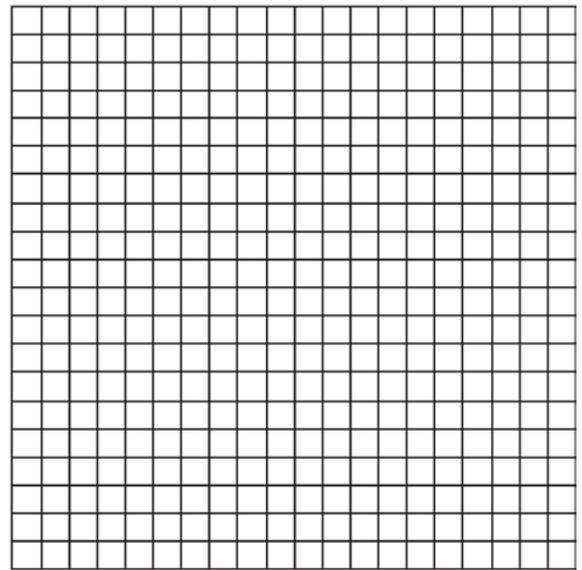


**A.CED.A.1: Exponential Decay**

- 1 A retailer advertises that items will be discounted by 10% every Monday until they are sold. In how many weeks will an item costing \$50 first be sold for under half price?
  - 1) 7
  - 2) 6
  - 3) 5
  - 4) 4
  
- 2 The amount  $A$ , in milligrams, of a 10-milligram dose of a drug remaining in the body after  $t$  hours is given by the formula  $A = 10(0.8)^t$ . Find, to the nearest tenth of an hour, how long it takes for half of the drug dose to be left in the body.
  
- 3 Depreciation (the decline in cash value) on a car can be determined by the formula  $V = C(1 - r)^t$ , where  $V$  is the value of the car after  $t$  years,  $C$  is the original cost, and  $r$  is the rate of depreciation. If a car's cost, when new, is \$15,000, the rate of depreciation is 30%, and the value of the car now is \$3,000, how old is the car to the nearest tenth of a year?

- 4 The current population of Little Pond, New York, is 20,000. The population is *decreasing*, as represented by the formula  $P = A(1.3)^{-0.234t}$ , where  $P$  = final population,  $t$  = time, in years, and  $A$  = initial population. What will the population be 3 years from now? Round your answer to the nearest hundred people. To the nearest tenth of a year, how many years will it take for the population to reach half the present population? [The use of the grid is optional.]



- 5 Objects cool at different rates based on the formula below.

$$T = (T_0 - T_R)e^{-rt} + T_R$$

$T_0$ : initial temperature

$T_R$ : room temperature

$r$ : rate of cooling of the object

$t$ : time in minutes that the object

cools to a temperature,  $T$

Mark makes T-shirts using a hot press to transfer designs to the shirts. He removes a shirt from a press that heats the shirt to  $400^\circ\text{F}$ . The rate of cooling for the shirt is  $0.0735$  and the room temperature is  $75^\circ\text{F}$ . Using this information, write an equation for the temperature of the shirt,  $T$ , after  $t$  minutes. Use the equation to find the temperature of the shirt, to the *nearest degree*, after five minutes. At the same time, Mark's friend Jeanine removes a hoodie from a press that heats the hoodie to  $450^\circ\text{F}$ . After eight minutes, the hoodie measured  $270^\circ\text{F}$ . The room temperature is still  $75^\circ\text{F}$ . Determine the rate of cooling of the hoodie, to the *nearest ten thousandth*. The T-shirt and hoodie were removed at the same time. Determine when the temperature will be the same, to the *nearest minute*.

### A.CED.A.1: Exponential Decay Answer Section

1 ANS: 1

$$50(.9)^t = 25$$

$$t \approx 6.57$$

REF: 082317aii

2 ANS:

$$5 = 10(0.8)^t$$

$$\frac{5}{10} = 0.8^t$$

3.1. Half the dose is left,  $A = 5$ :  $\log \frac{5}{10} = \log 0.8^t$

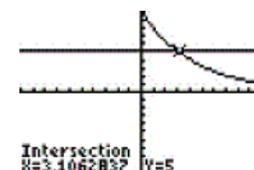
$$\log 0.5 = t \log 0.8$$

$$t = \frac{\log 0.5}{\log 0.8} \approx 31$$

```

Plot1 Plot2 Plot3
Y1=10*.8^X
Y2=5
Y3=
Y4=
Y5=
Y6=
Y7=

```



REF: 080132b

3 ANS:

$$V = C(1-r)^t$$

$$3000 = 15000(1-.3)^t$$

4.5.  $.2 = 7^t$

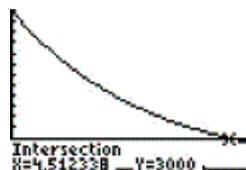
$$\log .2 = \log 7^t$$

$$t = \frac{\log 0.2}{\log 0.7} \approx 4.5$$

```

Plot1 Plot2 Plot3
Y1=15000(1-.3)^X
Y2=3000
Y3=
Y4=
Y5=
Y6=

```



REF: 010230b

4 ANS:

16,600, 11.3.  $P = 20000(1.3)^{-0.234 \cdot 3} \approx 16600$ . Half of Little Pond's present population is 10,000.

$$10000 = 20000(1.3)^{-0.234t}$$

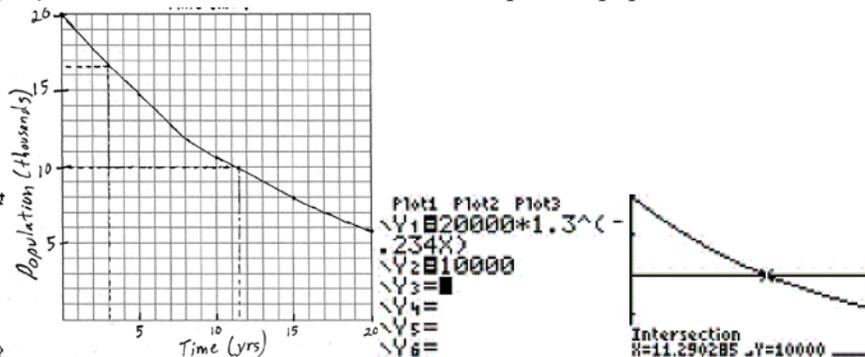
$$.5 = (1.3)^{-0.234t}$$

$$\log .5 = \log 1.3^{-0.234t}$$

$$\log .5 = -0.234t \cdot \log 1.3$$

$$\frac{\log .5}{\log 1.3} = -0.234t$$

$$t \approx 11.3$$



REF: 010632b

5 ANS:

$$T = (400 - 75)e^{-0.0735t} + 75, 325e^{-0.0735(5)} + 75 \approx 300, 270 = (450 - 75)e^{-8r} + 75, 325e^{-0.0735t} + 75 = 375e^{-0.0817t} + 75$$

$$r \approx 0.0817$$

$$t \approx 17$$

REF: 012337aii