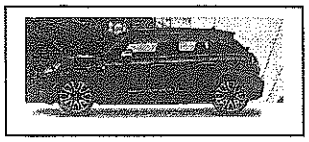
IB MYP 9 Math Modeling Decay Name Classwork 2-22-19

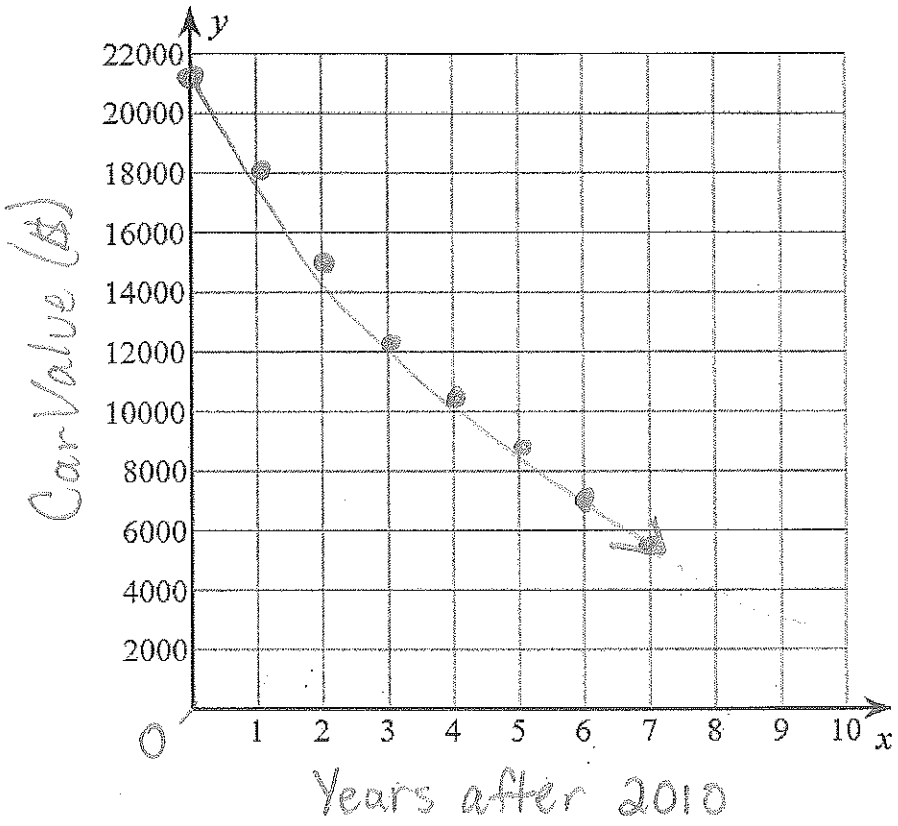
A brand new Mini Cooper cost $21,700 when it was purchased in 2010. As soon as the car is driven off the lot, the value of the car begins to depreciate- decrease in value. The table below shows the value of the car since 2010.



1. Complete the table to find to rate at which the car value is decreasing.

Year Since 2010	($) Car Value	Ratio of this year over last year $\frac{\text{(This year \$)}}{\text{(Last year \$)}}$
0	21,700	~~~~~~~~~~~~
1	18,011	$\frac{18011}{21,700} = .83$
2	14,949	$\frac{14949}{18011} \approx .8299\ldots \approx .83$
3	12,407	$\frac{12407}{14949} \approx .82996 \approx .83$
4	10,298	$\frac{10298}{12407} \approx .83$
5	8,548	$\frac{8548}{10298} \approx .83$
6	7095	$\frac{7095}{8548} \approx .83$
7	5888	$\frac{5888}{7095} \approx .8299 \approx .83$

2. Title and label the graph then plot the table to show the depreciation of the car value from 2010 to 2017.



Writing a rule:

a) The starting value of the car is 21,700

b) Each year the car value is multiplying by a fractional - constant rate of .83

Equation: $y = 21,700(.83)^x$

Questions:

1) What do you notice about the graph? Describe the shape and any patterns you see.

The value of the car is decreasing. The curve is close to linear because .83 is close to 1.

2) Verify your equation works using 2014. Show that your equation will produce a value of $10,298.

$y = 21,700(.83)^4$

$y \approx 21,700(.4746)$

$y \approx \$10298.5$

The actual value of the car was 10,298 and the equation produced a value $.50 (50 cents) above the actual value. This small difference shows our model is very good!

3) Predict the value of the car in 2018. (*The value of the car after 8 years*). Show work.

$x = 8$ $y = 21,700(.83)^8$

$y \approx 21,700(.225)$

$y \approx \$4887$

4) Predict the value of the car in 2024. Show your work.

2024 is 14 years after 2010.

$x = 14$ $y = 21,700(.83)^{14}$

$y \approx 21,700(.074)$

$y \approx \$1598$

5) When would the car be worth ***less than*** $200? How did you determine this many years?

$\frac{200}{21,700} = \frac{21,700(.83)^x}{21,700}$

$.0092 \approx .83^x$

$x = ??$

According to the graphing calculator the table shows a car value of $205.78 25 yrs after 2010. 26 yrs shows a value of $170.8. This means the value is below $200 in 2035.

6) Defend whether your predictions are realistic, ***or not realistic.***

The 2018 and 2024 predictions seem realistic, but it seems unlikely that the car would ever be under $200 in value. Unless the car is antique, most cars do not last 25 or more years. (Especially if the driver has a long commute to work and drives long distances.)

MYP Math 9 Name HOMEWORK 2-22-19

EXERCISE 23E

1 When a container of liquid is left to cool, its temperature in °C is given by $T = 100 \times (0.933)^t$, where t is the time in minutes.

a Find the initial temperature of the liquid. $a = 100°C$

b Find the temperature after:

i 10 minutes ii 20 minutes iii 30 minutes.

c Draw the graph of T against t for $t \geqslant 0$, using your results from a and b.

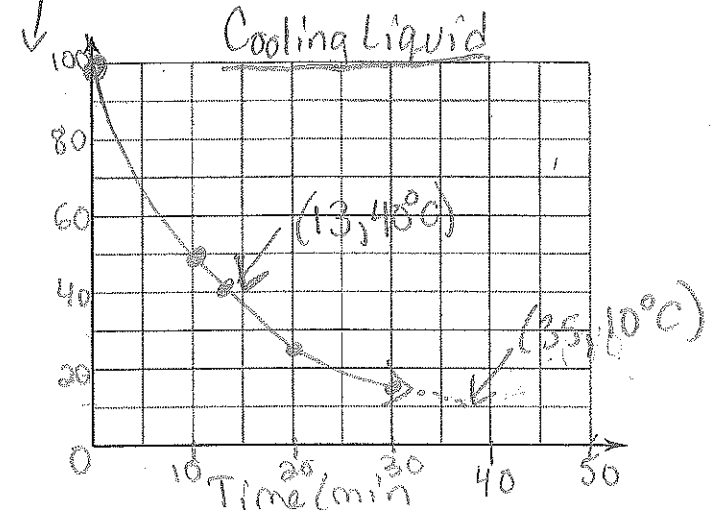
d How long will it take for the liquid's temperature to fall to:

i 40°C (From graph) About 13 minutes ii 10°C? About 35 minutes

1bi) $T = 100(.933)^{10}$
$T \approx 50°C$

1bii) $T = 100(.933)^{20}$
$T \approx 25°C$

1biii) $T = 100(.933)^{30}$
$T \approx 12.5°C$



2 The weight of a radioactive substance t years after being discovered is given by $W = 150 \times (0.997)^t$ grams.

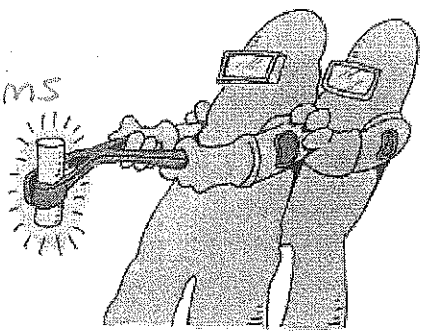
a How much radioactive substance was discovered? 150 grams

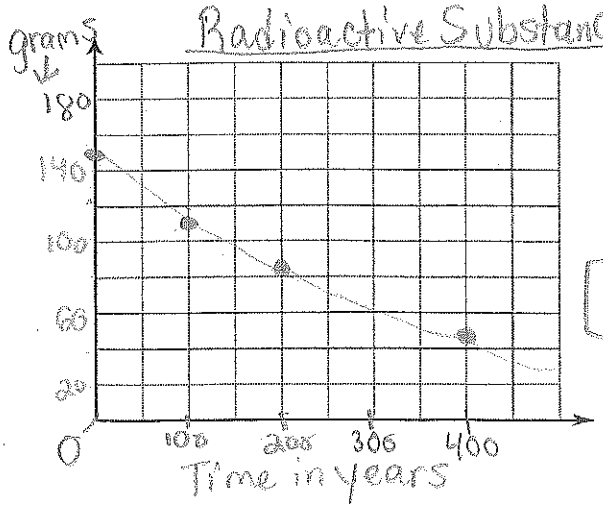
b Determine the weight of the substance after:

i 100 years ii 200 years iii 400 years.

c Sketch the graph of W against t for $t \geqslant 0$, using your results from a and b.

d How long will it take for the substance to decay to 25 grams?





2d) About 500 to 600 years. [Calculator table says 580-600 years]

2bi) $W = 150(.997)^{100}$
$W = 150(.74)$
$W \approx 111$ grams

2bii) $W = 150(.997)^{200}$
$W = 150(.55)$
$W \approx 82.5$ grams

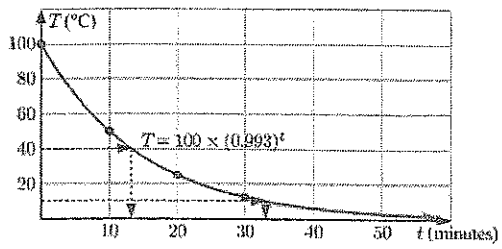
2biii) $W = 150(.997)^{400}$
$W \approx 45$ grams

EXERCISE 23E

1 a 100°C

b i 50.0°C ii 25.0°C iii 12.5°C

c

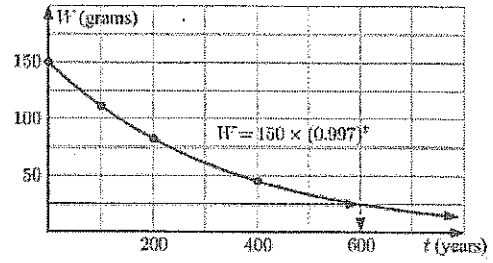


d i ≈ 13 mins ii ≈ 33 mins

2 a 150 g

b i ≈ 111 g ii ≈ 82.2 g iii ≈ 45.1 g

c



d ≈ 596 years