Note: You can use a calculator for these problems. Some may be a bit more involved than problems you would see on an in-class test, but they are good practice none-the-less.

1. Evaluate the limit: \( \lim_{x \to \infty} \frac{x^2 + 2x + 1}{3x^2 + x + 2} \) if it exists. \( \frac{1}{3} \)

2. Find the value of the limit: \( \lim_{x \to -\infty} (\sqrt{x^2 + x} - x) \). \( \frac{1}{2} \)

3. Estimate the area under the graph of \( f(x) = 16 - x^2 \) from \( x = 0 \) to \( x = 4 \) using 4 rectangles and right end points. \( 3 \frac{4}{5} \)

4. If \( \int_0^3 f(x)dx = 12 \) and \( \int_0^6 f(x)dx = 42 \), find the value of \( \int_0^5 (2f(x) - 3)dx \). \( 5 \frac{1}{6} \)

5. Evaluate \( \int_{-1}^1 x^{1/3}dx \). \( \frac{45}{4} \)

7. Consider the function \( f(x) = x^2 \) on the interval \([0, 1/2]\). According to the Mean Value Theorem there must be a number \( c \) in \((0, 1/2)\) such that \( f'(c) \) is equal to a particular value \( d \). What is \( d \)? \( \frac{1}{2} \)

8. On what interval is the graph of \( f(x) = x^3 - x \) concave downward? \( x < 0 \)

9. Find the difference between the local maximum and the local minimum values of the function \( x^3 - 3x + 27 \). \( 4 \)

10. Find all critical points for \( x^3 - 9x + 1 \) on \((-\infty, \infty)\). Is the function a max or min at these points? \( x = \pm \sqrt{3} \) min \( x = \sqrt{3} \) max

11. On what interval is \( f(x) = \frac{x^2}{x^2 + 1} \) increasing? \((-1, 1)\)

12. Find the y coordinate of the point of inflection of the function \( x^3 - x^2 \). \( -2/7 \)

13. Use Newton’s method to approximate a solution to \( x^3 + 2x = 3.1 \) to two decimal places. \( \text{2 roots: } x = 1.02, x = -3.02 \)

14. A drinking cup is made in the shape of a right circular cylinder. For a fixed volume, we wish to make the total material used as small as possible. Under this condition, what is the ratio of the height to the diameter? \( \frac{1}{2} \)

15. The velocity of a particle moving along a line is \( t^3 - t \) meters per second. Find the distance traveled in meters during the time interval \( 0 \leq t \leq 2 \). \( 5 \frac{1}{2} \)

16. Find the most general antiderivative to \( \sec^2 \theta + \cos \theta \). \( \tan \theta + \sin \theta + C \)

17. Evaluate \( \int \cos(\pi x)dx \). \( -\frac{1}{\pi} \sin \pi \frac{x}{2} \)

18. Evaluate \( \int_{-2}^1 |2x + 1|dx \). \( 4 \frac{1}{2} \)