Practice Exam 2 — Math 10240

This questions should give an idea of how the exam will be. The actual exam will have fewer questions—probably around 16. Like last time there will be 12 multiple choice and 4 short answer questions.

1. If u and v are chosen so that $b^u = 6$ and $b^v = \frac{3}{2}$, what are b^{u-v}, b^{v-u}, $b^{u/2}$, b^{-v}?

2. Graph the functions 2^{-x}, $3^{x/2}$.

3. What is $\lim_{x \to \infty} 2^x$ and $\lim_{x \to -\infty} 2^x$? How about $\lim_{x \to \infty} 1.001^x$? What is $\lim_{x \to 0} 0.95642^x$? Is it true that $\lim_{x \to 1} b^x = b$ for all b?

4. Suppose I lost a bet and had give you one penny today, twice that tomorrow, twice that the next day, and so on for the entire month of August (31 days long). How much will I give you on the 31th day? Was this a good bet?

5. What is the definition of e as a limit?

6. What is $\lim_{x \to \infty} (1 + \frac{r}{x})^x$?

7. What is $\lim_{x \to \infty} (\frac{x+1}{x})^x$?

8. How long will it take for \$5,000 to become \$1,000,000 if it is saved in an account paying 8% compounded continuously?

9. If 10% of the ants in my ant farm die each month, how long will it take for the population to be half what I started with? (Assume no new ants are born).

10. If my calculator only had buttons for the digits 0–9 and $+$, $-$, , $\div$, e^x and $\ln x$ how would I calculate $\sqrt[89]{20.07}$?

11. Solve for x: $7^{2x} = 49$.

12. Solve for x: $\ln(\ln x) = -1$.

13. What is the domain of $\log_\pi x$?

14. Write an expression using only natural logs that is equal to $\log_\pi 2007$.

15. Is e^x negative for any value of x?

16. Is $(\frac{1}{e})^x$ negative for any value of x?

17. Evaluate $\log_{1/e} e$.

18. Simplify $\log_7 14 - \frac{1}{2} \log_7 4$.

19. Simplify $\log_3 6 + \log_3 12 - \log_3 8$.

20. Simplify $\log_{12} 20 - \log_{12} 240$

21. Simplify $\ln(e^{\log_9 3^x})$.

22. Iodine-131 is a radioactive substance. After 2.6 days 20% of an initial amount will disappear (via radioactive-decay). How long does it take for 50% to disappear? (This amount of time is called the *half-life*).

23. What is the equation for the tangent line of $f(x) = -2x^2 + x - 7$ when $x = 0$?

24. What is $\lim_{x \to 0} \frac{(x+9)^{17} - 9^{17}}{x}$? What is $\lim_{x \to 0} \frac{(x+9)^{17} - 9^{17}}{2x}$?

25. Let $f(x) = e^x$. What is the slope of the secant line connecting the points $(-1, f(-1))$ and $(1, f(1))$?

26. Give the equation of the tangent line to $f(x) = x \ln x$ at $x = \frac{1}{e}$. Give the equation of the tangent line to f at $x = e$.

27. Why is the derivative of a constant function zero?

28. Given a function f, explain what $f'(a)$ for some a means in your own words.

29. Suppose $f'(x) = x^7 + e^x$. What is the derivative of $5f(x)$?

30. Suppose $f'(x) = \frac{1}{2x+5}$. What is the derivative of $g(x) = (x^7 - 1)f(x)$? What is the derivative of $f(x^2)$? What is the derivative of $f(\ln x)$?

31. What is $\lim_{x \to 2} \sqrt{\frac{x^2 - 4}{x - 2}}$?

32. Evaluate $\lim_{x \to 0} \frac{e^x - 1}{x}$?

33. What is the derivative of x^{51}?

34. What is the derivative of $\sqrt{x}$?

35. What is the derivative of $\sqrt[3]{x}$?

36. What is the derivative of $f(x) = \frac{1}{x^{4/5}}$?

37. What is the derivative of $f(x) = x^{2007} - 56x^{1001} + 7$?

38. What is the derivative of $\frac{\ln x}{x}$?

39. What is the derivative of $e^{x^2 - x}$?

40. What is the derivative of e^x?

41. What is the derivative of $\ln \sqrt{x}$

42. What is the derivative of xe^x?

43. What is the derivative of $\ln(2x + 1)$?

44. If a car's position is given by $s(t) = 23 + 7t + 15t^2 - t^3$ did the car ever brake? (i.e. is the acceleration ever negative?)

45. A ball is thrown straight up and its height above the ground is given by the function $h(t) = -16t^2 + 20t + 5$. What is its velocity at $t = 1$? At what time is the velocity 0? What does it mean if the velocity is negative?

46. What is the slope of the tangent line to $g(t) = e^{t^2}$ at $t = 1$.

47. Given that $\sqrt{1600} = 40$ how would you estimate $\sqrt{1700}$?

48. Give an example of a function which is continuous but not differentiable at some point x.

49. Is the function $f(x) = \frac{x-3}{x-3}$ differentiable at $x = 3$?