Name: Key

Unit 9 Review – Sequences, Series& Regressions

Helpful Information:

Regressions:

- Stat Diagnostics ON
- Use Stat button to enter lists
- Stat > Calc for regressions
    - Only choose options that say reg for regression
- r = correlation (always from -1 to 1)

Sequences & Series:

- formulas on reference sheet
- adding/subtracting = arithmetic
- multiplying/dividing = geometric
- Sigma: Alpha Window

Level I Practice:

1. The population of Jamesburg for the years 2010-2013, respectively, was reported as follows:

250,000 250,937 251,878 252,822

How can this sequence be recursively modeled?

1) $j_x = 250,000(1.00375)^{x-1}$

2) $j_x = 250,000 + 937^{(x-1)}$

3) $j_1 = 250,000$
$j_x = 1.00375 j_{x-1}$

4) $j_1 = 250,000$
$j_x = j_{x-1} + 937$

2. Joelle has a credit card that has a 19.2% annual interest rate compounded monthly. She owes a total balance of *B* dollars after *m* months. Assuming she makes no payments on her account, the table below illustrates the balance she owes after *m* months.

m	B
0	1000.00
10	1172.00
19	1352.00
36	1770.80
60	2591.90
69	2990.00
72	3135.80
73	3186.00

Over which interval of time is her average rate of change for the balance on her credit card account the greatest?

AROC = $\frac{\Delta y}{\Delta x}$

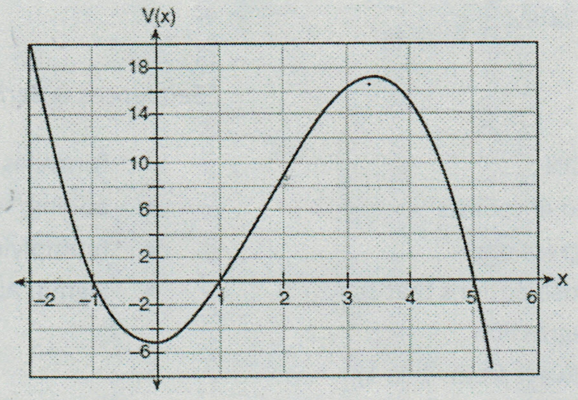
1) month 10 to month 60 28.398

2) month 19 to month 69 32.76

3) month 36 to month 72 39.31

4) month 60 to month 73 45.7

3. A cardboard box manufacturing company is building boxes with length represented by $x+1$, width by $5-x$, and height by $x-1$. The volume of the box is modeled by the function below.



Over which interval is the volume of the box changing at the fastest average rate?

1) [1,2] $(1,0)\ (2,9) = \frac{9-0}{2-1} = \frac{9}{1} = 9$

2) [1,3.5] $(1,0)\ (3.5,17)\quad \frac{17-0}{3.5-1} = \frac{17}{3.5} = 4.85$

3) [1,5] $(1,0)\ (5,0) = \frac{0}{4} = 0$

4) [0, 3.5] $(0,\ 3.5) = (0,-5)\ (3.5,17) = \frac{17-(-5)}{3.5-0} = \frac{22}{3.5} = 6.29$

Level II Practice:

4. The formula below can be used to model which scenario?

$$a_1 = 3000$$
$$a_x = 0.80a_{x-1}$$

1) The first row of a stadium has 3000 seats, and each row thereafter has 80 more seats than the row in front of it.

2) The last row of a stadium has 3000 seats, and each row before it has 80 fewer seats than the row behind it.

3) A bank account starts with a deposit of \$3000, and each year it grows by 80%.

4) The initial value of a specialty toy is \$3000, and its value each of the following years is 20% less.

5. Alexa earns $33,000 in her first year of teaching and earns a 4% increase in each successive year. Write a geometric series formula, S_n, for Alexa's total earnings over *n* years. Use this formula to find Alexa's total earnings for her first 15 years of teaching, to the *nearest cent*.

Reference Sheet $\quad a_1 = 33{,}000 \quad r = 4\% \; 1.04$

$$S_n = \frac{a_1 - a_1 r^n}{1-r} \rightarrow S_n = \frac{33{,}000 - 33{,}000(1.04)^n}{1-1.04}$$

$$S_{15} = \frac{33{,}000 - 33{,}000(1.04)^{15}}{1-1.04} = \$660{,}778.39$$

6. Pedro and Bobby each own an ant farm. Pedro starts with 100 ants and says his farm is growing exponentially at a rate of 15% per month. Bobby starts with 350 ants and says his farm is steadily decreasing by 5 ants per month. Assuming both boys are accurate in describing the population of their ant farms, after how many months will they both have approximately the same number of ants?

Pedro = Bobby

$100(1.15)^n = 350 - 5(n)$

$y_1 = y_2$

change window set

$x \rightarrow 0 \rightarrow 40$

$y \rightarrow 0 \rightarrow 350$ yscl 10

graph & use 2nd Calc: 5 → intersect

1) 7
2) 8
3) 13
4) 36

7. Which function shown below has a greater average rate of change on the interval $[-2,4]$? Justify your answer.

x	f(x)
−4	0.3125
−3	0.625
−2	1.25
−1	2.5
0	5
1	10
2	20
3	40
4	80
5	160
6	320

$$\text{AROC} = \frac{80 - 1.25}{4-(-2)} = \frac{78.75}{6} = 13.125$$

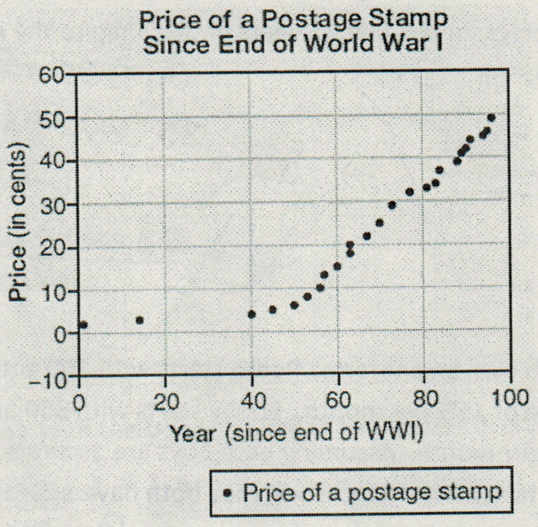
$g(x) = 4x^3 - 5x^2 + 3$

X	g(x)
−2	−49
4	179

$$\text{AROC} = \frac{179-(-49)}{4-(-2)} = \frac{179+49}{4+2} = \frac{228}{6} = 38$$

Ans: g(x) has a greater average rate of change @ 38 compared to f(x) @ 13.1

8. The price of a postage stamp in the years since the end of World War I is shown in the scatterplot below.



The equation that best models the price, in cents, of a postage stamp based on these data is

1) $y = 0.59x - 14.82$

2) $y = 1.04(1.43)^x$

3) $y = 1.43(1.04)^x$

4) $y = 24\sin(14x) + 25$

Level III Practice:

9. The eighth and tenth terms of a sequence are 64 and 100. If the sequence is either arithmetic or geometric, the ninth term can *not* be

1) -82

2) -80

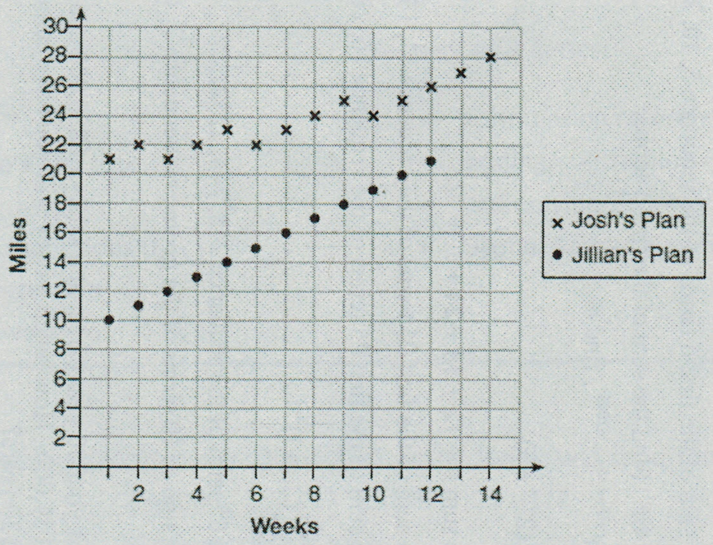
3) 80

4) 82

geometric $\frac{5}{4}$ or $\frac{-5}{4} = r$

arithmetic $+18 = d$

10. Elaina has decided to run the Buffalo half-marathon in May. She researched training plans on the Internet and is looking at two possible plans: Jillian's 12-week plan and Josh's 14-week plan. The number of miles run per week for each plan is plotted below.



Which one of the plans follows an arithmetic pattern? Explain how you arrived at your answer.

Jillian's plan is arithmetic pattern
-each week 1 more mile is added.

Write a recursive definition to represent the number of miles run each week for the duration of the plan you chose.

Jillian's plan
$a_1 = 10$
$a_n = a_{n-1} + 1$

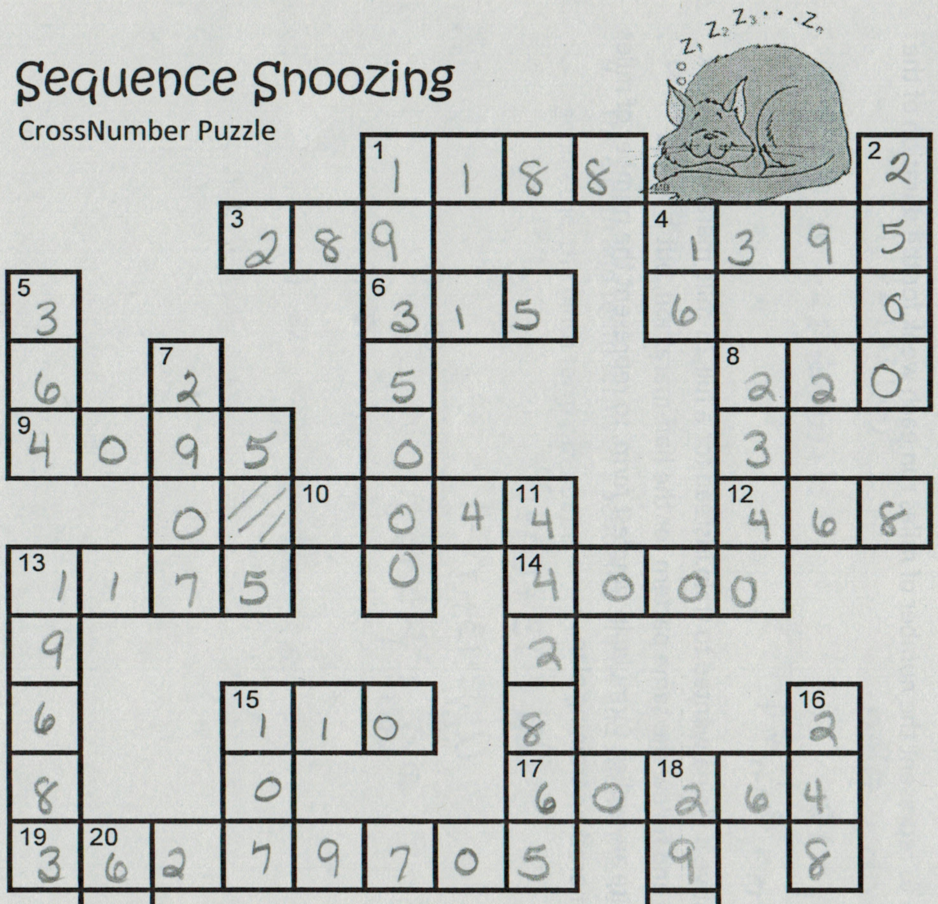
Jillian's plan has an alternative if Elaina wanted to train instead for a full 26-mile marathon. Week one would start at 13 miles and follow the same pattern for the half-marathon, but it would continue for 14 weeks. Write an explicit formula, in *simplest form*, to represent the number of miles run each week for the full-marathon training plan.

$a_n = 13 + (n-1)$
$a_n = 13 + n - 1$
$a_n = n + 12$

Sequence Snoozing

CrossNumber Puzzle

Name________________________________



Down

11 Find the sum of 11 terms of the sequence 5, 15, 45, ...

13 Find the 10^{th} term of the sequence 1, 3, 9, ...

15 The first term of an arithmetic sequence is 5. The 17^{th} term is 53. Find the 35^{th} term.

16 Find $\sum_{n=3}^{7} 2^n$.

18 Find the 100^{th} term of the sequence 1, 4, 7, 10, ...

20 Find the sum of the first 25 positive even integers.

Across

1 Find the sum of the first 27 terms of the sequence -8, -4, 0, ...

3 What is the 42^{nd} term of the sequence 2, 9, 16, ...

4 Find the 200^{th} term of the sequence 2, 9, 16, ...

6 Find the sum of the first 6 terms of the sequence 5, 10, 20, ...

8 Let $a_n = 4n^2$. Find the sum of the first 5 terms.

9 If $a^m = a^{1+2+4+8+...+2048}$, find m.

10 Find $\sum_{n=1}^{8} (2^{n+1} + 3)$.

12 Find the sum 6 + 12 + 18 + 24 + ... + 72.

13 Find the sum of the first 25 terms of the sequence 11, 14, 17, ...

14 Find the sum of the first 25 terms of the sequence 16, 28, 40, ...

15 Find $2 \cdot \sum_{n=1}^{3} (2n+1)^{n-1}$.

17 Find the 6^{th} term of the sequence 248, 744, 2232, ...

19 Find the sum of 10 terms of the geometric sequence 3, 18, 108, ...

Down

1 You start your 30 year career at a salary of \$50,000 and receive yearly raises of \$1,000. How much money will you have earned, in total, over the 30 years?

2 Find the sum of the sequence, 52, 56, 60, ... , 148.

4 Find the number of terms in the sequence 4, 7, 10, ... , 49.

5 Find the sum of the first 6 terms of the sequence 1, 3, 9, 27, ...

7 $a_1 = 3$; $a_{n+1} = 3a_n + 18$. Find a_6

8 A lecture hall has 20 seats in the first row, 24 in the second row, 28 in the third row, and so on for 30 rows. How many seats are in the lecture hall?