Math 121: Exam 1 Review Sheet

Exam Information

Exam 1 will be given on Friday, February 1 from 8-8:50 am. The exam will cover chapters 1.1-1.3, 1.5, 1.6, 2.1, and 2.2.

The exam is closed book, closed notes, and without calculator. It will be composed of multiple choice and free response questions.

All sections will be in the Main Auditorium

Exam Taking Tips & Advice

- Know where your exam location is. Visit the room a day or two before the exam to get the lay of the land.

- Arrive early to the exam location. If you arrive late then you get less time, not more time.

- Bring a watch. Cell phones should be turned off and packed away before the exam begins.

- Bring your student ID card. The cards will be checked when you hand in your exam.

- Use a pencil instead of a pen, and bring more than one with you. Cross out or erase any work that you do not want graded.

- As soon as you receive your exam, write your name and section number on the front page. Exams without names or correct section numbers will result in a loss of 5 points.

- Quickly skim through all of the problems on the exam before doing any one problem. Then do the problems that you think are easiest first.

- Pace yourself. Know when you should stop working on a problem and move on to another one. It is not worth leaving a 10-point problem blank because you struggled for ten minutes on a 5-point problem.

- There is no partial credit for multiple choice questions. You can show as little or as much work as you want, and the work does not have to be very organized. You should try to eliminate incorrect answers and, if necessary, you can guess from the remaining choices. Never leave a multiple choice answer blank.
• For the free response questions you must show all of your work. Be sure that your work is organized and legible and that you do not skip a lot of steps. Answers (even correct ones) will not receive a lot of credit without the necessary work to back them up. Partial credit will be awarded based on how much correct work that you show.

• If you have the time, you should check your answers. (Just be sure to manage your time see #8 above). It doesn’t pay to leave 20 minutes early without checking your answers. A lot of silly mistakes can be avoided by going through your work again.

Sample Questions

The following questions are not comprehensive of the material that you are responsible for knowing. These problems are meant to offer you some practice with multiple choice questions. You should refer back through the assigned homework exercises on the main course webpage for a full list of ”Expected Skills” as well as a more comprehensive study guide.

Multiple Choice: Circle the letter of the best answer.

1. If the tangent line to \( y = f(x) \) at the point \((1, 2)\) passes through the point \((-1, -1)\), then which of the following is \( f'(1) \)?

   (a) \(-1\)
   (b) \(-\frac{2}{3}\)
   (c) \(1\)
   (d) \(\frac{3}{2}\)
   (e) \(2\)
2. Consider the graph of \( y = f(x) \) shown below.

![Graph of \( y = f(x) \)](image)

Which of the following statements is true?

(a) \( f(x) \) is continuous on \([-5, 1]\)
(b) \( f(x) \) is continuous on \((-5, 1)\)
(c) \( f(x) \) has removable discontinuities at \( x = -3 \) and \( x = 1 \)
(d) \( f(x) \) has jump discontinuities at \( x = -3 \) and \( x = 1 \)
(e) \( f(x) \) has a jump discontinuity at \( x = -3 \) and a removable discontinuity at \( x = 1 \)

3. What is \( \lim_{x \to \frac{2\pi}{6}} \sin x \)?

(a) \( \frac{1}{2} \)
(b) \( \frac{\sqrt{2}}{2} \)
(c) \( -\frac{\sqrt{2}}{2} \)
(d) \( \frac{\sqrt{3}}{2} \)
(e) \( -\frac{\sqrt{3}}{2} \)
4. What is \( \lim_{x \to +\infty} \cos x ? \)

(a) \(+\infty\)
(b) \(-\infty\)
(c) DNE
(d) 1
(e) 1 and \(-1\)

5. What is \( \lim_{x \to -\infty} \frac{\sqrt{5x^2 - 2x}}{2x + 7} \)?

(a) \(-\infty\)
(b) \(-\frac{\sqrt{5}}{2}\)
(c) 0
(d) \(\frac{\sqrt{5}}{2}\)
(e) \(\infty\)

6. Which of the following best describes the behavior of \( f(x) = \frac{x + 3}{x^2 - 9} \)

(a) \( \lim_{x \to 3^+} f(x) = +\infty \)
(b) \( \lim_{x \to 3^-} f(x) = +\infty \)
(c) \( \lim_{x \to -3} f(x) = 0 \)
(d) \( \lim_{x \to -3} f(x) = \frac{1}{6} \)
(e) \( f(x) \) is continuous at \( x = 3 \)

7. The function \( f(x) = \cos 2x - \csc 3x \) is discontinuous at:

(a) \( \frac{\pi}{6} \)
(b) \( \frac{\pi}{4} \)
(c) \( \frac{\pi}{3} \)
(d) \( \frac{\pi}{2} \)
(e) None of the above.
8. Evaluate \( \lim_{x \to -\infty} \frac{8x^3 - 3x^2 + x}{2x^2 + 6x^3 - 5x^4} \)
   
   (a) 0  
   (b) 4  
   (c) \(-\frac{8}{5}\)  
   (d) \(-\infty\)  
   (e) \(\infty\)

9. Let \( f(x) = \begin{cases} x^5 & \text{if } x \leq 5 \\ x - 1 & \text{if } x > 5 \end{cases} \) Which of the following is \( \lim_{x \to 5^+} f(x) \)
   
   (a) 0  
   (b) 3  
   (c) 4  
   (d) 5  
   (e) 3125

10. Let \( f(x) = \frac{x - 7x^2}{3x^2 - 5} \). Then \( f(x) \) has a horizontal asymptote of \( y =? \)
   
   (a) \(-\frac{7}{3}\)  
   (b) \(-\frac{1}{5}\)  
   (c) \(\frac{1}{3}\)  
   (d) \(\frac{7}{5}\)

11. Evaluate \( \lim_{x \to 0} \frac{\tan^2 x}{x^2} \)
   
   (a) \(-1\)  
   (b) 0  
   (c) 1  
   (d) \(+\infty\)  
   (e) \(-\infty\)
12. Evaluate \( \lim_{x \to +\infty} \frac{4x^3 + x^2}{-8x^7 + 3x^3 - 1} \)

(a) \( \frac{4}{3} \)
(b) \( \frac{1}{2} \)
(c) \( \frac{3}{7} \)
(d) 0
(e) +\( \infty \)

13. Which of the following has a vertical asymptote at \( x = 1 \) and a horizontal asymptote at \( y = 6 \)?

(a) \( \frac{x + 2}{1 - x} \)
(b) \( \arctan(x) - \frac{\pi}{2} + 6 \)
(c) \( \frac{\ln(6x)}{x} \)
(d) \( \frac{6x^2 + 9}{x^2 - 1} \)
(e) \( e^{x-1} + 6 \)

14. Where is \( f(x) = \frac{\sqrt{x - 2}}{x^2 - x} \) continuous?

(a) \( x \neq 0 \) and \( x \neq 1 \)
(b) \( x \leq 2, \ x \neq 0, \) and \( x \neq 1 \)
(c) \( x \leq 2 \)
(d) \( x \geq 2 \)
(e) \( |x| > 2 \)

Answer the following questions as True or False.

15. The Intermediate Value Theorem can be applied to show that there exists a solution to \( \frac{\cos x}{x} = 0 \) in \( \left[ -\frac{\pi}{4}, \frac{\pi}{4} \right] \)

16. \( \lim_{x \to 4} \frac{x^2 + 2x}{x^2 - 2x - 8} = +\infty \)
17. The equation $3x^3 - 2x^2 + 4x - 3 = 0$ has a solution on the interval $(0, 1)$.

18. If $f(x)$ is not defined at $x = c$, then $\lim_{x \to c} f(x)$ DNE.

19. The value of $k$ which makes $f(x) = \begin{cases} \frac{\sin x}{x} & \text{if } x < 0 \\ \cos x + k & \text{if } x \geq 0 \end{cases}$ is 0.

20. $f(x)$ is continuous at $x = a$ if $\lim_{x \to a^-} f(x) = f(a)$

21. $x = -3$ is not a vertical asymptote of $f(x) = \frac{x^2 + x - 6}{x^2 + 2x - 3}$

22. The instantaneous rate of change of $f(x) = x^2 + 4$ at $x = 1$ is 2.

23. $\lim_{x \to 0} \frac{|x|}{x} = 1$

24. $\lim_{x \to 0} \frac{\sin \left( \frac{1}{x} \right)}{\frac{1}{x}} = 1$

25. $\lim_{x \to +\infty} \frac{\sin \left( \frac{1}{x} \right)}{\frac{1}{x}} = 1$

26. If a function is continuous at $x = a$, then it must be differentiable at $x = a$.

27. A function can have at most two horizontal asymptotes.

28. If $\lim_{x \to a^-} f(x) = L$, then $\lim_{x \to a} f(x) = L$. 