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 $3\log_7(2x) - \log_7\left(x^5\right)$ can we 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 CDC[1], 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.

$7(1.01)^t$ $\qquad$ $6+0.8\ln(t)$

(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?

[1] gis.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?

[2] coloramo.org/rates/

6. Suppose that you're thinking about taking out a 15-year fixed-rate mortgage on a \$360,000 home[3] 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 payment[4], and you decide on a 30-year mortgage instead, about what price for a home should you be looking for?

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

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