MATH 111 - Final Exam Name: _____
Spring 2004 UNCW Student I.D.# _____

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. Solve: $7x + 2x^2 - 1 = 2x - 4$

2. Solve: $\sqrt{2x-3} = 3 - x$

3. One year ago, Donna put a total of $4000 in her savings account and in a certificate of deposit (CD). Her savings account earned 6.5% interest annually and the CD paid 8%. How much did she have in each investment if her interest earnings for the year were $297.50?

4. Solve this system of equations.
$$5x - 2y = 6$$
$$2x + y = 15$$

5. Solve this system of equations.
$$3x^2 - 2y^2 = -5$$
$$2x^2 - y^2 = -2$$

6. Solve and give the solution in interval notation: $3 + |4 - 2x| \geq 27$

7. Evaluate the following:

   a. $\log 125 =$

   b. $3^{2\log_3(x-1)} =$

   c. $\log_7 e =$

8. Solve: $3(2^{2x+3}) = 96$

9. Solve: $\log_{18}(x) + \log_{18}(x+3) = 1$

10. Given $f(x) = 2x + 1$ and $g(x) = \dfrac{x-2}{x+3}$, find:
    a. $(f+g)(1)$
    b. $(f \circ g)(x)$

11. Graph $f(x) = x(x-1)^2(x+2)$. Determine the local maxima and minima on the interval (–3, 3). Round to three decimal places.

Local maxima: Local minima:

12. Find all the zeroes (real and complex) of the polynomial $f(x) = \left(x^2 + 16\right)\left(4x - x^3\right)$.

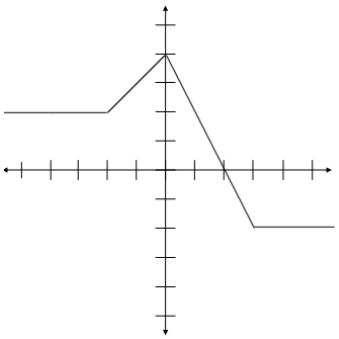
13. Simplify and write in standard form: $\dfrac{4-5i}{2+i}$.

14. Analyze the function $f(x)=\dfrac{x+1}{(x-2)(x+3)}$ and find the following.

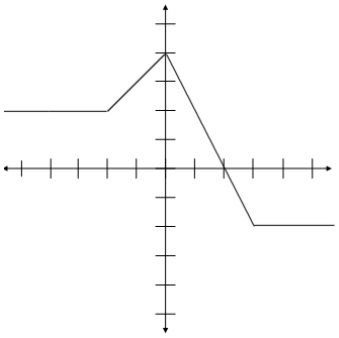
a. y-intercept
b. x-intercepts
c. vertical asymptotes
d. horizontal asymptote
e. Graph $y=f(x)$; include x- and y-intercepts and all asymptotes.

15. Shown below is the graph of $y=f(x)$.

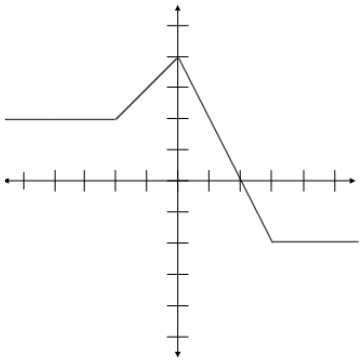
a. Sketch the graph of $y=f(x+1)$ on the same set of axes.



b. Sketch the graph of $y=-f(x)$ on the same set of axes.



c. Sketch the graph of $y=f(x)-2$ on the same set of axes.



16. Solve and give the solution in interval notation: $\dfrac{x-2}{x+2}\geq 1$.

17. Given the function $f(x)=\dfrac{x+1}{x-2}$, what is

a. the domain of f?

b. the inverse function $y=f^{-1}(x)$?

18. Find the amount of money that should be invested now (the present value) at 6% compounded continuously to produce a final balance of $85,000 in seven years.

19. Find the equation of the line that passes through the point (1, 4) and is parallel to the line $2x+5y=4$.

20. The following data from the *U. S. Census Bureau* shows the population of New Hanover County for select years from 1940($t=0$) to 1990 ($t=50$) in ten thousands.

Year (t)	Population
1940; t=0	4.8
1950; t=10	6.3
1960; t=20	7.2
1970; t=30	8.3
1980; t=40	10.3
1990; t=50	12

a. Find the line of best fit to the data. (Write the linear function in the form $y=mt+b$ for *t* in years and *y* in ten thousands.)

b. Find an exponential fit to the same data.

c. On the same axes, draw the scatter diagram, graph the best fit line and best fit exponential curve. Which of the two models fits better?

d. Using the model you chose in (c), estimate the population of New Hanover County in the year 2005.

21. The profit a company earns from selling *x* items is given by the formula $P(x)=150{,}000+750x-x^2$. Find the maximum profit the company can earn.

22. The number of sailboats on a large lake has grown according to the formula $P=44e^{kt}$ where *t* = 0 represents 1990. The number of sailboats tripled in 8 years. Find the growth rate *k*, and use the model to predict the number of sailboats in the year 2004. (Show all your work.)

23. Make a sketch of the graph of the polynomial function $f(x)=-9x(x-3)^4(x+2)^5$ that shows the zeros and the shape of the graph.

24. Graph the function $f(x)=\begin{cases} -|x|+3, & x<2 \\ 4, & x=2 \\ -1, & x>2 \end{cases}$, and find

$f(-1)=$

$f(3)=$

25. Which of the following are properties of the graph of the function $f(x)=\log_3 x$? Circle all that apply.
    a. Domain is $(0,\infty)$
    b. Decreasing function
    c. X-intercept at 1
    d. One-to-one function