MAC2241 Spring 2017
Suggested problems for final exam.
The final exam is **cumulative**.
You should **also** practice the
suggested problems for Tests 1 through 3.

Idris Mercer

April 12, 2017

1. Find the linearization of the function $f(x) = \ln x$ at $a = 1$.

2. Find the linearization of the function $f(x) = x^{3/4}$ at $a = 16$.

3. Find the linearization of the function $f(x) = \sqrt{1-x}$ at $a = 0$ and use it to approximate the numbers $\sqrt{0.9}$ and $\sqrt{0.99}$.

4. Find the linearization of the function $f(x) = (1+x)^{1/3}$ at $a = 0$ and use it to approximate the numbers $0.95^{1/3}$ and $1.1^{1/3}$.

5. Use a linear approximation to estimate the number 2.001^5.

6. Find the critical numbers of the function.

$$f(x) = 4 + \frac{1}{3}x - \frac{1}{2}x^2$$

7. Find the critical numbers of the function.

$$f(x) = x^{3/4} - 2x^{1/4}$$

8. Find the absolute maximum and absolute minimum of the function $f(x) = 12 + 4x - x^2$ on the interval $[0, 5]$.

9. Find the absolute maximum and absolute minimum of the function $f(x) = (x^2 - 1)^3$ on the interval $[-1, 2]$.

10. Find the absolute maximum and absolute minimum of the function $f(x) = \frac{x^2-4}{x^2+4}$ on the interval $[-4, 4]$.

11. Find the absolute maximum and absolute minimum of the function $f(x) = \ln(x^2 + 2x + 2)$ on the interval $[-2, 0]$.

12. Find the intervals on which f is increasing, decreasing, concave up, and concave down.

$$f(x) = 2x^3 + 3x^2 - 36x$$

13. Find the intervals on which f is increasing, decreasing, concave up, and concave down.

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

14. Find the maximum value of the function $f(x) = x + \sqrt{1-x}$ on its domain.

15. Find the intervals where $f(x)$ is increasing, decreasing, concave up, and concave down.

$$f(x) = 2 + 2x^2 - x^4$$

16. Find the intervals where $f(x)$ is increasing, decreasing, concave up, and concave down.

$$f(x) = (x+1)^5 - 5x - 2$$

17. Find the intervals where $f(x)$ is increasing and decreasing.

$$f(x) = x\sqrt{x+3}$$

18. Find the intervals where $f(x)$ is increasing, decreasing, concave up, and concave down.

$$f(x) = \ln(x^4 + 27)$$

19. Find the limit.

$$\lim_{x \to \pi/2^+} \frac{\cos x}{1 - \sin x}$$

20. Find the limit.

$$\lim_{x \to 0} \frac{\sin 4x}{\tan 5x}$$

21. Find the limit.

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

22. Find the limit.

$$\lim_{x \to \infty} \frac{\ln x}{\sqrt{x}}$$

23. Find the limit.

$$\lim_{x \to \infty} \frac{(\ln x)^2}{x}$$

24. Find the limit.

$$\lim_{x \to 0} \frac{5^x - 3^x}{x}$$

25. Find the limit.

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

26. Find two positive numbers whose product is 100 and whose sum is a minimum.

27. The sum of two positive numbers is 16. What is the smallest possible value of the sum of their squares?

28. Find the dimensions of a rectangle with perimeter 100 m whose area is as large as possible.

29. If 1200 cm^2 is available to make a box with a square base and an open top, find the largest possible volume of the box.

30. A box with a square base and an open top must have a volume of 32,000 cm^3. Find the dimensions of the box that minimize the amount of material used.

31. Find the antiderivative of the function.

$$f(x) = x^2 - 3$$

32. Find the antiderivative of the function.

$$f(x) = x^{-2}$$

33. Find the antiderivative of the function.

$$f(x) = x^4 - \frac{3}{4}x^2 + \frac{2}{3}x - 1$$

34. Find the antiderivative of the function.

$$f(x) = x^{4/5}$$

35. Find the antiderivative of the function.

$$f(x) = 2x - e^x$$

36. Find the antiderivative of the function.

$$f(x) = (1 + 2x)^2$$

37. Find the antiderivative of the function.

$$f(x) = \frac{x+1}{\sqrt{x}}$$

38. Find the antiderivative of the function.

$$f(x) = \frac{1}{2x}$$