

**MAT 111 Common Final**  
**Fall 2007**

Name: \_\_\_\_\_

**General test instructions: Show all your work on this test paper!** If you solve a problem algebraically, show all your steps. If you solve a problem by graphing on your calculator, show a sketch of the graph, with the solution labeled. Where appropriate, round answers to 3 decimal places.

1. Give all real and complex solutions of  $x^2 + 4x + 9 = 0$ . Simplify your answer completely.

3. Solve this system of equations:

$$\begin{cases} 4x + 3y = 6 \\ 3x - 2y = 13 \end{cases}$$

2. Solve  $\sqrt{2x+1} - x = -1$ .

4. Solve this system of equations, finding all points of intersection.

$$\begin{cases} x^2 + 2y = 19 \\ 2x - y = 13 \end{cases}$$

5. Solve the following inequality and express your answer in interval notation.

$$\frac{x + 3}{2x - 5} \geq 2$$

8. Solve the following equation for  $x$ .

$$\log_7(x) + \log_7(x - 6) = 1$$

9. The number  $N$  of bacteria in a certain culture at time  $t$  (in hours) obeys the law of uninhibited growth  $N(t) = 400e^{0.025t}$ .

(a) What is the population after 5 hours?

6. Write the following as a single logarithm.

$$4 \log(x) + \frac{1}{3} \log(x - 2) - 2 \log(x + 1)$$

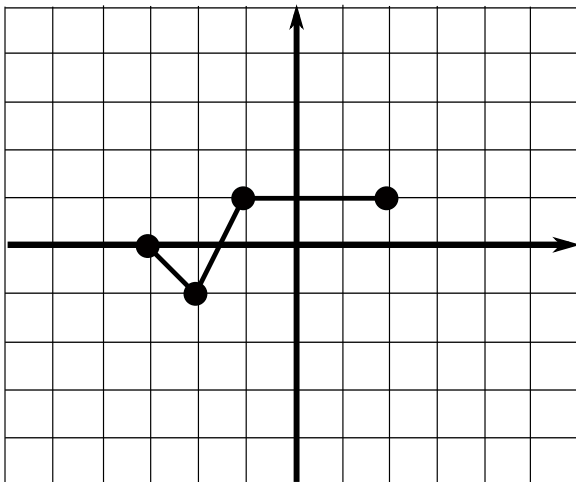
(b) When will the number of bacteria double?

10. A 20 lb bag of Economy brand cement contains 25% cement and 75% sand. How much pure cement must be added to produce a cement mix that is 60% cement?

7. Solve the following equation for  $x$ .

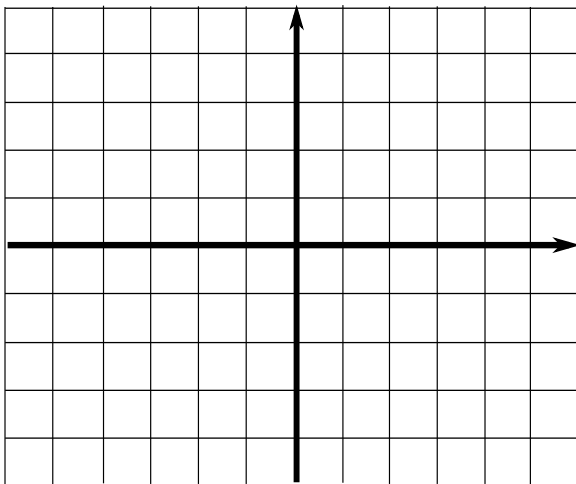
$$e^{(5x-1)} + 3 = 4$$

11. The function  $f(x)$  is graphed below.

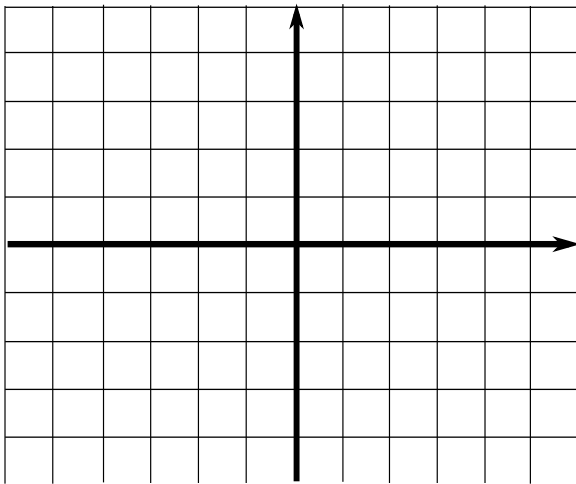


Graph the following transformations of  $f(x)$ :

(a)  $f(x - 1) + 3$

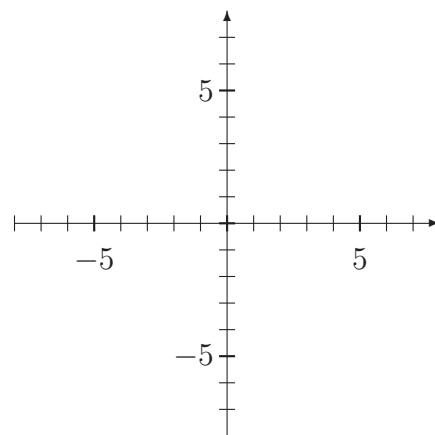


(b)  $-2f(x)$



12. Let  $f(x) = \frac{2x+7}{9+4x}$ . Find  $f^{-1}(x)$ .

13. (a) Graph  $f(x) = x^3 - 3x^2 + 2x + 1$ . Clearly label all intercepts.



(b)  $f$  has a relative minimum of \_\_\_\_\_

at  $x =$  \_\_\_\_\_.

(c)  $f$  has a relative maximum of \_\_\_\_\_

at  $x =$  \_\_\_\_\_.

(d) Name all intervals on which  $f$  is increasing.

14. The revenue in dollars from selling  $x$  units of a certain product is given by  $R(x) = 25x - .05x^2$ .

(a) What quantity  $x$  maximizes revenue?

(b) What is the maximum revenue?

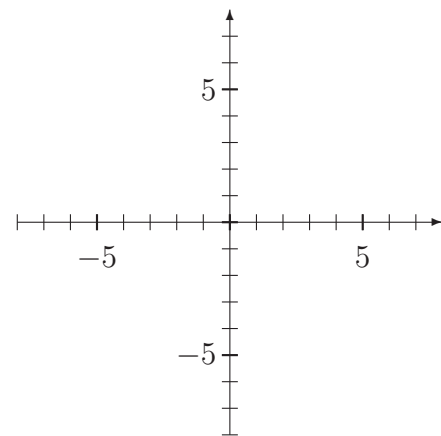
15. Divide these complex numbers, simplify, and write the answer in standard form.

$$\frac{4 + 2i}{3 - i}$$

16. Find an equation of the line passing through the point  $(1, 3)$  that is perpendicular to the line  $y = 2x + 3$ .

17. Find all the zeros and their multiplicities for the polynomial function  $f(x) = -2x^5 + 12x^4 - 18x^3$ .

18. A polynomial with degree 3 has zeros at 4, 1, -2, and its leading coefficient is negative. Sketch the graph of this polynomial.



19. Solve  $|4x - 7| - 5 > -3$ .

20. Analyze the graph of  $y = \frac{2x-1}{x+5}$ .

(a) Find the domain.

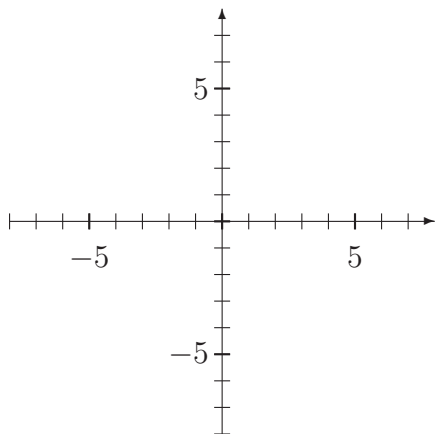
(b) Find any x-intercepts.

(c) Find any y-intercepts.

(d) Find any vertical asymptotes.

(e) Find any horizontal asymptotes.

(f) Sketch a graph of the function.



21. Let

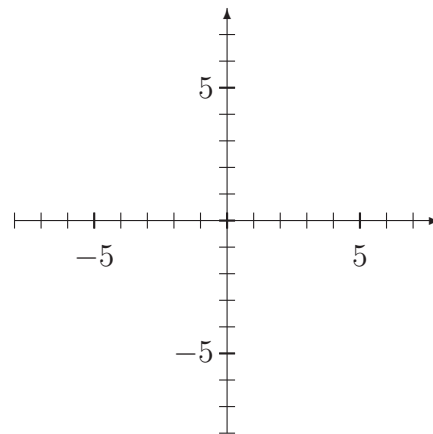
$$g(x) = \begin{cases} 3 & -5 \leq x < -2 \\ -3x + 1 & -2 \leq x \leq 0 \\ -x^2 & x > 0 \end{cases}$$

(a) Evaluate  $g(-2)$ .

(b) Evaluate  $g(-4) - 6g(3)$ .

(c) Determine the domain of  $g(x)$ .

(d) Graph  $g(x)$ .



(e) Find the range of  $g(x)$ .

22. Let  $f(x) = \frac{1}{x^2-2}$  and  $g(x) = \sqrt{x-3}$ .  
(a) Find  $(f \circ g)(x)$ .

(b) Find the domain of  $(f \circ g)(x)$ .

23. Susan is planning to retire in 20 years. She calculates that she will need \$100,000 in addition to the money she will get from her retirement plans. How much should she invest today at 10% compounded weekly to accomplish her objective?

24. Solve  $5 \cdot 3^x = 50$ . Provide both an exact answer and a decimal approximation.

25. Solve  $x + 5\sqrt{x} - 14 = 0$ .

26. The United States gross national product for the years 1998-2002, in trillions of dollars, is given in the table below, with year 1 corresponding to 1998.

Year	1	2	3	4	5
Amount in Account	8.78	9.30	9.85	10.10	10.44

(a) Use your graphing calculator to fit a linear model to the data. Write the equation and correlation coefficient here.

(b) Use your graphing calculator to fit an exponential model to the data. Write the equation and correlation coefficient here.

(c) Which equation is a better model of the data? Explain.