Math 111 Final Exam Form A

Section _____ Date_____ Name _____

Show all work or document calculator usage to receive full credit.

1. Determine whether the given pair of lines is parallel, perpendicular or neither. Show all work and give a reason for your answer.

$$\begin{cases} y = 4x - 5 \\ 4y = 8 - x \end{cases}$$

_____ (2pts)

2. Determine the equation of the line passing through $(-3,7)$ and $(-1,-5)$. Show all work. Express your answer in slope-intercept form.

Equation: _____ (3pts)

3. a. Find the radius of the circle that passes through the point $(3,7)$ and has its center at $(-1,4)$. Show all work.

Radius: _____ (1pt)

b. Find the equation of that circle. Express your answer in center-radius form.

Equation: _____ (2pts)

4. Solve analytically. Show all work. Express your answer in interval notation.

$2(x-4) < 3-5(2x+1)$

_____ (2pts)

5. Find the point that is symmetric to $(7,-3)$:

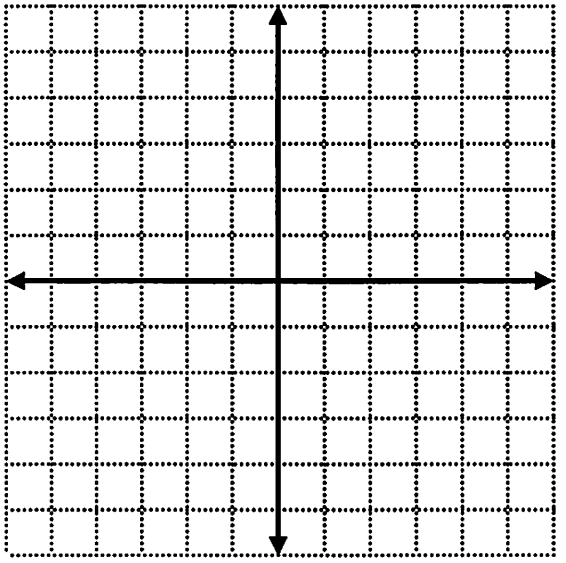
   a. With respect to the x-axis _____ (1pt)

   b. With respect to the y-axis _____ (1pt)

   c. With respect to the origin _____ (1pt)

6. Graph the piecewise function. (3pts)

$$f(x)=\begin{cases} 2x-1 & \text{for } x<0 \\ 3 & \text{for } 0\le x<4 \\ -\frac{1}{2}x & \text{for } x\ge 4 \end{cases}$$



7. Given $f(x)=3x^2-6x+4$ and $g(x)=x^2-3x-10$, find $(f-g)(x)$ and state the domain of $(f-g)(x)$ in interval notation.

$(f-g)(x)=$ _____ (2pts)

Domain of $(f-g)(x)$: _____ (1pt)

8. Given $f(x)=3x$ and $g(x)=2x^2-4x-7$, evaluate $(g\circ f)(x)$ and simplify.

_____ (2pts)

9. Determine the domain of the function. Express your answer in interval notation.

$f(x)=\sqrt{x+2}$

Domain: _____ (2pts)

10. Write an equation for a function that has the shape of $y=|x|$ that is shifted left 3 units, reflected about the x-axis, and shifted down 4 units.

_____ (3pts)

11. For the graph of $f(x)=-2x^2-24x-64$, state the coordinates of the vertex.

_____ (2pts)

12. Find the EXACT zeros of $f(x)=x^2-4x-41$ algebraically.

_____ (3pts)

13. Solve and write interval notation for the solution set: $|x+4|>5$

_____ (3pts)

14. Find the exact solution(s): $\sqrt{x+7} = x+1$

_____ (3pts)

15. Find the exact solution(s): $\frac{2}{x+5} + \frac{1}{x-5} = \frac{16}{x^2-25}$

_____ (3pts)

16. Determine the leading term, the leading coefficient, and the degree of the polynomial. Then classify the polynomial function as constant, linear, quadratic, cubic, or quartic.

$f(x) = 4x^3 - 7x^2 + \frac{2}{3}x - 6$

Leading term: _____ (1pt) Leading coefficient: _____ (1pt)

Degree of the polynomial: _____ (1pt) Classify the function: _____ (1pt)

17. a. Graph the function using the given viewing window [-10, 10, -30, 20]. Determine all relative maxima and minima of the function. Round answers to two decimal places.

$f(x) = 0.2x^3 - 0.2x^2 - 5x - 4$

Maxima: _____ (1pt)

Minima: _____ (1pt)

b. Determine the interval(s) where $f(x)$ is increasing. Write your answer in interval notation.

Increasing: _____ (1pt)

18. Data on airline revenue from add-on fees are listed in the following table. Use a graphing calculator to fit a regression line to the data, and let x=0 represent the year 2010.

Year, x	Airline Revenue from Add-On Fees (in billions), y
2010, 0	$22.6
2011, 1	$32.5
2012, 2	$36.1
2013, 3	$42.6
2014, 4	$49.9

a) Linear Regression Equation:

_____ (2pts)

b) Predict airline revenue from add-on fees in 2025.

Revenue in 2025: _____ (2pts)

19. The data in the following table shows healthcare costs in the U.S. between 1990 and 2013.

Year, x	Cost (per person), y
1990, 0	$1,947
1996, 6	$3,157
2002, 12	$4,330
2007, 17	$5,774
2013, 23	$7,114

a) Using your graphing calculator, find the R^2 value for each model. Round answers to 4 decimal places, and let x= 0 represent year 1990. (2pts)

Linear: _____

Quartic: _____

b) Based on the R^2 value, which function is the best fit? _____ (1pt)

c) Using your graphing calculator, find the leading term for each model. Round answers to 4 decimal places.

Linear: _____ (2pts)

Quartic: _____

d) Based on the end-behavior of each model, is the function you chose in part b) appropriate? Give a reason for your answer.

_____ (2pts)

20. For the polynomial function $f(x)=x^4-2x^3+34x^2-98x-735$,

a) Find the zeros; that is, solve $f(x)=0$.

_____ (4pts)

b) Factor $f(x)$ into linear factors.

_____ (1pt)

21. For the function $f(x)=\frac{2x+9}{x-3}$, find each of the following. If it doesn't exist, then answer "none."

a. Domain in interval notation. _____ (1pt)

b. Equation of the vertical asymptote: _____ (1pt)

c. Equation of the horizontal asymptote: _____ (1pt)

d. Equation of the oblique asymptote: _____ (1pt)

e. $x-$intercept(s) as ordered pairs: _____ (1pt)

f. $y-$intercept as an ordered pair: _____ (1pt)

22. Find the critical values and solve the inequality. Give the solution in interval notation.

$$\frac{x-3}{x+2}\leq 0$$

_____ (4pts)

23. Find $\log_3 18$ using the change-of-base formula and your calculator. Round to four decimal places.

_____ (2pts)

24. Solve the exponential equation algebraically. Write solution(s) in exact form.

$3^{4x+2} = 27$

_____ (3pts)

25. Solve the logarithmic equations algebraically. Write solution(s) in exact form.

$\log_3(x+5) + \log_3(x-5) = 2$

_____ (4pts)

26. Jennifer recently graduated and landed a new job earning $34,000. Even though retirement is not in her immediate future, she remembers her math teacher stressing the benefits of investing over a long period of time. Jennifer decided to invest $3,400. Assuming that she earns 5% compounded quarterly, how much money will Jennifer have in her account upon her retirement 42 years later? $B = P\left(1+\frac{r}{n}\right)^{nt}$

_____ (4pts)

27. The population of Jackson, Missouri was approximately 9,500 in 1990 and the growth rate was 2.1% per year. When will the population of Jackson be 20,500? $P(t) = P_0 e^{kt}$

_____ (4pts)

28. Solve the following nonlinear system, giving the solution(s) as ordered pair(s).

$$\begin{cases} y = x^2 + 6x + 9 \\ x + y = 3 \end{cases}$$

_____ (4pts)

29. Use two variables to solve this problem and show your work:
Kathy inherited $3,000 and invested it in two municipal bonds that pay 2% and 4% simple interest. The annual interest is $100. Find the amount invested at each rate.

Amount at 2%:_____

Amount at 4%:_____ (4pts)

30. Suppose the following matrix equation is true. Find x and y.

$$\begin{bmatrix} 5 & \frac{x}{2} \\ 2y & -8 \end{bmatrix} = \begin{bmatrix} 5 & 3 \\ -2 & -8 \end{bmatrix}$$

$x =$_____(1pt)

$y =$_____(1pt)