Name: Key
Recitation Instructor, Day, Time:

TRADITIONAL MATH 100 – Exam 2 - October 13, 2015

Directions: You will find 13 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.

1	2	3	4	5	6	7	8	9	10	11	12	13	TOTAL

1. (6 points) Find the solutions and check your answers: $|4x - 9| = x + 5$.

$4x-9 = x+5$ or $4x-9 = -x-5$

$3x = 14$ or $5x = 4$

$x = \frac{14}{3}$ or $x = \frac{4}{5}$

Check $x = \frac{14}{3}$: Left Side: $\left|\frac{56}{3} - \frac{27}{3}\right| = \frac{29}{3}$ ✓

Right Side: $\frac{14}{3} + \frac{15}{3} = \frac{29}{3}$

Check $x = \frac{4}{5}$: Left Side: $\left|\frac{16}{5} - \frac{45}{5}\right| = \frac{29}{5}$ ✓

Right Side: $\frac{4}{5} + \frac{25}{5} = \frac{29}{5}$

Both $x = \frac{14}{3}$ and $x = \frac{4}{5}$ work.

2. (6 points) Find the solutions to $3x^2 + x - 5 = 0$.

$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$; here $a = 3$, $b = 1$, $c = -5$

$x = \frac{-1 \pm \sqrt{1 - 4(3)(-5)}}{2(3)}$; $\boxed{x = \frac{-1 \pm \sqrt{61}}{6}}$

3. (8 points) Solve: $|2x - 9| > 17$.

$2x - 9 > 17$ or $2x - 9 < -17$

$2x > 26$ or $2x < -8$

$\boxed{x > 13 \text{ or } x < -4}$

4. (10 points) Given that $x = 5$ is one zero of $p(x) = 2x^3 - 16x^2 - 26x + 280$, find all the other zeros, real or complex, of $p(x)$.

5 | 2 | -16 | -26 | 280
↓ | | 10 | -30 | -280
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2 | -6 | -56 | 0

$P(x) = (x-5)(2x^2 - 6x - 56)$

$= (x-5)(x^2 - 3x - 28)2$

$= 2(x-5)(x-7)(x+4)$

$\Rightarrow$ $x = 7$, $x = -4$ are other zeros

5. (6 points) Simplify and write in standard $a + bi$ form: $(-8 - i) - (14 + 3i)$

$-8 - i - 14 - 3i = \boxed{-22 - 4i}$

6. (10 points) The profit function for selling x units of a certain product is given by $P(x) = -x^2 + 1600x + 960,000$. What number of units generates maximum profit, and, what is the maximum profit? Show your work with algebra. If you choose to use a graph as part of your work, you must include a graph having the pertinent information that helps to answer this question.

$P(x)$ is a parabola that opens downward since leading coefficient is negative.

So $P(x)$ attains a max @ the vertex.

vertex (h,k) is given by $h = \frac{-1600}{2(-1)} = 800$ units

and $k = P(800) = -640000 + 1600(800) + 960000$

$= \$1,600,000$

So max profit of $1,600,000 occurs @ x = 800 units

7. (10 points) Consider the polynomial $p(x) = 200x^4 - 12x^3 + 2x + 200$. Circle TRUE or FALSE for each of the statements below.

(a) TRUE FALSE $p(x)$ has even degree.

(b) TRUE FALSE $p(x)$ has a positive y-intercept.

(c) TRUE FALSE $p(x)$ has negative leading coefficient.

(d) TRUE FALSE As $x \to \infty$, $p(x) \to \infty$.

(e) TRUE FALSE As $x \to -\infty$, $p(x) \to \infty$.

8. (8 points) A parabola has vertex at $(-3, 9)$ and passes through the point $(2, 14)$. What is the equation of the parabola? Write your answer in the form $y = a(x-h)^2 + k$. DO NOT MULTIPLY OUT.

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

$$14 = a(2-(-3))^2 + 9$$

$$14 = a(5)^2 + 9$$

$$5 = 25a$$

$$a = \frac{1}{5}$$

$$\boxed{y = \frac{1}{5}(x+3)^2 + 9}$$

9. (6 points) Using the **REMAINDER THEOREM**, find $p(-1)$ when $p(x) = 2x^4 - x^2 + 4x - 1$. Be sure to identify your final answer.

* Either long division or synthetic division is fine

$$\begin{array}{r|ccccc} -1 & 2 & 0 & -1 & 4 & -1 \\ & \downarrow & -2 & 2 & -1 & -3 \\ \hline & 2 & -2 & 1 & 3 & -4 \end{array}$$

$\boxed{p(-1) = -4}$

10. (6 points) Simplify i^{1243}.

$$\begin{array}{r} 310 \\ 4\overline{)1243} \\ -12 \\ \hline 4 \\ -4 \\ \hline 03 \\ -0 \\ \hline 3. \end{array}$$

$$\begin{aligned} i^{1243} &= i^{4(310)+3} \\ &= i^{4(310)} \cdot i^3 \\ &= (i^4)^{310} \cdot (-i) \\ &= 1 \cdot (-i) = \boxed{-i} \end{aligned}$$

11. (8 points) Solve: $|5x + 6| < 12$.

$$-12 < 5x + 6 < 12$$

$$-12 < 5x + 6 \text{ and } 5x + 6 < 12$$

$$-18 < 5x \text{ and } 5x < 6$$

$$-\frac{18}{5} < x \text{ and } x < \frac{6}{5}$$

$$\boxed{-\frac{18}{5} < x < \frac{6}{5}}$$

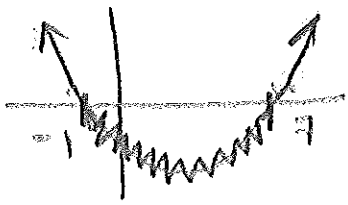
12. (8 points) Solve the quadratic inequality $x^2 - 6x < 7$.

number line or graph or case analysis must be included to get full credit:

$x^2 - 6x - 7 < 0$

$(x-7)(x+1) < 0$

either one okay



$\boxed{-1 < x < 7}$

13. (8 points) Find all solutions to the polynomial equation $x^4 - 14x^2 + 24 = 0$. Leave answers in radical form.

$(x^2-2)(x^2-12) = 0$

$(x-\sqrt{2})(x+\sqrt{2})(x-\sqrt{12})(x+\sqrt{12}) = 0$

$\boxed{x = \pm\sqrt{2}, \quad x = \pm 2\sqrt{3}}$