MATH 143 — FINAL EXAM

Monday, May 13, 2002

3:00 - 5:00 pm

Name: ______________________________

Section: ______________________________

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Instructions:

1. No notes or formula sheets are allowed. A calculator will be necessary.

2. Unless a problem can be done in a single step, enough **work must be shown** to demonstrate proper understanding. A correct but less than obvious answer with no work shown is unlikely to be worth much in terms of credit.

3. All solutions should be written on the exam itself. Any scratch paper is to be collected by the instructor for disposal.

4. An **exact answer** is an expression, such as $3\,e^2 - \sqrt{7}$, that could be computed on a calculator. All answers should be exact, unless an approximate decimal value is asked for.

5. Problems are printed on both sides of the paper. Each page is worth 30 points, giving a total of 150 points.

1. (6 pts.) What is the domain of the function $f(x) = 3\ln(2x+1)$?

2. (6 pts.) What is the range of the function $f(x) = 2.1\,(x+3.4)^2 - 5.6$?

3. (8 pts.) Let $f(x) = 2x^2 - 3x$. Compute $\dfrac{f(x+h)-f(x)}{h}$. Simplify your answer.

4. (10 pts.) The graph of a function $y = f(x)$ is given below. Use information in the graph to answer parts a through g. Give exact answers where possible, approximations when necessary.

   a. Domain $(f) =$

   b. Range $(f) =$

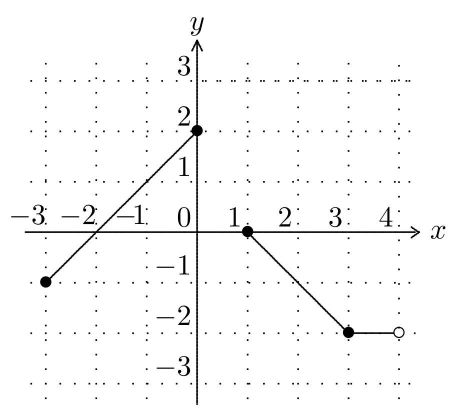
   c. $f(0) =$

   d. $f(f(2)) =$

   e. Where is $f(x)$ positive?

   f. Where is $f(x)$ increasing?

   g. Solve $f(x) = 0$.



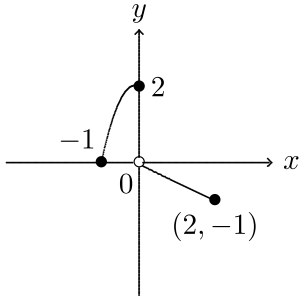
5. (8 pts.) Solve the inequality $\dfrac{x\,(x-2)}{(3\,x+1)} \geq 0$.

6. (8 pts.) Find a linear function f such that $f(2) = 3$ and such that the graph of f is parallel to the line $2\,x + 3\,y = 5$.

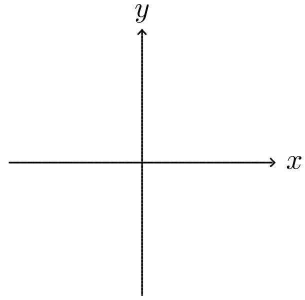
7. (6 pts.) What point on the graph of $y = 5 + f(3-x)$ corresponds to a point (a, b) on the graph of f?

8. (8 pts.) The graph of a function f is given below as part a. Use it to draw the graphs in parts b and c. Indicate clearly the locations of the three points corresponding to the points marked with • in the original graph.

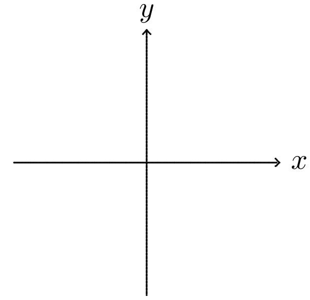
a. $y = f(x)$



b. $y = f(-x) - 1$



c. $y = -f(2+x)$



9. (8 pts.) For each of the following functions, describe the behavior of the function as $x \to +\infty$ and as $x \to -\infty$ by one of the following: (i) $f(x) \to +\infty$ (ii) $f(x) \to -\infty$ (iii) $f(x) \to L$ where L is a particular real number. Indicate which by entering the actual value of L or by entering $+\infty$ or $-\infty$ in the corresponding cell of the table.

   a. $f(x) = 7x^3 - 3x^5 + 2x^2$

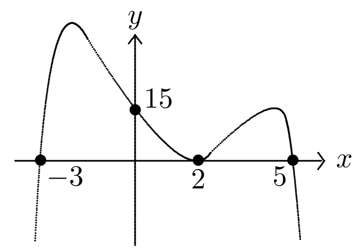
   b. $f(x) = \dfrac{2x^3}{1-x}$

   c. $f(x) = \dfrac{3x+1}{x^2-x}$

   d. $f(x) = 2e^{-x} + 3$

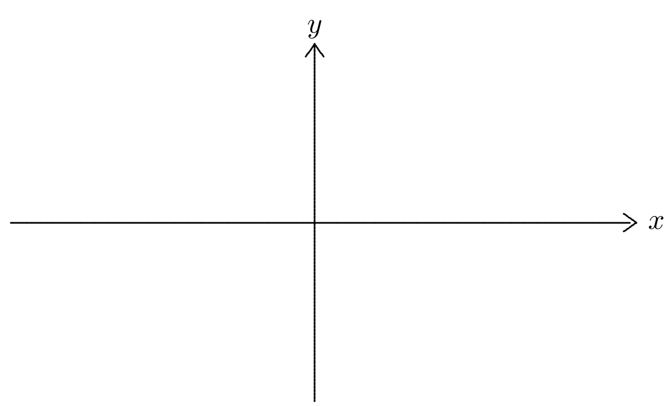
	$x \to -\infty$	$x \to +\infty$
a.		
b.		
c.		
d.		

10. (6 pts.) Give a possible formula for a polynomial with the following graph:



11. (8 pts.) Determine all asymptotes (vertical, horizontal, or slant) to $y = \dfrac{2x^3 - x - 1}{x^2 + 3x}$.

12. (8 pts.) Sketch the graph of $y = \dfrac{(5x - 3x^2)}{(2x+1)^2}$. Be sure to show and label all intercepts and asymptotes.



13. (8 pts.) Solve the equation $\ln(3 - x) = 1 + \ln(2\,x)$ exactly.

14. (6 pts.) Give a formula for the inverse of the function $f(x) = 3 + e^{-2\,x}$.

15. (8 pts.) Solve the equation $2^{1-x} = 5 \cdot 3^{2\,x}$ exactly.

16. (8 pts.) Suppose that \$3500 is deposited in a savings account earning four and three-quarters percent annual interest, compounded monthly. Assuming no additional deposits, how long will it take before the account is worth \$5000? Express your answer in terms of years and months.

17. (10 pts.) It is found that $5\,\mu g$ of a $184\,\mu g$ sample of some radioactive material have decayed after 3 years. What is the half-life of the material? (Compute to three decimal digits.)

18. (10 pts.) One root of the equation $7\,x^3 - 25\,x^2 + 23\,x + 15 = 0$ is $2 + i$. Determine the remaining roots.

19. (10 pts.) A swimmer is at a point A that is 2 miles out from the closest point B on the shore. The shore is assumed to be a straight line. He wants to go to a point C that is 5 miles down the shore from B. He can swim at 2 miles-per-hour and can jog at 6 miles-per-hour. Compute the time required for him to go from A to C as a function of the distance between B and P, where P is the point between B and C where he first reaches the shore.