Mth 30, Homework 6 on sections 4.1, 4.2, 4.3, 4.4

Due by Wed, Mar 26.

Please use lots of space and explain your answers, showing clearly any work you had to do. Each question is worth 3 points.

Section 4.1 Exponential Functions

(1) Let $f(x)$ be the exponential function $5 \cdot 3^x$. Compute: **(a)** $f(4)$ and **(b)** $f(-2)$

(2) Let

$$g(x) = -8\left(\frac{1}{4}\right)^x$$

and compute: **(a)** $g(0)$, **(b)** $g(3)$ and **(c)** $g(-1)$

(3) A fast food chain starts with 12 restaurants and every year the number increases by 8%. Explain why and how $f(t) = 12(1.08)^t$ models this situation. How many restaurants does the chain have after 20 years?

(4) You deposit $\$1500$ into a savings account that earns 3% interest, compounded annually. How much is in your account after 12 years?

(Hint: multiply by 1.03 for each year.)

Section 4.2 Graphs of Exponential Functions

(5) Sketch the graph of $f(x) = 4^x$ carefully by plotting 5 points corresponding to $x = -2, -1, 0, 1, 2$, including the y-intercept and showing the horizontal asymptote.

(6) By starting with your graph in the last question and using transformations, (like moving up, down, left, right or reflecting through the x axis), sketch the graphs of

- **(a)** $h(x) = 4^x - 1$
- **(b)** $q(x) = -4^x$
- **(c)** $r(x) = 4^{x-3}$

(7) For the exponential function $y = e^x$ do the following:

- **(a)** Sketch its graph carefully by plotting 5 points corresponding to $x = -2, -1, 0, 1, 2$. Use your calculator to find these powers of e.
- **(b)** Give the domain and range of this function in interval notation.
- **(c)** Is this function one-to-one?

Section 4.3 Logarithms

(8) Find the following:

(a) $\log_2(16)$ **(b)** $\log_5(25)$ **(c)** $\log_9(1)$ **(d)** $\log_3(243)$

(Hint: remember you are looking for a power.)

(9) Convert into exponential form:

(a) $\log_2(x) = 8$ **(b)** $\log_b(1000) = 3$ **(c)** $\log_8(a) = w$

(In other words give the same information without mentioning logs.)

(10) Evaluate the following:

(a) $\log_3\left(\frac{1}{27}\right)$ **(b)** $\log_7(\sqrt{7})$ **(c)** $\log(0.01)$ **(d)** $\ln(e^{2000})$

(Hint: remember that $\log(x)$ means $\log_{10}(x)$ and $\ln(x)$ means $\log_e(x)$.)

Section 4.4 Graphs of Logarithmic Functions

(11) Answer these questions about the function $\log_3(x)$

(a) Carefully sketch its graph. Include at least three points on the graph and draw the vertical asymptote. Remember to number and label the axes.

(b) Give its domain and range.

(c) Where is it positive? Give your answer in interval notation.

(12) Sketch the graph of $\log_3(x-2)-1$ by transforming your graph from the last question. Make sure to show the new vertical asymptote and new x intercept.

(13) Draw the graphs of e^x and $\ln x$ together on the same axes. How are these two graphs related? Is one a mirror image of the other?

If you get stuck on a question or aren't sure if you understand it:

- Go over the relevant class notes or section in the textbook.
- Ask me about it after class.
- Come to my office hours: Mon 2:00 - 3:00, Wed 2:00 - 3:00 in CP 317.
- Go to the Math Tutorial Lab in-person in CP 303 or online.