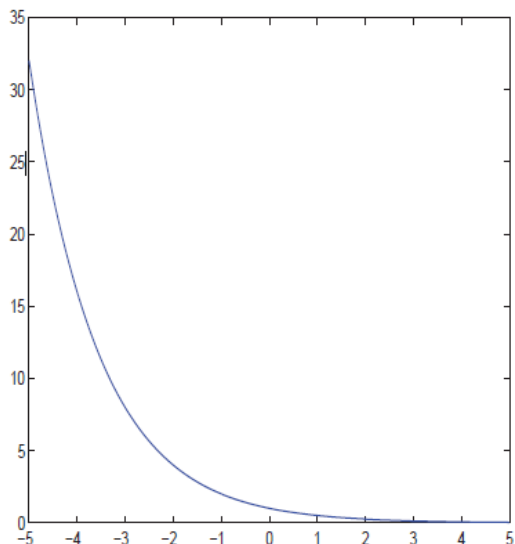


Math 147 Practice Problems for Exam I

Exam 1 will cover sections 1.1, 1.2, 1.3, 3.1, 3.2, 3.3, 3.4, 3.5, and 4.1. Graphing calculators and calculators with built-in functions are not allowed to be used on this exam. The first ten problems on the exam will be multiple choice. Work will not be checked on these problems, so you will need to take care in marking your solutions. For the remaining workout problems mathematically unjustified answers will not receive credit.

1. Which of the following functions corresponds with the graph in Figure 1 below?



- A. $y = \log_2 x$
 B. $y = \log_{1/2} x$
 C. $y = 2^x$
 D. $y = \left(\frac{1}{2}\right)^x$

2. Graph the equation $y = 2\sin\left(\frac{x}{4}\right) + 1$.

3. Find the period and amplitude of the function $y = 2\cos\left(\frac{x}{3}\right) + 2$.

4. Simplify the following expressions:

a) $\log_3 81^{5x+1} + \log_{1/7} 49^x$ b) $e^{3\ln(4x)} + 4\log_6 6^x$

5. After 5 days, a particular radioactive substance decays to 37% of its original amount. Find the half-life of this substance.

6. Polonium 210 (Po^{210}) has a half-life of 140 days. If a sample of Po^{210} has a mass of 400 micrograms, find a formula for the mass after t days. How long would it take a sample to decay to 58% of its original amount?

7. Use a logarithmic transformation to find a linear relationship between (appropriate transformations of) x and y if

a) $y = 2(7)^{4x}$ b) $y = 8x^{2/7}$

8. Find the following limits:

a) $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$

b) $\lim_{x \rightarrow 3^+} \frac{x}{x^2 - 2x - 3}$

c) $\lim_{x \rightarrow 0} \frac{2\sin(3x)}{7x}$

d) $\lim_{x \rightarrow 0} \frac{1 - \cos(2x^2)}{x^2}$

e) $\lim_{x \rightarrow 0} \frac{\sin(x) + 1 - \cos(2x)}{3x}$

f) $\lim_{x \rightarrow 8} \frac{\sqrt{x+1} - \sqrt{2x-7}}{x-8}$

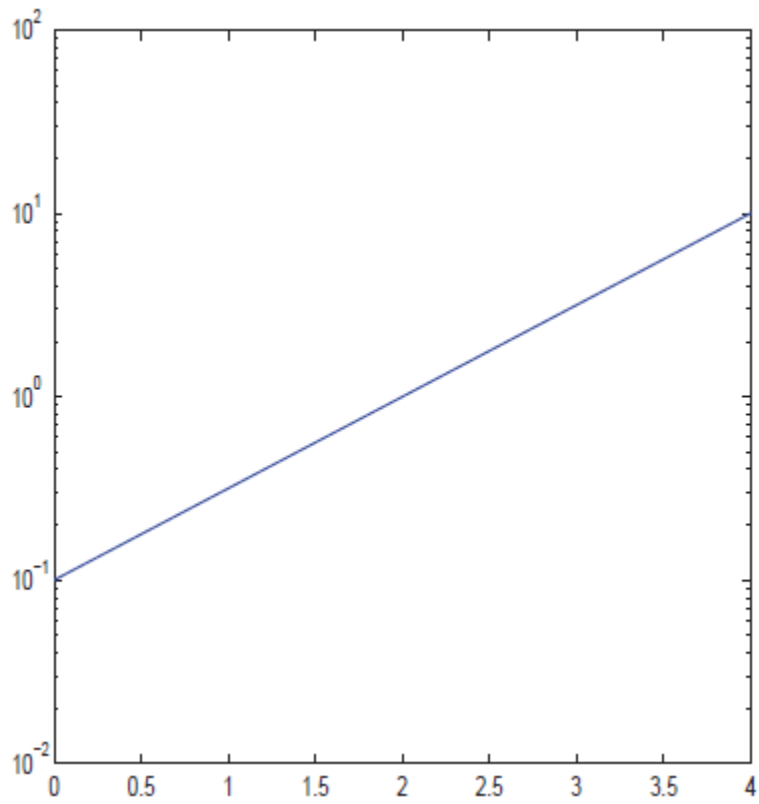
g) $\lim_{x \rightarrow \infty} \frac{x^2 - 4x^3}{3x^2 - 2}$

h) $\lim_{x \rightarrow \infty} \frac{7x^3 + 2x^2 - 4}{-x - 2}$

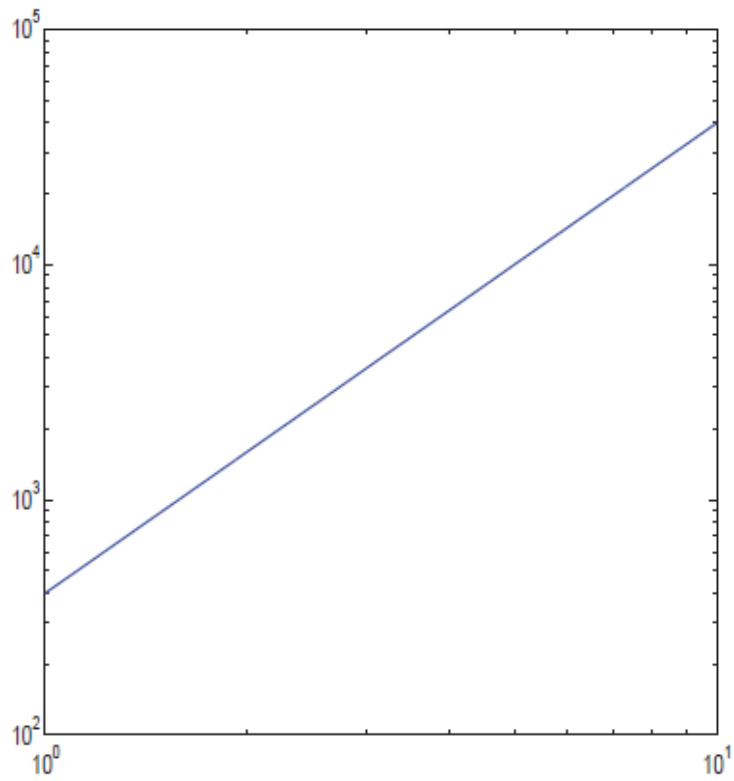
i) $\lim_{x \rightarrow \infty} \frac{x^2 - 7}{x^2 - 2x^3}$

9. Use the squeeze theorem to find $\lim_{x \rightarrow \infty} (e^{-x} \sin x)$.

10. Given the semilog plot below, find a functional relationship between x and y .



11. Given the double-log plot below, find a functional relationship between x and y .



12. Find $\lim_{x \rightarrow 3} f(x)$. Determine all values of x for which $f(x)$ is discontinuous, if any.

$$f(x) = \begin{cases} \frac{x^2 - 9}{6(x - 3)} & x > 3 \\ 1 & x = 3 \\ \frac{\sqrt{x + 6} - 3}{x - 3} & x < 3 \end{cases}$$

13. Find the value of c (if any) that makes the given function continuous at all points.

$$f(x) = \begin{cases} x^2 + 1 & x \leq 1 \\ x - c & x > 1 \end{cases}$$

14. Use the bisection method to approximate a solution to $x^4 + x^3 + x - 1 = 0$ with a maximum error less than $1/3$.

15. Use the bisection method to find a solution of $\cos(x) = x$ that is accurate to two decimal places.

16. (a) Use the bisection method to find a solution of $3x^3 - 4x^2 - x + 2 = 0$ that is accurate to two decimal places.

(b) Graph the function $f(x) = 3x^3 - 4x^2 - x + 2$

(c) Which solution did you locate in (a)? Is it possible in this case to find the other solution by using the bisection method together with the intermediate-value theorem?

17. Find the equation of the tangent line to the curve $f(x) = \sqrt{x}$ at the point $(4, 2)$.

18. Find the equation of the normal line to the curve $f(x) = \frac{4}{x-1}$ at $x = -1$.

19. Find all points where the functions below are not differentiable.

a) $f(x) = 2|x - 3| + 1$

b) $f(x) = \begin{cases} x^2 + 1 & x \leq 0 \\ e^{-x} & x > 0 \end{cases}$

c) $f(x) = \begin{cases} |x + 1| & x \leq 1 \\ 2 & 1 < x < 3 \\ \frac{1}{x - 4} & x \geq 3 \end{cases}$