

Midterm Exam Three

Math 113-001/6 College Algebra
Colorado Mesa University Fall 2022

Name: _____

1. Write the following expression in a simpler equivalent form that only has a single x and no parentheses.

$$\left(\frac{6x^3}{(3x)^2}\right)^4$$

2. The expression $3\log_7(2x) - \log_7(x^5)$ can be written as a single logarithm $\log_7(\text{stuff})$. What must the stuff be?

3. What value(s) of x satisfy this equation?

$$\ln(3x + 1) = 2$$

4. According to the CDC¹, the prevalence of *diagnosed* cases of diabetes in the US among adults (adjusted for age) as a percentage of the total population per year is displayed in the following table.

| year | 2001 | 2004 | 2008 | 2012 | 2016 | 2020 |
|---------|------|------|------|------|------|------|
| percent | 6.4 | 7.0 | 7.9 | 8.4 | 8.5 | 8.2 |

- (a) Do you think an exponential model or a logarithmic model would fit the data best?
- (b) Based on your choice in the previous part, perform regression to find a function of t years after 2000 that models the data. Write this function below with parameters rounded to two decimal places. (If you do not have a calculator capable of regression, simply write "no calc" and circle whichever of these functions you think fits the data best.) Use this function as your model for the remaining questions.
- $7(1.01)^t$ $6 + 0.8\ln(t)$
- (c) What does your model predict the percent of US adults diagnosed with diabetes to be this year?
- (d) According to your model, what year will 9% of the US adult population be diagnosed with diabetes?

¹gis.cdc.gov/grasp/diabetes/diabetesatlas-surveillance.html

5. Coloramo Credit Union offers a *Money Market Account*², which is basically a “premium” savings account that offers a higher interest rate on your balance but has stricter requirements, like a \$2500 minimum account balance.
- (a) You open a Money Market account at Coloramo with \$2500 and a 0.3% annual interest on your balance. Supposing the interest is compounded monthly, and supposing you don’t deposit or withdraw any more money, what will your account balance be after one year?
- (b) Supposing instead that the interest is compounded *daily*, what will your account balance be after *three years*?
- (c) Supposing the interest is compounded monthly, and supposing you don’t deposit or withdraw any more money, how long before your account balance is \$2540?

²coloramo.org/rates/

6. Suppose that you're thinking about taking out a 15-year fixed-rate mortgage on a \$360,000 home³ at the current market interest rate, 7%. Recall that the formula that describes a mortgage with *monthly* payments is

$$S = P \left(\frac{1 - \left(1 + \frac{r}{12}\right)^{-12t}}{\frac{r}{12}} \right)$$

where S is the value of the property, P is the monthly mortgage payment, r is the interest rate of the mortgage, and t is the duration of the mortgage.

- (a) According to this formula, what are your monthly payments going to be?

- (b) You can't afford those monthly mortgage payments, so you begin looking for a less expensive home. If your budget only allows for a \$1600 monthly mortgage payment⁴, and you decide on a 30-year mortgage instead, about what price for a home should you be looking for?

³This is about the average home price in Grand Junction.

⁴Financial professionals recommend you allocate 28% of your income on mortgage payments; this payment is about 28% of a yearly income of \$70,000.