Name:
Recitation Instructor:
Recitation Day and Time:

College Algebra – Exam 2 – March 4, 2008

Page 1 22 pts.	Page 2 28 pts.	Page 3 24 pts.	Page 4 26 pts.	TOTAL 100 pts

Directions: You will find 14 problems listed below. Please show all your work neatly and box your final answers. No notes or books are allowed. You have one hour to complete this exam.

1. (6 points) Find a value of k which will make $x = 2$ satisfy $5k + 2x = 3 - 7x$.

$5k + 2(2) = 3 - 7(2)$
$5k + 4 = 3 - 14$
$5k + 4 = -11$ → $\frac{5k}{5} = \frac{-15}{5}$
$\boxed{k = -3}$

2. (8 points) Given $f(t) = 3t^2 + 2t + 1$ and $g(x) = x + 1$, find the following and simplify completely:

(a) $f(g(x)) = f(x+1) = 3(x+1)^2 + 2(x+1) + 1$
$= 3(x^2+2x+1) + 2x + 2 + 1$
$= 3x^2 + 6x + 3 + 2x + 3$
$= \boxed{3x^2 + 8x + 6}$

(b) $f(f(1)) = f(3(1)^2 + 2(1) + 1)$
$= f(3 + 2 + 1)$
$= f(6)$
$= 3(6)^2 + 2(6) + 1 = 108 + 12 + 1 = \boxed{121}$

3. (8 points) Given $f(x) = 3x^2 - 4x + 2$ and $g(x) = 2x^2 + x - 3$, find $(f \cdot g)(x)$ and simplify completely.

$(3x^2 - 4x + 2)(2x^2 + x - 3) = 6x^4 + 3x^3 - 9x^2 - 8x^3 - 4x^2 + 12x + 4x^2 + 2x - 6$
$= \boxed{6x^4 - 5x^3 - 9x^2 + 14x - 6}$

4. (6 points) Find an equation for the graph that has the shape of x^2, but shifted right 6 units and down 3 units.

$$f(x) = (x-6)^2 - 3$$

5. (8 points) State the quadratic formula, identifying any symbols you use. Then use the quadratic formula to solve the following equation: $x^2 - 8x + 5 = 0$.

Quadratic Formula:
Given $ax^2+bx+c=0$,
$$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

In this equation, $a=1$, $b=-8$, $c=5$:
$$x = \frac{8 \pm \sqrt{64-4(1)(5)}}{2(1)}$$
$$x = \frac{8 \pm \sqrt{44}}{2} = \frac{8 \pm 2\sqrt{11}}{2} = \boxed{4 \pm \sqrt{11}}$$

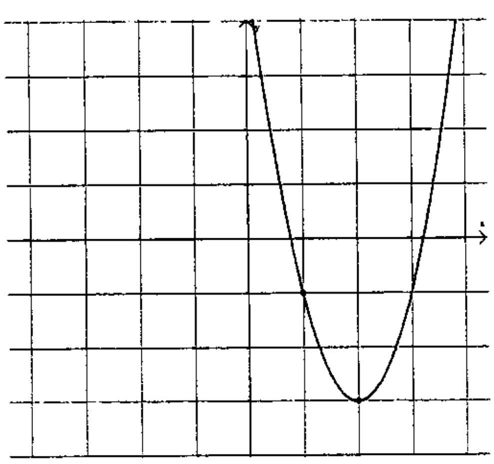
6. (6 points) Two phone companies had a total of 72.9 million users last month. If the first company had 23.1 million more users than the second company, how many users did each company have? You must define any variables used and show all your work using algebra.

Let x = # of users in 1st company (in millions)
$x + 23.1$ = # of users in 2nd company (in millions)

$x + x + 23.1 = 72.9$
$2x + 23.1 = 72.9$
$2x = 49.8$

x = $\boxed{\text{24.9 millions users for 1st Company}}$
$24.9 + 23.1 =$ $\boxed{\text{48 million users for 2nd Comp.}}$

7. (8 points) Find an equation of the parabola given below, with vertex at $(2, -3)$, passing through $(1, -1)$. Write answer in the form $y = ax^2 + bx + c$.



$y = a(x-h)^2 + k$
$y = a(x-2)^2 - 3$
$-1 = a(1-2)^2 - 3$
$-1 = a - 3$
$2 = a$

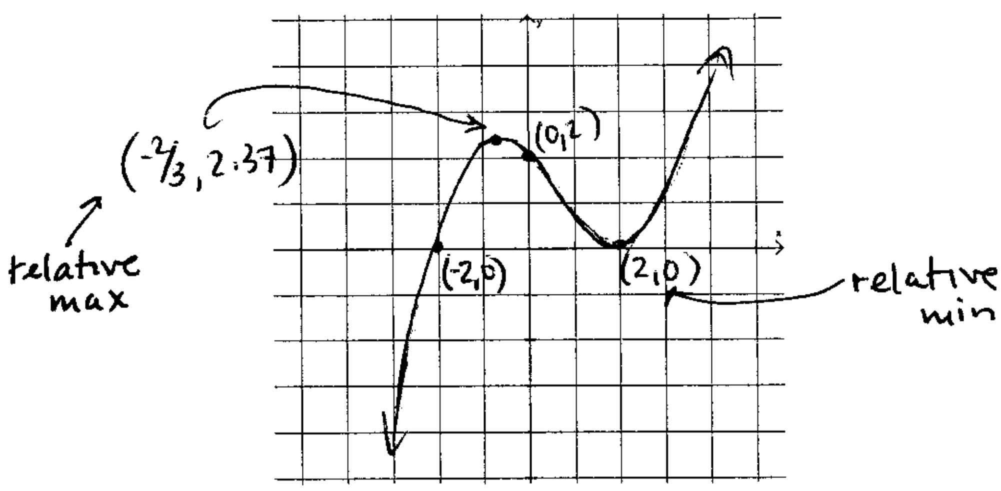
$y = 2(x-2)^2 - 3$
$y = 2(x^2 - 4x + 4) - 3$
$= 2x^2 - 8x + 8 - 3$
$\boxed{y = 2x^2 - 8x + 5}$

8. (6 points) Simplify and write in standard form: $\dfrac{4+2i}{1-i}$

$$\frac{(4+2i)(1+i)}{(1-i)(1+i)} = \frac{4+4i+2i+2i^2}{1-i^2} = \frac{4+6i-2}{2} = \frac{2+6i}{2} = \boxed{1+3i}$$

9. (10 points)

(a) Using your calculator, graph $f(x) = .25x^3 - .5x^2 - x + 2$ over the following intervals: $-5 \le x \le 5$ and $-5 \le y \le 5$. Label intercepts and relative extrema.



(b) Find any relative maxima and minima, and explain which buttons you used on your calculator.

Hit 2nd+ [Trace] + Minimum (option 3). Scroll to the left of the relative min, hit [enter], scroll to the right of the relative min, hit [enter], hit [enter] a third time, you get the answer. Repeat the process for the relative max, using "Maximum" instead (option 4)

10. (8 points) Given $P(x) = -4x^2 + 16x$, for what value of x does $P(x)$ attain a maximum value, and what is the maximum value? You must use algebra to justify your answer, calculator explanations will not receive full credit.

Method 1: Vertex formula

The vertex (h, k) is given by $h = \frac{-b}{2a}$, $k = P(h)$

(a and b are coefficients of x^2 and x, respectively).

$h = \frac{-16}{2(-4)} = 2 \quad P(2) = -16+32 = 16$

Since $a < 0$, this quadratic function opens downward and attains a max. value of 16 when $x = 2$.

Method 2: Completing the square:

$P(x) = -4(x^2-4x+4)+16$

$= -4(x-2)^2+16.$

Vertex is therefore $(2, 16)$.

11. (6 points) Find the zeros of the function $f(x) = 4x^2 - 11x - 3$.

$4x^2 - 11x - 3 = 0$

$(4x+1)(x-3) = 0$

$4x+1 = 0$ or $x-3=0$

$4x = -1$

$x = \frac{-1}{4}$ or $x = 3$

The zeros are $x = -1/4$ and $x = 3$

12. (6 points) Solve for x and check your answers: $\sqrt{2x-1} - 3 = 6$.

$\sqrt{2x-1} - 3 = 6$

$\sqrt{2x-1} = 9$

$(\sqrt{2x-1})^2 = 9^2$

$2x - 1 = 81$

$2x = 82$

$\boxed{x = 41}$

Check: $\sqrt{2(41)-1} - 3$

$= \sqrt{81} - 3$

$= 9 - 3$

$= 6$ ✓

13. (8 points) Solve for x and check your answers: $\frac{x}{x-4} - \frac{5}{x+4} = \frac{22}{x^2-16}$.

LCD: $(x-4)(x+4)$

$\left[\frac{x}{x-4} - \frac{5}{x+4} = \frac{22}{x^2-16}\right][(x-4)(x+4)]$

$x(x+4) - 5(x-4) = 22$

$x^2 + 4x - 5x + 20 = 22$

$x^2 - x - 2 = 0$

$(x-2)(x+1) = 0$

$x - 2 = 0$ or $x + 1 = 0$

$\boxed{x = 2 \text{ or } x = -1}$ Both work.

Check $x = 2$: $\frac{2}{-2} - \frac{5}{6} = \frac{-11}{6}$

$\frac{22}{4-16} = \frac{-11}{6}$ =) ✓

Check $x = -1$: $\frac{-1}{-5} - \frac{5}{3} = \frac{-22}{15}$

$\frac{22}{1-16} = \frac{-22}{15}$ =)

14. (6 points) Graph the following piecewise-defined function: $f(x) = \begin{cases} x+1, & x > 0 \\ -1, & x \leq 0 \end{cases}$.