

Math 1311 Test 3 Review

Test instructions

Where: CASA Testing Center (222 Garrison Gym)

Time: 50 minutes

What is covered? Chapter 4 and 5

Number of questions: 12

10 Multiple Choice Questions 8 points each (total of 80 points)

2 Free Response Questions 10 each (total of 20 points)

For the free response part, please show your work neatly. Do not skip steps.

Bring your calculator with you to CASA. If you forget your calculator, you will have to take the test without. There are NO spares. Bring extra batteries too.

Remember the make-up policy: NO MAKE UPS!

1. A population grows by 4.5% each year. By what **percentage** does it grow each month?

$$4.5\% \rightarrow .045 \quad a_y = 1 + .045 = 1.045$$

$$a_m = (a_y)^{\frac{1}{12}} = (1.045)^{\frac{1}{12}} = 1.0037$$

$$1.0037 - 1 = .0037 \rightarrow .37\%$$

2. A population declines by 0.5% each year. By what **percentage** does it decline each decade?

$$.5\% \rightarrow .005 \quad a_y = 1 - .005 = .995$$

$$a_D = (a_y)^{10} = (.995)^{10} = .9511$$

$$1 - .9511 = .0489 \rightarrow 4.89\%$$

3. A certain population has a yearly per capita growth rate of 2.3%, and the initial value is **3 million**.

a. Use a formula to express the population as an exponential function.

b. Express using functional notation the population after 4 years, and then calculate its value.

$$P(t) = P(a)^t \quad 2.3\% \rightarrow .023$$

$$(a) \quad P(t) = 3(1.023)^t \quad a = 1 + .023 = 1.023$$

$$(b) \quad P(4) = 3(1.023)^4 = 3.2857 \text{ million of people}$$

4. An overweight man makes lifestyle changes in order to lose weight. He currently weighs 260 pounds and has a target weight of 200 pounds. Each month his current weight decreases by 5.5%.
- Make an exponential model of his weight W versus the time t in months since the diet began.
 - How long will it take for his weight to reach 210 pounds?

$$(a) \quad W(t) = 260 (.945)^t$$

$$5.5\% \rightarrow .055 \rightarrow a = 1 - .055 = .945$$

$$(b) \quad \underbrace{260 (.945)^t}_{Y_1} = \underbrace{210}_{Y_2} \quad t = 3.775$$

about 4 months

5. Test if the following data is exponential.

| | | | | |
|---|---|----|----|----|
| x | 0 | 2 | 4 | 6 |
| y | 5 | 10 | 20 | 40 |

$$\text{Exp.} \quad \frac{10}{5} = \frac{20}{10} = \frac{40}{20} = 2$$

Linear

| | | | | |
|---|---|----|----|----|
| x | 0 | 2 | 4 | 6 |
| y | 5 | 15 | 25 | 35 |

$$\frac{15-5}{2} = \frac{25-15}{2} = \frac{35-25}{2} = 5$$

6. Which regression model should be used to approximate the data?
- A population of deer is introduced into a region with abundant resources.
 - During a certain period, the price of a bag of groceries grows by about 3% each year.
 - A biologist tells us that, for a group of small animals in our study, a 1-inch increase in length always results in the same increase in running speed.

a) logistic

b) exp.

c) linear

7. Use exponential regression to fit the following data set. Use the model to calculate $y(7)$ and to solve for $y = 21$ for x .

| | | | | | |
|---|-----|-----|------|------|------|
| x | 1 | 2 | 3 | 4 | 5 |
| y | 4.1 | 8.7 | 19.2 | 28.6 | 64.7 |

$$y(x) = 2.22 (1.96)^x$$

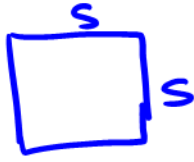
$$y(7) = 2.22 (1.96)^7 = 243.11$$

$$y(x) = 21 \quad x = 3.35$$

8. The Richter scale is used for comparing the magnitudes of earthquakes. An increase of t units on the Richter scale indicates a 10^t increase in the magnitude of an earthquake. One earthquake measures 3.5 on the Richter scale, and another reads 5.3. How do the two earthquakes compare? Round your answer to the nearest whole number.

$$10^{(5.3-3.5)} = 63 \text{ times}$$

9. How does the area of a square change if the length of its side is increased by 25%?



$$A = s^2$$

$$s = s + s(0.25) = s(1.25)$$

$$(1.25)^2 = 1.5625 \text{ times bigger}$$

10. A school board has a plan to increase participation in the PTA. Currently only about 25 parents attend meetings. Suppose the school board plan results in logistic growth of attendance. The school board believes their plan can eventually lead to an attendance level of 50 parents. In the absence of limiting factors the school board believes its plan can increase participation by 10% each month. Let m denote the number of months since the participation plan was put in place, and let P be the number of parents attending PTA meetings.

- What is the carrying capacity K for a logistic model of P versus m ?
- Find the constant b for a logistic model.
- Find the r value for a logistic model. Round your answer to three decimal places.
- Find a logistic model for P versus m .

$$(a) K = 50$$

$$(b) b = \frac{K}{N(0)} - 1 \quad b = \frac{50}{25} - 1 = 2 - 1 = 1$$

$$(c) 10\% \rightarrow .1 \quad a = 1 + .1 = 1.1$$

$$r = \ln a = \ln(1.1) = .095$$

$$(d) N = \frac{K}{1 + be^{-rt}} \quad N = \frac{50}{1 + e^{-.095t}}$$

11. Use a formula to express w as a function of t if $w = s^2 + 1$ and $s = t - 3$.

$$\begin{aligned}w(t) &= w(s(t)) && (a-b)^2 = a^2 - 2ab + b^2 \\ &= (t-3)^2 + 1 && (a-b)(a-b) \\ &= t^2 - 6t + 9 + 1 \\ &= t^2 - 6t + 10\end{aligned}$$

12. (Free Response) A certain quantity grows by .73% per day.

- What is the daily growth factor?
- What is the weekly growth factor?
- What is the monthly growth factor? Assume a 30 day month.
- By what percent is the quantity growing every month?

$$(a) .73\% \rightarrow .0073 \quad a_D = 1 + .0073 = 1.0073$$

$$(b) a_W = (a_D)^7 = (1.0073)^7 = 1.0522$$

$$(c) a_M = (a_D)^{30} = (1.0073)^{30} = 1.2438$$

$$(d) 1.2438 - 1 = .2438 \rightarrow 24.38\%$$

13. (Free Response) The table below shows how the balance in a savings account grows over time since the initial investment

| Time in months | 0 | 1 | 2 | 3 | 4 |
|-----------------|-----------|---------|---------|---------|---------|
| Savings balance | \$3500.00 | 3542.00 | 3584.50 | 3627.52 | 3671.05 |

Compute the balance in the account **a year** after the account is open.

$$S(t) = 3500 (1.012)^t$$

$$S(12) = 3500 (1.012)^{12} = \$ 4038.63$$