MATH 135 – Calculus 1
Sample Questions for Exam 1
September 19, 2019

Disclaimer: The following questions indicate the range of topics that might appear on the exam. But the exam itself will not be anywhere near this long. The actual exam questions might also look somewhat different from these.

I. Express the set of x satisfying $|2x - 5| > 1$ as an interval or union of intervals.

II. The following table contains values for three different functions: $f(x), g(x), h(x)$.

x	0	0.1	0.2	0.3	0.4
$f(x)$	-4.2	-5.9	-7.6	-9.3	-11.0
$g(x)$	10	20	40	80	160
$h(x)$	4	2.3	1.5	2.1	6.1

A) One of these is a linear function. Explain how you can tell which one it is, and give a formula for it.

B) One of these functions is *neither linear nor exponential*. Explain which one that is and why.

C) Give a possible formula for $g(x)$. (Hint: the values are doubling every time x increases by .1.)

III. All parts refer to $f(x) = -3x^2 + 12x + 21$.

A) Where does the graph $y = f(x)$ cross the x-axis?

B) Where does it cross the y-axis.

C) Sketch the graph $y = -3x^2 + 12x + 21$ for x in $[-4, 4]$ and showing correct scales on both the x- and y-axes.

IV. You start at $x = 0$ at time $t = 0$ (hours) and drive along the x-axis (x values in miles) at 40 miles an hour for 2 hours. At $t = 2$ you stop for one hour. Then starting at $t = 3$, you retrace your earlier path and return to your starting position at 80 miles per hour.

A) Sketch the graph of your position as a function of time.

B) Give (piecewise) formulas for your function on the appropriate t-intervals.

V.

A) Express the domain of the function $f(x) = \frac{x}{x^2-1}$ as a union of intervals.

B) Figure 1 on the back of this page shows the graph $y = \frac{x}{x^2-1}$. Based on this, what can you say about the range of $f(x)$?

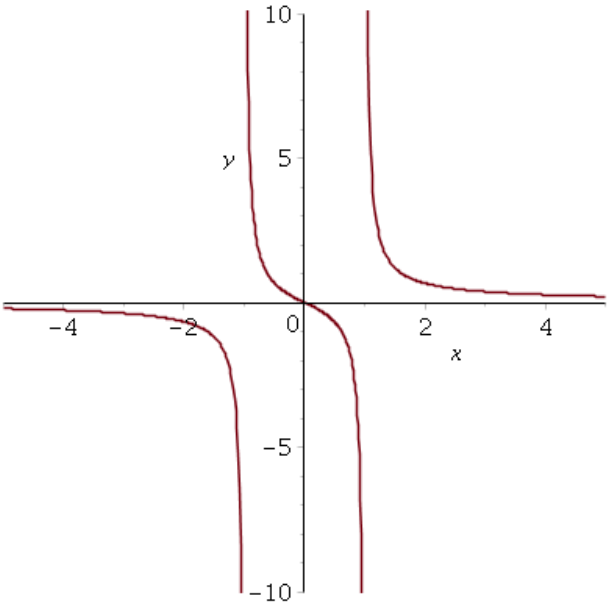

Figure 1: Figure for Question V

C) Explain why $f(x)$ (on its default domain) *fails* to have an inverse function.

D) Give a restricted domain on which $f(x)$ *does* have an inverse function, and sketch the graph of the inverse.

VI.

A) What are the *amplitude* and *period* of the sinusoidal function $y = 3\sin\left(\frac{x}{2}\right) + 2$?

B) What would change in your answer to A) if the formula was $y = \frac{1}{3}\sin(2x) + 2$?

VII.

A) Simplify: $\log_3(27) + \ln(e^{-3})$.

B) Solve for x: $2^{x+3} = 3^{x/2}$.

C) The population of a city (in millions) at time t (years) is $P(t) = 2.4e^{0.06t}$. What is the population at $t = 0$? When will the population reach 4 million?

D) (Continuation of C) How long will it take for the population to reach double the number at $t = 0$?

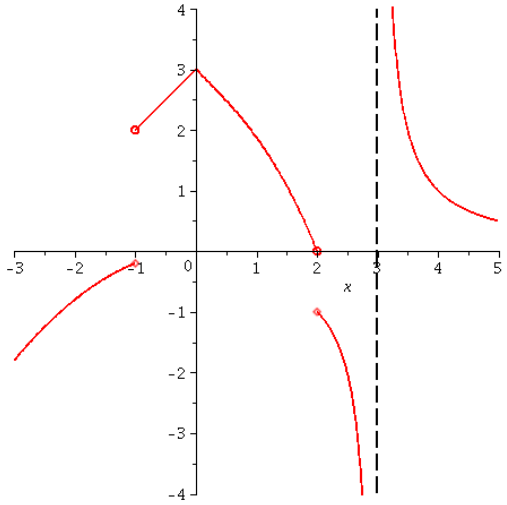

Figure 2: Figure for Question X

VIII. Let $f(x)$ be the function tabulated below.

x	0	0.1	0.2	0.3	0.4
$f(x)$	-3	-5.9	-7.6	-8	-12.0

A) What is the *average rate of change* of $f(x)$ over the interval $[0.1, 0.2]$?

B) Same question for the interval $[0.2, 0.3]$.

C) Given the information you have, what is your best estimate for the *instantaneous rate of change* at $t = 0.2$?

IX. Investigate

$$\lim_{x\to 0} \frac{2^x - 1}{3^x - 1}$$

numerically by computing the values of $f(x) = \frac{2^x-1}{3^x-1}$ at $x = -.1, -.01, -.001, .001, .01, .1$. What's your estimate of the value of this limit?

X. Consider the function graphed in Figure 2.

A) What is $\lim_{x\to 0} f(x)$?

B) What are $\lim_{x\to 2^-} f(x)$ and $\lim_{x\to 2^+} f(x)$?

C) What does your answer to part B say about $\lim_{x\to 2} f(x)$?