Math113 College Algebra

Third Midterm Exam

Colorado Mesa University · 2026 Fall

NAME: _____

1. Determine the value of A that satisfies this equation. Express this value as a decimal number accurate to within one-thousandth.

   $$69(33)^{A} = 173$$

2. Determine the value of B that satisfies this equation. Express this value as a decimal number accurate to within one-thousandth.

   $$51 = 97\log_{33}(B)$$

3. Suppose the number of cells in a colony of E. coli is growing exponentially, increasing by a factor of thirty-three each day. Initially, observing it under a microscope, you count 56 cells in the colony. If you leave and come back 57 *hours* later how many cells should you expect the colony to have?

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4. The formula for the future value of P dollars invested at an interest rate r compounded monthly for t years is $P\left(1+\frac{r}{12}\right)^{12t}$. If you were to invest \$12,345 at an annual interest rate of 2.4%, after how many years would your investment appreciate to a worth of \$104,284?

5. Suppose that the following Gompertz function G models the cumulative number of cases of Ebola recorded during the western Africa epidemic of 2014–15, with $t = 0$ corresponding to March 2014. What is the value of $G(8.75)$, and what is the interpretation of this value in the context of the situation?

$$G(t) = 28616\,\mathrm{e}^{-18\left(0.65\right)^{t}}$$

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6. This last July, the federal government began offering tax-advantaged investment accounts for US citizens under the age of eighteen (trumpaccounts.gov). The accounts would be tied to an index fund tracking the S&P 500. Upon opening the account, the IRS would automatically deposit $1000. Parents would thereafter be able to contribute up to $5000 per year to their child's account.

   (a) A couple opens this account for their newborn child, receives the $1000, and then forgets about the account. If the S&P 500 grows continuously at a rate of 10.7% per year, what will the account balance be on their child's eighteenth birthday?

   (b) Another couple opens this account for their newborn child, proudly refuses the initial $1000 from the IRS, and then deposits $5000 each year on their child's birthday, well into the child's adulthood. If the S&P 500 grows at an average annual rate of only 9.5% over these years, how old will their child be when the account balance reaches $1 million?

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$$S = P\left(1+\frac{r}{n}\right)^{nt} \qquad S = Pe^{rt} \qquad S = P\left(\frac{\left(1+\frac{r}{n}\right)^{nt}-1}{\frac{r}{n}}\right) \qquad S = P\left(\frac{1-\left(1+\frac{r}{n}\right)^{-nt}}{\frac{r}{n}}\right)$$

7. Here is data for the population of Mesa County for select decades.

Year	2020	2010	2000	1990	1980	1970	1960	1950	1940
Population (in thousands)	155.7	146.7	116.3	93.1	81.5	54.7	50.7	38.8	33.8

From wikipedia.org/wiki/Mesa_County,_Colorado.

(a) Perform regression to determine the *exponential* function that best models this data. At what percent per year does this model indicate Mesa County's population is growing?

(b) What year does the *exponential* model indicate the population of Mesa County first exceeded 100,000 people? Demonstrate how to calculate this from the formula for the model.

(c) Perform regression to determine the *logistic* function that best models this data. According to this model, what is Mesa County's carrying capacity? According to this model, what year did the growth of Mesa County's population begin decelerating?

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