Prince Sultan University
Orientation Mathematics Program
MATH 001
Final Examination
Term 101
Thursday, January 20, 2011
Time Allowed: 120 minutes (2 hours)

Student Name: _____

Student ID #: _____ Section #: _____

Instructor'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. This examination has 14 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1,2	18	
3,4	20	
5,6	16	
7,8,	16	
9,10,	12	
11,12,13,14	18	
Total	100	

1) [6 points] Factor each of the following **completely**:

i) $3x^3 - 24$

ii) $9 + 6x + x^2$

2) [12 points] Simplify each of the following:

i) $\frac{5}{x-3} - \frac{2}{x^2-9}$

ii) $3a + \left\{-4b - \left[4a - 7b - (-4a - b)\right] + 5a\right\}$

iii) $(3-5i)(-8+2i)$

iv) $\frac{\sqrt{-9}}{2i-(3-i)}$

3) [16 points] Solve the following equations:

i) $8x-(3x-5)=40$

ii) $5x^2-75=0$

iii) $(2x-1)^{4/3}-16=0$

iv) $2|x+3|-1\le 5$

4) [4 points] Graph the function $f(x)=\sqrt{x}$. Then use transformations of this graph to graph $f(x)=-\sqrt{x+1}+2$

5) [8 points] Given $f(x)=\frac{1}{1-5x}$ and $g(x)=\frac{1}{x}$,

i) find $(f\circ g)(x)$

ii) find $(g\circ f)(\frac{2}{5})$

iii) find the inverse of *f*, $f^{-1}(x)$

6) [8 points] Given the following two points: $(-4,3)$ and $(2,1)$,

i) find the **distance** between the two points

ii) find the **midpoint** of the line segment joining the two points

iii) find an equation of the line passing through the two points

7) [6 points] The following is the equation of a circle: $x^2 + y^2 + 2x - 4y - 5 = 0$,

i) complete the square and write this equation in standard form.

ii) find the centre and radius of the circle.

8) [10 points] Given the function $f(x) = 3x^2 - 2x - 1$,

i) determine whether the graph has a maximum or minimum.

ii) find the maximum or minimum value of f.

iii) determine the x and y intercepts of the graph of f.

iv) find $f(1-t)$

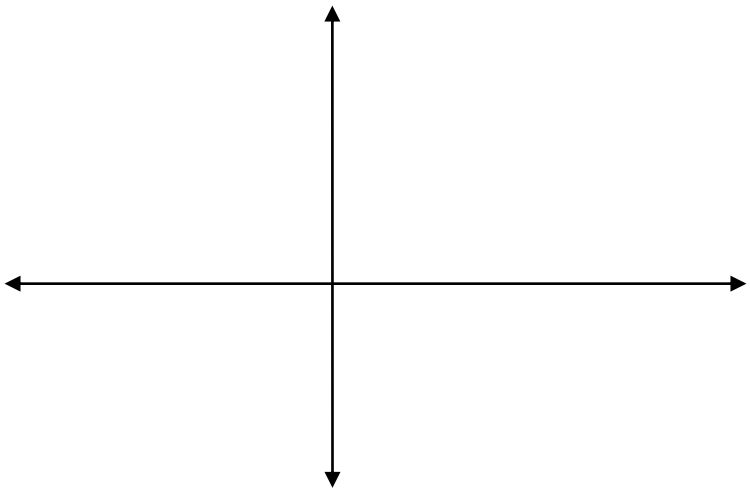
9) [8 points] Consider the polynomial function $f(x) = -2x^2(x-2)(x+4)$,

i) determine the degree of the polynomial.

ii) determine the graph's end behavior using the degree and the leading coefficient.

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

iv) sketch the graph of $f(x)$



10) [4 points] Show that the function $f(x) = x^3 - x - 1$ has a real zero between 1 and 2.

11) [4 points] Use **synthetic division** to show that 2 is a zero of the equation $x^3+5x^2-2x-24=0$. Then solve the polynomial equation for *x*.

12) [6 points] Find the third degree polynomial with real coefficients satisfying the following conditions: 2 and 2i are zeros; and $f(1)=-5$

13) [4 points] Given the rational function $f(x)=\frac{4x^2}{x^2-1}$, find:

i) the vertical asymptote(s), if any

ii) the horizontal asymptote, if any

14) [4 points] Solve $\frac{2x-1}{x+1}\le -3$ and express the solution set in interval notation.