

Math-13 Sections 01, 02

Exam #1

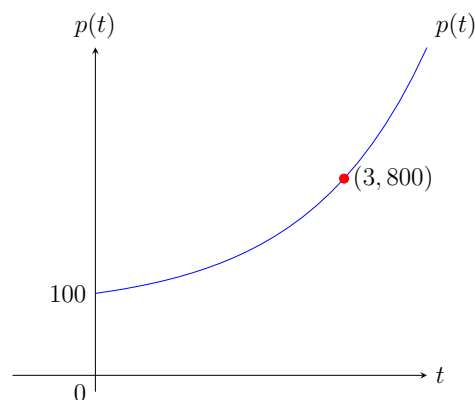
Due: 10/4/2020 at 11:59pm

This exam is open book and notes. You may use a calculator. No collaboration or other web access is allowed. All answers must be in exact form unless stated otherwise (i.e., no decimal answers allowed). You *must* show all work and that work must be logical and complete; there is *no* credit for guessed answers or answers without supporting work.

You must work the exam problems, in order, on separate sheets of paper; camscan your results into a single PDF file; and then submit your PDF file back to Moodle (just like the written homeworks). This *must* be done by the deadline; late exams, multiple page or non-PDF submissions, and exams sent by email will not be accepted.

Good luck!

1. Explain why π is an irrational number. Note: do not just say, “because it is not rational.” Be more specific.
2. In class, we discussed the fact that every function is a relation, but not every relation is a function. Explain what makes a relation a function.
3. The follow function shows the population of bacteria p in a petri dish at time t (in days):



- (a) What is the initial ($t = 0$) number of bacteria in the dish?
- (b) Describe using words the meaning of the point $(3, 800)$ on the graph.
- (c) What is the alternate functional syntax for the point $(3, 800)$?
- (d) What is $\lim_{t \rightarrow 3} p(t)$?
- (e) Is $p(t)$ continuous at $t = 3$? If not then indicate which requirement for continuity fails.

4. Determine the implicit domain for the function:

$$f(x) = \sqrt{6x^2 + 5x - 4}$$

Your work must include a real number line graph containing the critical points and an indication of the sign in each interval between the critical points. You may use test points or factor multiplicity to determine the sign changes across the critical points. Your final answer must be in interval notation.

5. Determine the smallest approximation for e^π that is with 0.000005 of the exact value. Make sure that your final answer is the *approximation* and not the error.

6. Determine the following limit:

$$\lim_{x \rightarrow 1} \frac{2x^2 - x - 1}{x^2 - 1}$$

7. Let $f(x) = \sqrt{x+1}$. Determine the following limit:

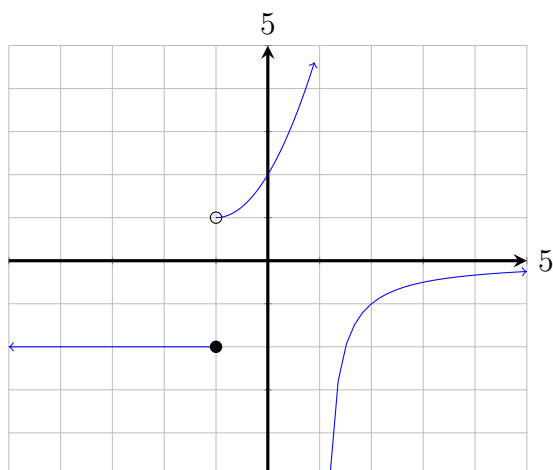
$$\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

8. Consider the following piecewise function:

$$f(x) = \begin{cases} x^2, & x < 2 \\ 3, & x = 2 \\ 2x, & x > 2 \end{cases}$$

Is $f(x)$ continuous at $x = 2$? If not, then state the specific reason why not.

9. Consider the following function:



Determine the following. If a value does not exist then write DNE.

- (a) $\lim_{x \rightarrow -\infty} f(x)$
- (b) $\lim_{x \rightarrow -1^-} f(x)$
- (c) $\lim_{x \rightarrow -1^+} f(x)$
- (d) $\lim_{x \rightarrow -1} f(x)$
- (e) $f(-1)$
- (f) $\lim_{x \rightarrow 1^-} f(x)$
- (g) $\lim_{x \rightarrow 1^+} f(x)$
- (h) $\lim_{x \rightarrow 1} f(x)$
- (i) $f(1)$
- (j) $\lim_{x \rightarrow \infty} f(x)$

10. Sketch the graph for the following function:

$$f(x) = \frac{x^2 - x - 6}{(x + 1)(x + 2)(x + 3)}$$

Your work must clearly show how you determined the critical points. Your sketch must clearly show and label any and all zeros, vertical asymptotes, horizontal asymptotes, and holes.