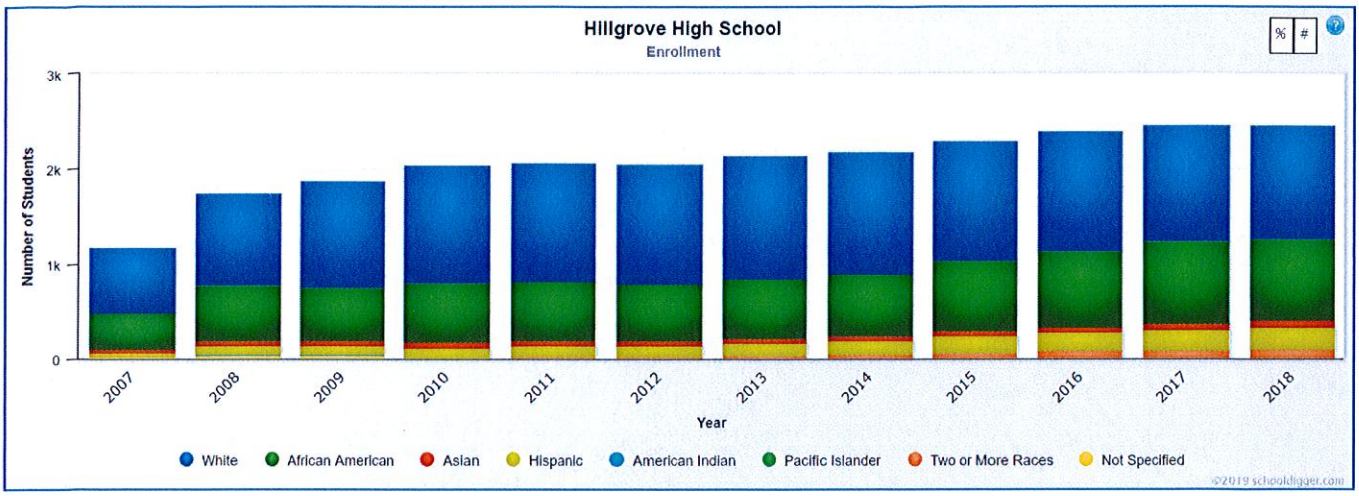
BC Calculus
Lab: Logistic vs Exponential Equations

Name_____
Date_____ Pd.____



L1 L2

Year	White	African American	Asian	Hispanic	American Indian	Pacific Islander	Two or More Races	Not Specified	t	Total
2007	682	391	31	43	1	n/a	n/a	22	0	1170
2008	978	584	54	92	3	n/a	n/a	43	1	1754
2009	1117	562	55	92	4	n/a	n/a	42	2	1872
2010	1241	624	64	111	4	0	0	0	3	2044
2011	1259	620	52	119	3	0	21	0	4	2074
2012	1257	608	47	109	3	0	27	0	5	2051
2013	1296	627	46	132	1	0	37	0	6	2139
2014	1288	649	47	137	1	1	54	0	7	2177
2015	1272	734	57	168	2	1	67	0	8	2301
2016	1267	803	53	192	1	1	87	0	9	2404
2017	1226	865	67	216	2	1	89	0	10	2466
2018	1201	853	73	234	4	0	100	0	11	2465

Data source: National Center for Education Statistics, U.S. Dept of Education.

Enter Data into your TI-84

1. Press (STAT)
2. Press 5: SetUpEditor Press Enter
3. Press (STAT)
4. Press 1: Edit
5. $L_1 = 0,1,....11$ for the years
6. $L_2 = 1170,1754,....$ for the Total Population of Hillgrove
7. Press 2nd Quit (to go to Homescreen)

Exponential

1. Press (STAT)
2. CALC
3. 0: ExpReg
4. Enter: 5 times

$y = a*b\wedge x$

a= 1565
b= 1.0494
r^2 = .72
y= $(1565)(1.0494)^x$

Logistic

1. Press (STAT)
2. CALC
3. B: Logistic
4. Enter: 5 times

$y = c/(1+ae\wedge(-bx))$

a= .7708
b= .40956
c= 2397
r^2 = .92
y= $\frac{2398}{1+.7708e^{-.40956x}}$

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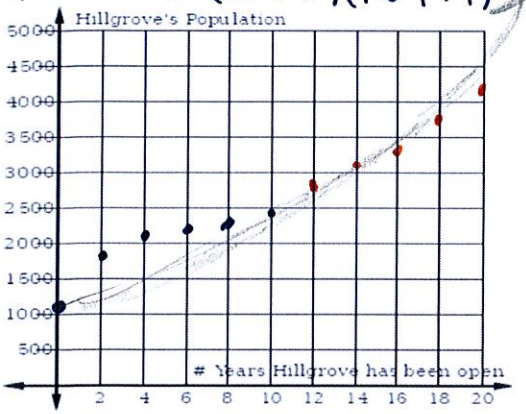
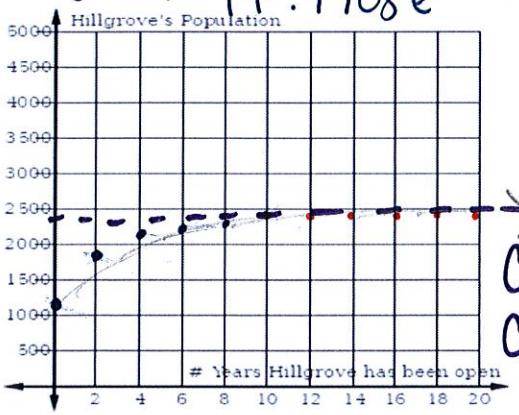
Graph the Exponential and Logistic equations: plug the equations into the calculator to predict the population in future years.

Exponential y= $(1565)(1.0494)^x$



Logistic: y= $\frac{2398}{1+.7708e^{-.40956x}}$



HA: carrying capacity

What is the prediction of the population in 14, 18, and 20 years?

Exponential: y(12), y(14), y(16), y(18), y(20)
2791 3073 3385 3727 4105

Logistic: 2385, 2392, 2395, 2396, 2397

Which model is a better model for Hillgrove's population? Why?

Logistic: because can not grow exponentially forever.

https://www.geogebra.org/m/Pd4Hn4BR

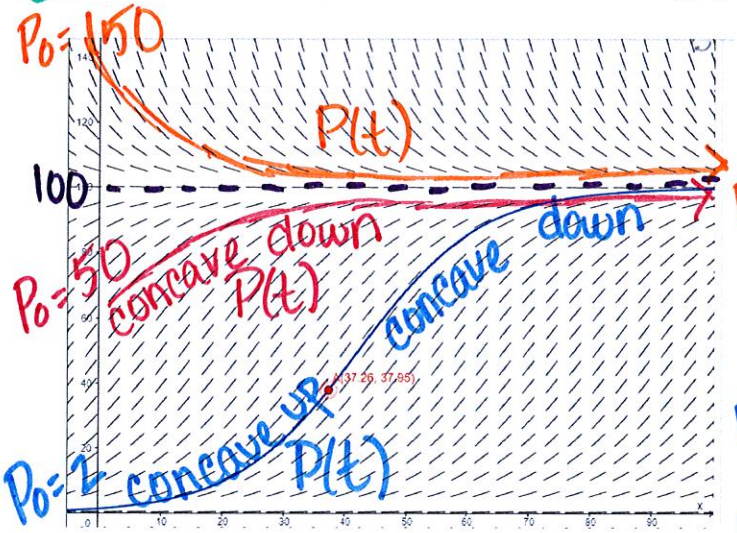
$\frac{dP}{dt} = .1P - .001P^2$ "Force One"

$\frac{dP}{dt} = .1P\left[\frac{.1P}{.1P} - \frac{.001P^2}{.1P}\right]$

$\frac{.001}{.1} = \frac{1}{100}$

$\frac{dP}{dt} = .1P\left[1 - \frac{1P}{100}\right]$

$\frac{dP}{dt} = KP\left[1 - \frac{P}{A}\right]$



What is the carrying capacity? A= 100

What is the growth rate? K= .1

What would your graph look like if you started over the carrying capacity? concave up

If you lie above the carrying capacity your graph is decreasing with negative slopes

If you lie below the carrying capacity your graph is increasing with positive slopes

What is the concavity?