amount of W-187 remaining (mg) |
|---|---|
| 0 | 100 |
| 1 | 50 |
| 2 | 25 |
| 3 | 12.5 |
| 4 | 6.25 |

**b)** $f(x) = 100\left(\frac{1}{2}\right)^x$ c) 


**d)** 0.781 25 mg

**e)** 4.3 days

**3) a)** $v(t) = 20000(0.7)^t$ **b) i)** 14 000 **ii)** 9800 **c)** 


**d)** about 6.5 years

**4) a)** $A = 800\left(\frac{1}{2}\right)^{\frac{t}{23}}$ **b)** 39.29 mg