

Welcome Back to MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: <u>2/19</u> Topic: _____	No School 0 1 2	
Tuesday Date: <u>2/20</u> Topic: <u>Growth and Decay Review</u>	0 1 2	
Wednesday Date: _____ Topic: _____	0 1 2	
Thursday Date: _____ Topic: _____	0 1 2	
Friday Date: _____ Topic: _____	0 1 2	

Warm-up: Model the decrease of views with an equation. $y = 55(.873)^x$



Days since Ms. Berg shared her cat video	Number of views of the video on Instagram	Ratio: $\frac{\text{today's views}}{\text{yesterday's views}}$
0	55	XXXXXXXXXX
1	48	$\frac{48}{55} \approx .872$
2	42	$\frac{42}{48} \approx .875$
3	37	$\frac{37}{42} \approx .881$
4	32	$\frac{32}{37} \approx .865$

$.872 + .875$
 $+ .881 + .865$
 ≈ 3.49
 $\frac{3.49}{4} \approx .873$
 (12.7%)

What is the rate of decay?

$1 - r = .873$

$r \approx .127$



Class Plan:

1. Warm-up: Practice modeling data.

2. Practice project.



3. Consider topics for project.

Exponential Equation:

a: Starting value

b: Constant multiplier (multiplier is always positive.)

r: Rate of growth/decay, interpreted as a %

$$y = a \cdot b^x$$

Exponential Growth

$$b > 1$$

$$y = a(1 + r)^x$$

Ant Population Example:

$$y = 16(1.5)^x$$

r = 50% growth

Exponential Decay

$$0 < b < 1$$

$$y = a(1 - r)^x$$

Car Value Example:

$$y = 21,700(0.83)^x$$

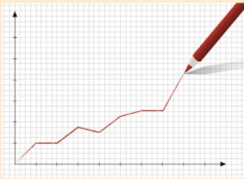
r = 17% depreciation

Exponential Equation:

1) Read directions

2) Calculate ***b***, Model data

$$y = a \cdot b^x$$



Directions for the practice project:

- 1) Using the Hamline data, scale and create a graph.
- 2) Build your equation. Use your notes and checklist to assist you.
- 3) Interpret the real-life meanings of your equation.
- 4) Verify your equation.
- 5) Make predictions using your graph and/or equation.
- 6) Write down and answer questions that can be answered from your models.
- 7) Organize your work as neatly as possible.

Year since 1999	\$ In-state tuition and fees	Ratio of current tuition \$ ÷ previous tuition \$
0	20461	
1	20351	
2	20966	
3	22894	
4	24331	
5	25063	
6	25544	
7	26790	
8	27203	

Average of ratios _____

3) Verify equation

4) Make predictions

SL Practice project: 1) Find constant multipliers.

Directions: Find a common ratio by averaging the ratios of the column below.

Year since 1999 X	\$ In-state tuition and fees Y	Ratio of current tuition \div previous tuition \div
0	20461	XX
1	20351	$20,351 / 20,461 \approx 0.995$
2 2001	20966	$20,966 / 20,351 \approx 1.03$
3	22894	1.09
4	24331	
5	25063	
6	25544	
7	26790	
8	27203	

2) Find average

Average of ratios _____

SL Practice project KEY:

The data below is the Hamline University tuition from 1999 to 2010.

Year since 1999	\$ In-state tuition and fees	Ratio of current tuition \$ \div previous tuition \$
0 1999	20461	////
1 2000	20351	$\frac{20351}{20461} \approx .995$
2 2001	20966	$\frac{20966}{20351} \approx 1.03$
3 2002	22894	$\frac{22894}{20966} \approx 1.09$
4 2003	24331	$\frac{24331}{22894} \approx 1.06$
5 2004	25063	$\frac{25063}{24331} \approx 1.03$
6 2005	25544	$\frac{25544}{25063} \approx 1.02$
7 2006	26790	$\frac{26790}{25544} \approx 1.05$
8 2007	27203	$\frac{27203}{26790} \approx 1.02$

Average of ratios $\frac{.995 + 1.03 + 1.09 + 1.06 + 1.03 + 1.02 + 1.05 + 1.02}{8} = \frac{8.295}{8}$

Directions for the practice project:

1) Using the Hamline data, scale and create a graph.

✓
1.02
1.03
1.05

Average about = 1.04

SL Practice project: Graph Data

Year since 1999	\$ In-state tuition and fees
0	20461
1	20351
2	20966
3	22894
4	24331
5	25063
6	25544
7	26790
8	27203

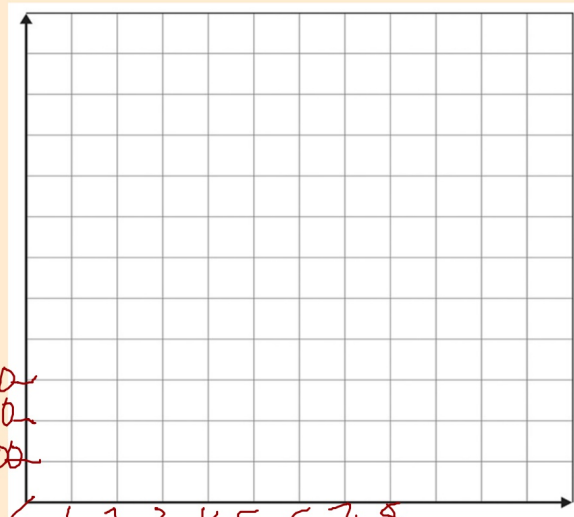
Hamline Tuition

Tuition (\$) ~~9000~~

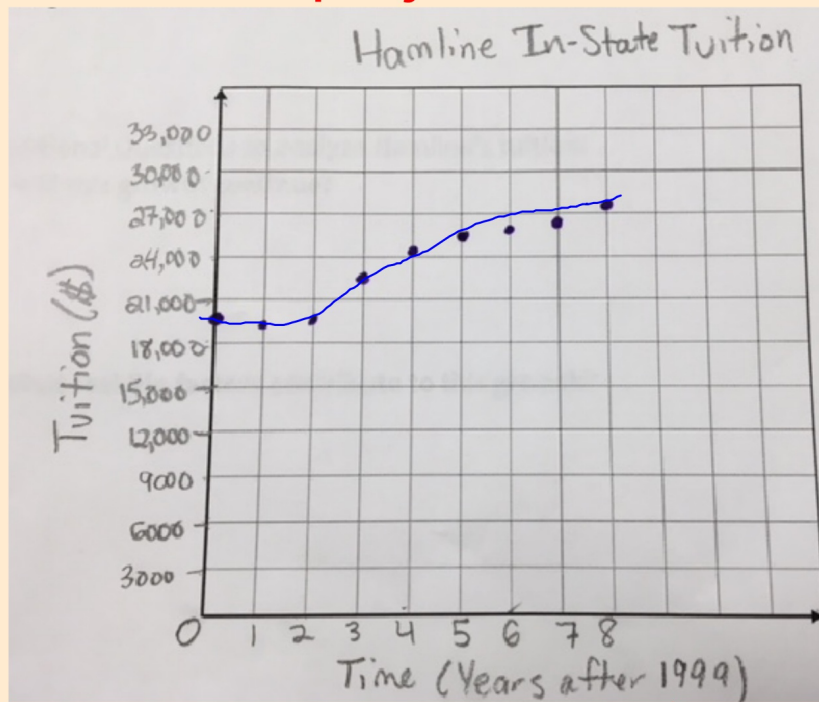
~~6000~~
~~3000~~

0 1 2 3 4 5 6 7 8

Years after 1999



SL Practice project KEY:



SL Practice project: Build and Interpret your equation

2) Build your equation. Use your notes to assist you. $y = a \cdot b^x = a(1+r)^x$

a) The starting tuition of Hamline University is _____

b) Each year the tuition price is multiplying by a constant rate of _____

c) Write an equation modeling tuition growth. _____

3) Interpret the real-life meanings of your equation.

Y: _____

X: _____

a: _____

b: _____

r: _____

SL Practice project KEY:

2) Build your equation. Use your notes to assist you. $y = a \cdot b^x = a(1+r)^x$

a) The starting tuition of Hamline University is 20,461

b) Each year the tuition price is multiplying by a constant rate of 1.04

c) Write an equation modeling tuition growth. $y = 20,461(1.04)^x$

3) Interpret the real-life meanings of your equation.

Y: The total (current) cost of Hamline tuition.

X: Time in years after 1999.

a: Hamline tuition during 1999

b: Amount multiplied to each year of tuition

r: 4% Growth rate of tuition costs $r \approx 3.03\%$

SL Practice project: Verify your equation

4) Verify your equation. Use year 6 (2005) in your equation to show tuition is \$ 25,554

$$y = 20461(1.04)^x$$

SL Practice project KEY:

4) Verify your equation. Use year 6 (2005) in your equation to show tuition is \$ 25,554

$$25,554 \approx 25,889$$

$$y = 20,461 (1.04)^6$$

$$y \approx 20,461 (1.265)$$

$$y \approx \$25,889$$

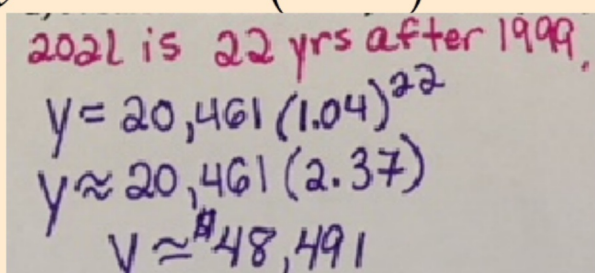
\$25,889 is about \$350 over the actual price of tuition during 2005. Because the data isn't growing at the same constant rate (*rate was averaged*), this small difference shows the equation is a good fit to the data.

SL Practice project: Make Predictions

5) Make predictions using your graph and/or equation.

a) Predict the tuition in year 2021. (The year you graduate high school!)

$$y = 20461(1.04)^x$$



Handwritten work showing the calculation of tuition for 2021:

2021 is 22 yrs after 1999.
 $y = 20,461(1.04)^{22}$
 $y \approx 20,461(2.37)$
 $y \approx \$48,491$

SL Practice project: Further Analysis

Additional Questions to analyze Hamline's tuition:

6) Will this growth continue?

7) What real-life factors contribute to this growth?

SL Practice project: Further Analysis

Additional Questions to analyze Hamline's tuition:

6) Will this growth continue?

It is likely that tuition costs will continue to grow, but the growth may slow down and not be as high as 4% each year. 2018 tuition costs (\$40,284) are \$8000 **less** than what the model predicts for 2021. It is unlikely that tuition will grow by **\$8000** in 3 school years. This evidence shows the growth will likely slow down.

SL Practice project: Further Analysis

7) What real-life factors contribute to this growth?

- Factors that contribute to this growth include growing costs to maintain the schools buildings, technology, and personel.
- There are federal subsidies to higher education that have been reduced, which require the schools to charge more.
- Student Services have also increased as more students are suffering from mental health related issues. This requires additional counselors, therapists, and psychologits.

SL Practice project: Further Analysis



Undergraduate Tuition Rates

[View Tuition Due Dates »](#)

Deposits

Title	Amount
Non-Refundable Deposit (new students only)	\$400

Cost Estimator

The **Undergraduate Cost Estimator** may help undergraduate students, who have an award package, estimate their cost of attendance at Hamline

2018-2019 Tuition Rates

FULL TIME (12-18 CREDITS PER SEMESTER)

Installment	Amount
Per year	\$40,284

Consider topics for project!



Data must be collected or
chosen tomorrow!



Exercises: Write a conclusion for the practice project.

- In conclusion, the Hamline tuition project shows.....

Next Friday

Unit test 3-2

* Exemplars of Quiz posted
at 3pm