Name: Key
Recitation Instructor, Day, Time:

TRADITIONAL MATH 100 – Exam 3 – April 2015

Directions: You will find 15 problems listed below. No notes/books/friends are allowed. Graphing calculator models above the level of a TI-84 plus are not allowed. You have one hour to complete this exam.

Page 1 20 pts.	Page 2 20 pts.	Page 3 20 pts.	Page 4 20 pts.	Page 5 20 pts	TOTAL 100 pts

1. (7 points) Find $f^{-1}(x)$ when $f(x) = 7x + 4$.

$y = 7x + 4$

$y - 4 = 7x$

$\frac{y-4}{7} = x$

$\boxed{f^{-1}(x) = \frac{x-4}{7}}$

2. (7 points) Given $g(x) = 2x^2 + x - 5$ and $h(x) = x - 1$, find $g(h(x))$.

$g(x-1) = 2(x-1)^2 + (x-1) - 5$

$= 2(x^2 - 2x + 1) + x - 1 - 5$

$= 2x^2 - 4x + 2 + x - 6$

$= \boxed{2x^2 - 3x - 4}$

3. (6 points) Expand using properties of logarithms (you may assume all variables to be positive): $\log(wx\sqrt{y})$

$\log(wx\sqrt{y}) = \log(w) + \log(x) + \log(\sqrt{y})$

$= \underline{\log(w) + \log(x) + \frac{1}{2}\log(y)}.$

4. (8 points) Solve the following rational equation: $\frac{x+5}{3x+27} = \frac{x+3}{3x+5}$

$$\frac{(x+5)(3x+5) - (x+3)(3x+27)}{(3x+27)(3x-5)} = 0.$$

$$\frac{3x^2+5x+15x+25-[3x^2+27x+9x+81]}{(3x+27)(3x-5)} = 0$$

$$\frac{-16x-56}{(3x+27)(3x-5)} = 0 ; \quad \frac{-8(2x+7)}{3(x+9)(3x-5)} = 0 ; \quad \boxed{x = -\frac{7}{2}}$$

5. (6 points) Solve and check: $x + 4 = \sqrt{2x+32}$

$x^2+8x+16 = 2x+32.$

$x^2+6x-16 = 0$

$(x+8)(x-2) = 0$

$x = -8$ or $x = 2.$

Check $x=-8$: $-4 \neq \sqrt{16}$

Check $x=2$: $6 = \sqrt{36}$ ✓

$\boxed{\text{Only } x = 2 \text{ works}}$

6. (6 points) Simplify i^{2013}.

$$\begin{array}{r} 503 \\ 4 \overline{)2013} \\ -20 \\ \hline 13 \\ -12 \\ \hline 1 \end{array}$$

$$i^{2013} = (i^4)^{503} \cdot i$$

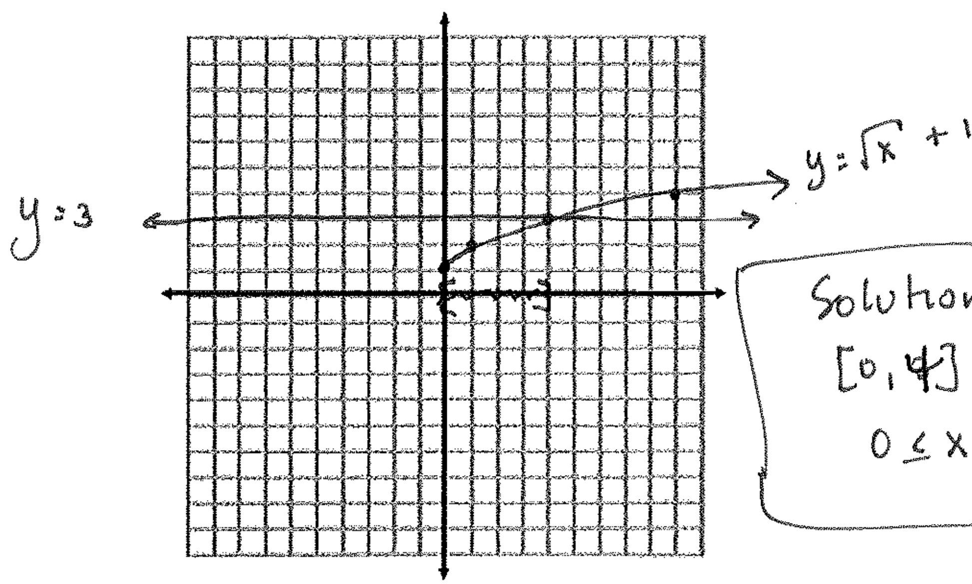
$$= 1 \cdot i = \boxed{i}$$

7. (6 points) Condense into a single logarithmic expression using the properties of logarithms (you may assume that x is positive): $\log(x) + \frac{1}{4}$

$$\log(x) + \frac{1}{4} = \log(x) + \frac{1}{4}\log(10)$$
$$= \log(x) + \log 10^{1/4}$$
$$= \log(x \cdot 10^{1/4})$$
$$= \log(x \sqrt[4]{10})$$

Either one OKAY!

8. (5 points) Solve the inequality by graphing: $\sqrt{x} + 1 \leq 3$



Solution: $[0, 4]$ or $0 \leq x \leq 4$.

9. (9 points) Fill in the blank:

(a) $\log_4\left(\frac{1}{64}\right) = \underline{\ -3\ }$

(b) $\log_3(243) = \underline{\ 5\ }$

(c) $\log_b(b) = \underline{\ 1\ }$

10. (8 points) Given that $x = -2$ is one zero of $p(x) = x^3 + 6x^2 + 21x + 26$, find all the other zeros, real or complex, of $p(x)$.

$$\begin{array}{r|rrrr} -2 & 1 & 6 & 21 & 26 \\ & \downarrow & -2 & -8 & -26 \\ \hline & 1 & 4 & 13 & \end{array}$$

$$\boxed{x = -2 \pm 3i}$$

$x^2 + 4x + 13 = 0$

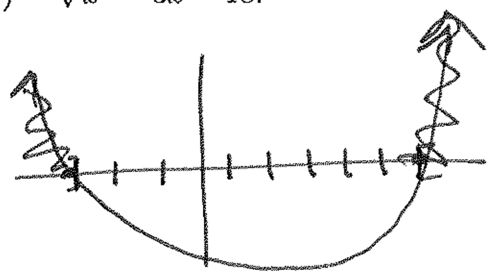
$$x = \frac{-4 \pm \sqrt{16-52}}{2} = \frac{-4 \pm \sqrt{-36}}{2} = \frac{-4 \pm 6i}{2} =$$

11. (6 points) Find the domain of the function $g(x) = \sqrt{x^2 - 3x - 18}$.

$x^2 - 3x - 18 \geq 0.$

$(x-6)(x+3) \geq 0.$

$$\boxed{x \leq -3 \ \text{or} \ x \geq 6}$$



(# line method or case-analysis are fine.)

12. (6 points) Solve the rational inequality $\dfrac{x+3}{x-1} \leq 0$, remembering to check endpoints.

(+)		(−)		(+)
test $x = -5$	-3	test $x = 0.$	1	test $x = 5$
$\dfrac{(-)}{(-)}$		$\dfrac{(+)}{(-)}$		$\dfrac{(+)}{(+)}$

$x = 1$ not in domain of $\dfrac{x+3}{x-1}$;

$$\boxed{\text{Solution: } [-3, 1)}$$

13. (6 points) Simplify and write in standard $a + bi$ form: $(-3+7i)(10-4i)$

$$(-3+7i)(10-4i) = -30 + 12i + 70i - 28i^2$$
$$= -30 + 82i + 28$$
$$= \boxed{-2 + 82i}$$

14. (6 points) Find the domain of the function $f(x) = \log(13x + 29)$.

$13x + 29 > 0$.

$13x > -29$

$\boxed{x > \frac{-29}{13}}$

15. (8 points) Consider the rational function $r(x) = \dfrac{x^2 - 3x - 18}{x^2 - 10x + 9}$. Answer the following questions.

(a) What is the domain of $r(x)$?

$x^2 - 10x + 9 = (x-9)(x-1)$; $\boxed{\text{All reals except } x = 9, x = 1}$

(b) What are the zeros of $r(x)$?

$(x^2 - 3x - 18) = (x-6)(x+3)$; $\boxed{x = 6, \ x = -3}$

(c) What are the poles (vertical asymptotes) of $r(x)$?

$x = 9$, $x = 1$.

(d) Does $r(x)$ have a horizontal asymptote? If so, what is it?

Yes. $\boxed{y = 1}$