Day 22. Answers to review problems.

Review of Exponential Growth

1. a. A 32.24, b 32.6, C 93.96, D 104.4 . None of these formulas are the same as any other formula.

   b. B is a linear growth formula and C is an exponential growth formula. A is not a formula for either linear growth or exponential growth. I did not expect you to notice that D is a linear formula because it is not presented in the way we have been seeing them. But notice that this formula is equivalent to $D = 29 \cdot 1.8n = 0 + 52.2n$ so this is linear with a slope of 52.2 and y-intercept of 0.

   c. As I said, the point was to show you some of the ways students wrote formulas incorrectly on the test. It was fairly common for students to write a formula like D when they meant to write a formula like C. The critical difference here is whether the variable *n* is in the exponent or not.

2. a. exponential growth with an initial population of 10 thousand people, and it grows by a factor of 1.75 thousand people every 8.3 years.

   b. linear growth with the population when year=0 equal to 53.4 thousand people and the population increases by 0.8 thousand people every year.

   c. Since $0.04x = \frac{4}{100}x = \frac{1}{25}x = \frac{x}{25}$ the formula is $y = 800 \cdot (3)^{x/25}$. Exponential growth with an initial amount of 800, which triples every 25 months.

   d. Since $0.1x = \frac{1}{10}x = \frac{x}{10}$ the formula is $y = 23 \cdot (1.8)^{x/10}$. Exponential growth with an initial amount of 23, which increases by a growth factor of 1.8 every 10 years.

   e. Exponential decay with an initial amount of 73 which decreases by a factor of 0.5 every 400 years.

   f. Since $0.5x = \frac{5}{10}x = \frac{1}{2}x = \frac{x}{2}$ the formula is $y = 3200 \cdot (0.5)^{x/2}$. Exponential decay with an initial amount of 3200 which decreases by a factor of 0.5 every 2 years.

   3. $y = 23 \cdot (1.8)^{0.1x} = 23 \cdot (1.8^{0.1})^x = 23(1.06054)^x$. So the growth factor is 1.06054 and the annual percent increase is 6.054%.

   4. $y = 73(2)^{x/8} = 73(2^{1/8})^x = 73(1.090508)^x$. So the growth factor is 1.090508 and the annual percent increase is 9.0508%.

   5. $y = (2)^{x/12.3} = (2^{1/12.3})^x = 1.057972^x$. So the growth factor is 1.057972 and the annual percent increase is 5.7972%.

Day 22. Answers to review problems.

6. $y=(2)^{x/80}=(2^{1/80})^x=1.008702^x$. So the growth factor is 1.008702 and the annual percent increase is 0.8702%.

7. The formula is $y=100(1.03)^x$ where 100 is the initial amount and x is the number of years. Using the rule of 72, we have 72/3 = 24. So a first guess is that it doubles every 24 years. We'll check by plugging in 24 to see what really happens after 24 years. $y=100(1.03)^{24}=203.2794$. So 24 years is a little bit too long. A better guess would be 23.5 years.

8. The formula is $y=100(1.04)^x$ where 100 is the initial amount and x is the number of years. Using the rule of 72, we have 72/4 = 18. So a first guess is that it doubles every 18 years. We'll check by plugging in 18 to see what really happens after 18 years. $y=100(1.04)^{18}=202.5817$. So 18 years is a little bit too long. A better guess would be 17.5 years.

9.

x	Frost	x	Texas
0	500	0	500
1	530	1	525
2	560	2	551.25
12	860	12	897.9282

Frost Bank: $y=500+30x$ Texas Bank: $y=500(1.05)^x$.

10.

x	Glen Rose	x	Meridian
0	1200	0	1000
1	1240	1	1050
2	1280	2	1102.5
15	1800	15	2078.928

Glen Rose: $y=1200+40x$ Meridian: $y=1000(1.05)^x$.

11. A is exponential growth, B is linear growth, C is neither.
12. Use the geometric mean to find the mid-decade values for Pop'n A. (sqrt(product))
13. Use the arithmetic mean to find the mid-decade values for Pop'n B. (half of sum)

Year	Pop'n A	Year	Pop'n B
1950	203	1950	1080
1955	224	1955	1290
1960	247	1960	1500
1965	273	1965	1710
1970	302	1970	1920
1975	333	1975	2130
1980	368	1980	2340
1985	406	1985	2550

Day 22. Answers to review problems.

1990	448		1990	2760
1995	495		1995	2970
2000	546		2000	3180