Prince Sultan University
Orientation Mathematics Program
MATH 001
Final Examination
Semester I, Term 081
Saturday, January 31, 2009
Time Allowed: 150 minutes

Student Name: _____

Student ID #: _____ Section #: _____

Teacher's Name: _____

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may **NOT borrow** a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be **NO talking** during the examination.
5. Your exam will be taken **immediately** if your mobile phone is seen or heard
6. Looking around or making an attempt to cheat will result in your exam being cancelled
7. Provide an organized complete solution for each Question.
8. This examination has 18 problems. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1,2	15	
3,4,5	17	
6,7,8	14	
9,10,11	14	
12,13	13	
14,15,16	12	
17,18	15	
Total	100	

Show all steps for each question

1. (9 points) Simplify the following expressions:

   i) $\left(2x^{-3}yz^{-6}\right)\left(2x^{-5}\right)$

   ii) $\sqrt[3]{24xy^3} - y\sqrt[3]{81x}$

   iii) $\dfrac{\dfrac{x}{x-2}+1}{\dfrac{3}{x^2-4}+1}$

2. (6 points) Perform the following operations:

   i) $\left(7x^2y+z\right)\left(2x^2y-3z\right)$

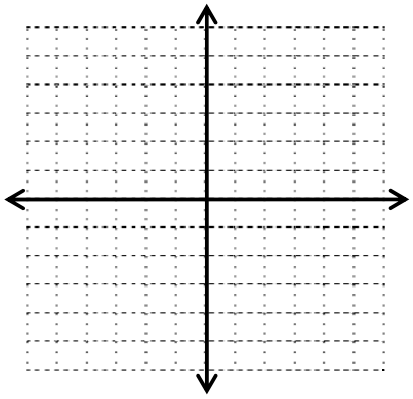
   ii) $\dfrac{x}{x^2-2x-24} - \dfrac{x}{x^2-7x+6}$

3. (8 points) Solve the following equations:

(i) $\frac{3}{x+2}+\frac{2}{x-2}=\frac{8}{(x+2)(x-2)}$

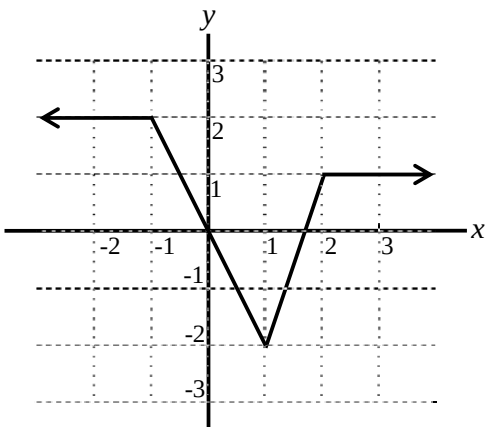
(ii) $x^2-2x+2=0$

4. (6 points) Find the coordinates of the vertex, the *x*-intercepts, and the *y*-intercept of the graph of the quadratic function $f(x)=x^2-4x+3$, then graph the function f.



5. (3 points) Find and simplify the difference quotient $\frac{f(x+h)-f(x)}{h}$, $h\neq 0$, for the function $f(x)=3x-9$.

6. (6 points) Use the graph of the function f to determine each of the following:



(a) The domain of f

(b) The range of f

(c) $f(3)$

(d) The intervals on which f is increasing

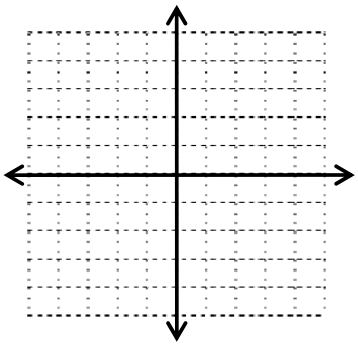
(e) The intervals on which f is decreasing

(g) The intervals on which f is constant

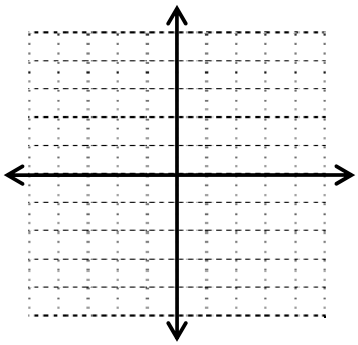
7. (5 points) Find the equation of the line passing through the point (1,-1) and perpendicular to the line whose equation is $3y - x - 15 = 0$.

8. (3 points) Given the function $f(x) = \sqrt[3]{x-5}$. Find $f^{-1}(x)$

9. (4 points) Begin by graphing the function $f(x) = \sqrt{x}$. Then use the transformations of this graph to graph the function $g(x) = -\sqrt{x+2}$. **(Note: plot on each graph at least 3 points)**



The graph of $f(x)$



The graph of $g(x)$

10. (6 points) Given the functions $f(x) = -3x + 2$ and $g(x) = 2x + 9$. Find each of the following in the simplest form:

(i) $(f - g)(x)$

(ii) $(f \cdot g)(x)$

(iii) $(f \circ g)(x)$

11. (4 points) Given the pair of points $(2,1)$ and $(6,8)$:

(i) Find the distance between these two points.

(ii) Find the midpoint of the line segment whose end points are these points.

12. (5 points) Find the center and radius of the circle whose equation is:

$x^2 + y^2 + 12x - 2y + 21 = 0$

13. (8 points) Consider the polynomial function $f(x) = x^3 - 3x^2 - 9x + 27$.

(i) Use the Leading Coefficient Test to determine the end behavior of the graph of f.

(ii) Find the zeros of f and give the multiplicity of each zero. State whether the graph crosses or touches the *x*-axis at each zero.

(iii) Determine whether f is even, odd or neither. Explain

14. (3 points) Use Intermediate Value Theorem to determine whether the polynomial function $f(x) = 2x^4 - 3x^3 + 9x + 2$ has a real zero between -2 and -1.

15. (3 points) Divide using long division: $\left(7x^2 + 37x + 36\right) \div \left(x + 4\right)$.

16. (6 points) Solve the equation $3x^3 - 31x^2 + 62x + 56 = 0$ given that 4 is a zero of $f(x) = 3x^3 - 31x^2 + 62x + 56$.

17. (6 points) Given the rational function $f(x) = \dfrac{6x}{(x-1)(x+7)}$:

(i) Find the domain of f.

(ii) Find the vertical asymptotes, if any.

(iii)Find the horizontal asymptotes, if any.

18. (9 points) Solve the following inequalities and express the solution sets in interval notation.

(i) $|2-x| \le 3$

(ii) $\dfrac{x+2}{x(x-2)} \ge 0$