MATH 111 - Final Exam **Name** _____

Fall 2004 **SSN** _____

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, sketch the graph, with solution labeled.

Where appropriate, round answers to 3 decimal places.

1. Find the equation of the line that passes through the point (3,4) and is parallel to the line $3x + 7y = 9$.

2. Solve: $x(2-x) = 3(x-4)$

3. Simplify and write in standard form: $\dfrac{3+5i}{3+i}$

4. Solve: $2+\sqrt{12-2x} = x$

5. A soft drink vending company analyzes their sales records and finds that if they sell x cans of soda, their profit (in dollars) is given by $P(x) = -0.0000004x^2 + 0.25x - 7000.$
   Find the number of cans required to make the maximum profit, and find the maximum profit.

6. Given $f(x) = \sqrt{2x+11}$ and $g(x) = x^2 + 2$, find

   a. $(f+g)(-1)$

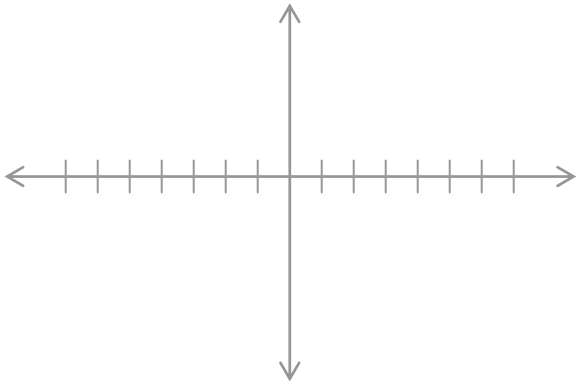
   b. $(f \circ g)(x)$

7. Solve the system of equations:
$2x + y = -9$
$3x + 2y = -7$

8. Solve the system of equations:
$3x^2 - y^2 = 9$
$x^2 + 2y^2 = 10$

9. Solve the following inequality. Give the solution in interval notation:
$|2 - 5x| - 7 \le 11$

10. Make a sketch of the graph of the polynomial function $f(x) = -6x^2(x+3)^5(x-1)^3$ that shows the zeros and the shape of the graph.



11. Find all real and complex zeros of the polynomial $f(x) = (x^2 - 36)(x^2 + 4x + 9)$.

12. Solve the inequality $\frac{3x-5}{x+2} \ge 2$.
Give the answer in interval form.

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

a. Domain

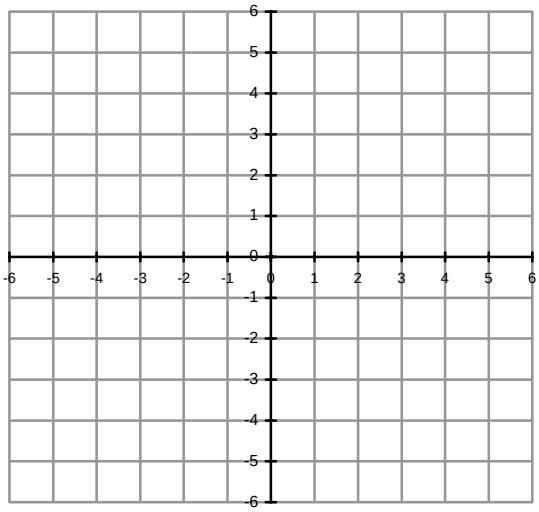
b. *y*-intercept

c. *x*-intercept(s)

d. Horizontal asymptote

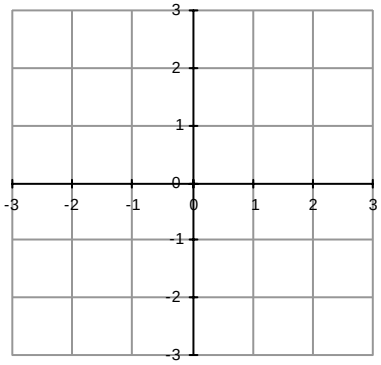
e. Vertical asymptote(s)

f. Carefully draw the graph of $f(x)$ showing all intercepts and asymptotes.



14. Given $f(x)=-x^3-2x^2+x+1$

a. Sketch f.



b. List any local maxima of f.

c. List any local minima of f.

d. List the interval(s) where f is increasing.

15. Answer the following regarding the properties of the graph of $f(x)=e^x$. (circle correct answers)

a. $f(x)$ is _____ on its domain.
increasing decreasing

b. The domain of $f(x)$ is _____.
$[0,\infty)$ $(0,\infty)$ $[-e,\infty)$ $(-\infty,\infty)$

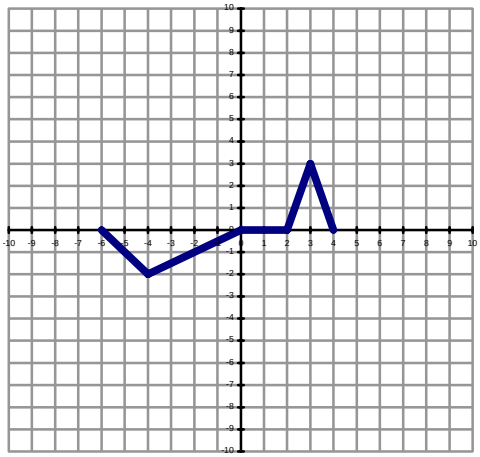
c. The range of $f(x)$ is _____.
$[0,\infty)$ $(0,\infty)$ $[-e,\infty)$ $(-\infty,\infty)$

d. $f(x)$ has a *y*-intercept at _____.
(0,0) (e,0) (0,e) (1,0) (0,1)

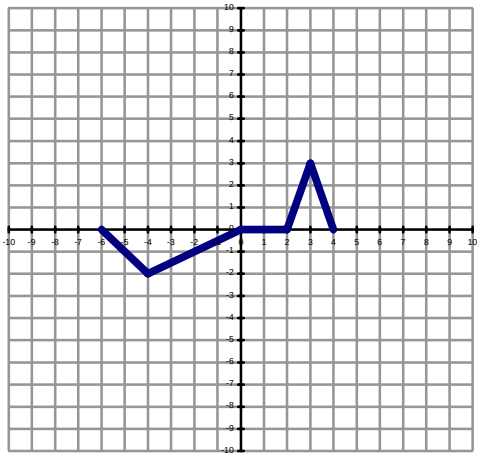
e. $f(x)$ is a one-to-one function. True/False

16. Shown below are three graphs of $y = f(x)$. For each, sketch the indicated transformation of $f(x)$, and clearly indicate shifted points.

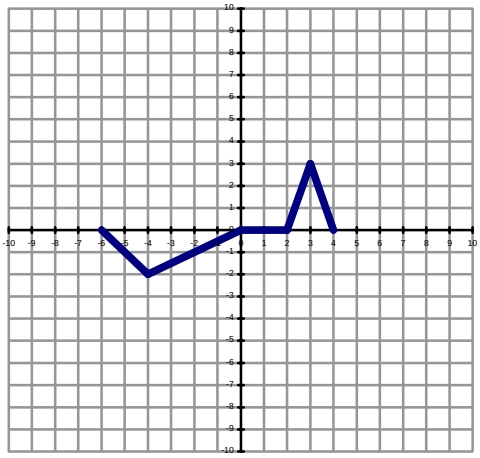
a. Sketch the graph of $y = f(x+4)$:



b. Sketch the graph of $y = f(-x)$:



c. Sketch the graph of $y = -3f(x)$:



17. A chemistry experiment calls for a 30% sulfuric acid solution. If the lab supply room has only 50% and 20% sulfuric acid solutions on hand, how much of each should be mixed to obtain 12 liters of a 30% solution?

18. Evaluate the following:

a. $\log_2 4^3$

b. $7^{3\log_7 5}$

c. $\log_{12} e$

19. Solve: $2(3^{3x+7}) = 162$

20. Let $f(x)=\dfrac{2x+1}{x-3}$. Find:

    a. $f^{-1}(x)$

    b. The domain and range of $f(x)$.

21. How much money should Mr. and Mrs. Smith place into a new account in order to have a balance of $40,000 in 18 years for their newborn grandchild's college expenses, if the account earns 5% interest, compounded continuously?

22. Solve: $\log_9(x)+\log_9(x+8)=1$

23. The half-life of radioactive cobalt is 5.27 years. The formula for radioactive decay is $A(t)=A_0e^{kt}$ where t is measured in years.

    a. Find the decay rate *k* for radioactive cobalt.

    b. If a substance contains 100 grams of radioactive cobalt, how much will be present in the substance in 20 years?

24. The population (in thousands) of locusts on some wheat field is given in the table below:

Day (t)	1	2	3	4	5	6	7	8
Population (P)	10.1	12.7	16.5	22.4	27.3	34.7	43.9	57.6

a. Find the equation of the line that best fits the data.

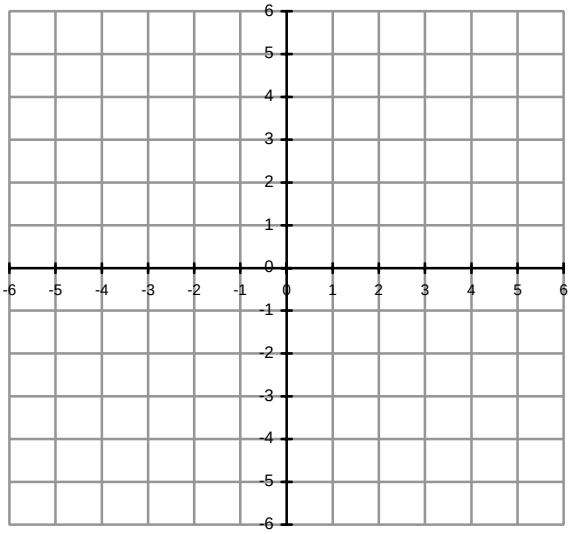
b. Find the equation of the exponential function that best fits the data.

c. On the same graph, draw a scatter diagram and the two regression curves. Decide which model fits better.

d. Using the better of the two models, project the population of locusts for $t = 12$.

25. Graph the function

$$f(x) = \begin{cases} x+3 & \text{if} \quad x \le -2 \\ |x-2| & \text{if} \quad -2 < x < 4 \\ 2 & \text{if} \quad x \ge 4 \end{cases}$$



Find $f(-2)$

Find $f(2)$