Pre-Calculus 3.1 Together Name: Key

1. In 2017, the number of people in Illinois was 12.8 million. The state's population is estimated to be growing at 0.88% annually.

a. Assuming the rate of increase stays the same, predict the population in 2020.

$A = 12.8(1+.0088)^3$ 13.11 million

b. Assuming the rate of increase stays the same, predict the population in 2030.

$A = 12.8(1+.0088)^{13}$ 14.2 million

2. Determine the amount of money in a savings account that provides an annual rate of 4.25% compounded weekly if the initial deposit is \$1500 and the money is left in the account for 5 years.

$A = 1500\left(1+\frac{.0425}{52}\right)^{52(5)}$ \$1854.99

3. Compare the balance after 10 years of a \$5000 investment earning 8.5% interest compounded continuously to the same investment compounded quarterly.

a) Continuously:

$A = 5000e^{.085(10)}$

\$11,69.8,23

b) Quarterly:

$A = 5000\left(1+\frac{.085}{4}\right)^{4(10)}$

\$11594.52

4. In 2007, it is estimated that the United States used about 101,000 quadrillion thermal units. If U.S. energy consumption decreases at a rate of about 0.5% annually, what amount of energy will the United States use in 2020?

$A = 101(1-.005)^{13}$ 94.63 quadrillion

5. A population of 300 is decreasing at a continuous rate of 5%. Find the amount left in the population after 7 years.

$y = 300 \cdot e^{(-.05)(7)}$ 211.41

6. The population of a town is increasing at a rate of 1.5% annually. The current population in 2017 is 52,356 people. Predict the year in which the population will triple.

(1) $y = 52356(1+.015)^x$ Table on calc, look for $3\cdot(52356)$

74 years

(2) $157068 = 52356(1+.015)^x$

solve.

$3 = 1.015^x$ $\log_{1.015} 3 = x$

7. The data in the table shows a population growing exponentially. Identify the growth rate.

Year	Population (in millions)
2000	5.1
2008	8.1

keep all digits in calc same

$\frac{8.1}{5.1} = \frac{5.1}{5.1}(1+r)^8$

$\sqrt[8]{1.58\ldots} = \sqrt[8]{(1+r)^8}$

$1.059\ldots = 1+r$

$-1 \quad -1$

$r \approx .06$

$r = .0595\ldots$

Find the population in 2020

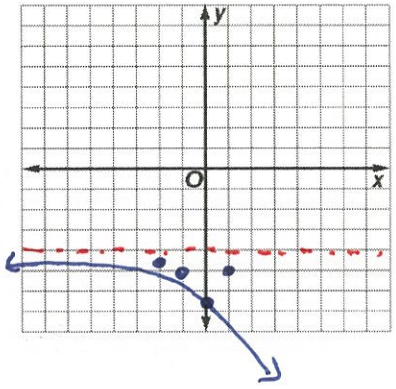
$A = 5.1(1+.0595\ldots)^{20}$ use saved # ; more accurate!

$A = 16.21$ million

8. Analyze the graph of $g(x) = -e^{(x+1)} - 4$ and find the following information. Then graph it.

Transformations: x-axis reflection, L1, D4

End Behavior: $\lim_{x \to -\infty} g(x) = -4$ $\lim_{x \to \infty} g(x) = -\infty$



Increasing: no where Decreasing: $(-\infty, \infty)$

Domain: $(-\infty, \infty)$ Range: $(-\infty, -4)$ Asymptote Equation: $y = -4$

$y = e^x$ Growth $\cdot(-1)$ -1 -4

x	y
-1	.4
0	1
1	2.7

x	y
-2	.4
-1	1
0	2.7

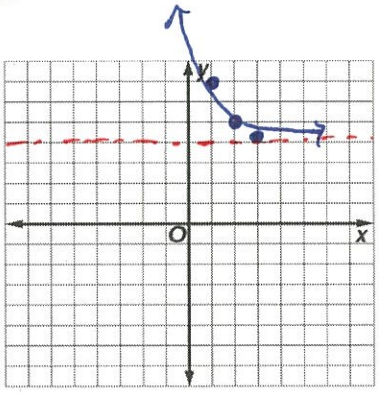
x	y
-2	-.4
-1	-1
0	-2.7

x	y
-2	-4.4
-1	-5
0	-6.7

9. Analyze the graph of $g(x) = \left(\frac{1}{3}\right)^{x-2} + 4$ and find the following information. Then graph it.

Transformations: Right 2, up 4

End Behavior: $\lim_{x \to -\infty} g(x) = \infty$ $\lim_{x \to \infty} g(x) = 4$



Increasing: no where Decreasing: $(-\infty, \infty)$

Domain: $(-\infty, \infty)$ Range: $(4, \infty)$ Asymptote Equation: $y = 4$

$y = \frac{1}{3}^x$ Decay $+2$ $+4$

x	y
-1	3
0	1
1	1/3

x	y
1	3
2	1
3	1/3

x	y
1	7
2	5
3	4 1/3