Name: Key
Recitation Instructor, Day, Time:

TRADITIONAL MATH 100 – Exam 2 – February 27, 2018

Directions: You will find 15 problems listed below. No notes/books 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. (6 points) Find the solutions and check your answers: $1 + 2|x + 4| = 17$.

$2|x+4| = 16$

$|x+4| = 8$

$x+4 = 8$ or $x+4 = -8$

$x = 4$ or $x = -12$

Check $x = 4$: $1+2|4+4| = 1+2(8) = 17$ ✓

Check $x = -12$: $1+2|-12+4| = 1+2(8) = 17$ ✓

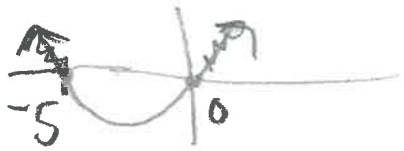
2. (6 points) Find the solutions to $3x^2 - x - 7 = 0$.

$$x = \frac{-(-1) \pm \sqrt{1-4(3)(-7)}}{2(3)}$$

$$x = \frac{1 \pm \sqrt{85}}{6}$$

3. (8 points) Solve the quadratic inequality $x^2 + 5x > 0$.

$x(x+5) > 0$



$(-\infty, -5) \cup (0, \infty)$

$x < -5$ or $x > 0$

4. (8 points) In a controlled lab environment, some organisms exhibit constant growth over a specific time period. Suppose a certain organism starts out weighing 1 mg, and grows to 13 mg over a 48 hour time period. Find a linear model (in other words, find a linear function) that describes the growth of the organism for $0 \leq t \leq 48$ hours.

(0, 1mg)
(48, 13 mg)

$f(t) = \frac{1}{4}t + 1$

slope: $\frac{12\text{ mg}}{48\text{ hrs}} = \frac{1}{4}\text{ mg/hr}$

5. (6 points) Find an equation of the line passing through $(-4, 5)$ and perpendicular to $x + 3y = 2$.

Slope of given line: $3y = -x + 2$

$y = -\frac{1}{3}x + \frac{2}{3}$

$m = -\frac{1}{3}$

New line slope: $M = 3$

New line: $y - 5 = 3(x + 4)$

or $y = 3x + 17$

6. (6 points) Find the quotient and remainder when $p(x) = 3x^3 - x^2 + 1$ is divided by $x^2 + 4x - 1$. Write $p(x)$ in the form $d(x)q(x) + r(x)$, where $d(x), q(x)$ and $r(x)$ are the divisor, quotient and remainder, respectively.

$$
\begin{array}{r}
3x - 13 \\
x^2+4x-1 \;\overline{)\; 3x^3 - x^2 + 0x + 1} \\
-(3x^3 + 12x^2 - 3x) \\
\hline
-13x^2 + 3x + 1 \\
-(-13x^2 - 42x + 13) \\
\hline
45x - 12
\end{array}
$$

$p(x) = (x^2+4x-1)(3x-13) + (45x-12)$

$d(x) \cdot q(x) + r(x)$

7. (5 points) Suppose the number of vehicle thefts in a given area, from the years 1960 to 1990, could be modeled by the polynomial $p(x) = 30.97x^3 - 1266.9x^2 + 19199x + 29,130$, where x is the number of years since 1960. What is $p(13)$, and what is its meaning in context of the model? Explain in a brief sentence.

$p(13) = 30.97(13)^3 - 1266.9(13)^2 + 19199(13) + 29,130$

$p(13) \approx 132652$

In 1973, there were about 132,652 vehicle thefts in the area

8. (5 points) Find the vertex of the quadratic function $C(x) = -x^2 - 140x + 600$. Is the vertex a maximum or minimum, and how do you know?

$(h, k) = \left(\frac{140}{2(-1)}, C(h)\right)$

$= (-70, C(-70))$

$C(-70) = -(-70)^2 - 140(-70) + 600$

$= 5500$

vertex: $(-70, 5500)$

Maximum since $a < 0$ (parabola opens down)

9. (10 points) Consider the polynomial $p(x) = 4x^6 - 10x^2 + x - 400$. Circle TRUE or FALSE for each of the statements below.

(a) TRUE (FALSE) $p(x)$ has odd degree. degree = 6, even

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

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

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

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

($p(x)$ rises on both ends)

10. (8 points) A parabola has vertex at $(1, -2)$ and passes through the point $(3, 4)$. What is the equation of the parabola? Write your answer in the form $y = ax^2 + bx + c$.

$4 = a(3-1)^2 - 2$

$4 = 4a - 2$

$6 = 4a$

$\frac{3}{2} = a$

$y = \frac{3}{2}(x-1)^2 - 2$

$y = \frac{3}{2}[x^2 - 2x + 1] - 2$

$y = \frac{3}{2}x^2 - 3x + \frac{3}{2} - \frac{4}{2}$

$y = \frac{3}{2}x^2 - 3x - \frac{1}{2}$

11. (6 points) Using the **REMAINDER THEOREM**, find $p(4)$ when $p(x) = 2x^4 + x + 4$. Be sure to identify your final answer.

4	2	0	0	1	4
	↓	8	32	128	516
	2	8	32	129	520

$p(4) = 520$

12. (6 points) Consider two quadratic functions given by $f(x) = 2x^2 - 11x + 12$ and $g(x) = x^2 - 3x + 5$. Find the intersection points of these two parabolas and state your answers as ordered pairs.

$2x^2 - 11x + 12 = x^2 - 3x + 5$

$x^2 - 8x + 7 = 0$

$(x-7)(x-1) = 0$

$x = 7, 1$

$g(7) = f(7) = 33$

$g(1) = f(1) = 3.$

$(7, 33)$ and $(1, 3)$

13. (6 points) Solve: $|x - 7| < 8$.

$-8 < x - 7 < 8$

$-8 < x - 7$ and $x - 7 < 8$

$-1 < x$ and $x < 15$

$-1 < x < 15$

14. (6 points) Solve: $|3x - 2| > 4$.

$3x - 2 > 4$ or $3x - 2 < -4$

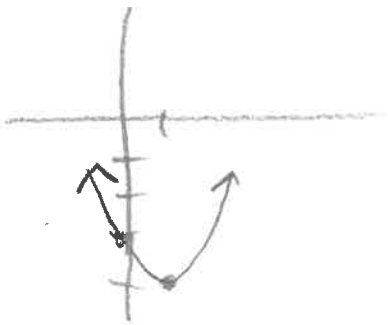
$3x > 6$ or $3x < -2$

$x > 2$ or $x < -2/3$

15. (8 points) Consider the parabola $f(x) = (x - 1)^2 - 4$. Answer the following questions. (Drawing a quick sketch of the graph of $f(x)$ may help you.)

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

All real #'s



(b) What is the vertex of $f(x)$?

$(1, -4)$

(c) What is the range of $f(x)$?

$y \geq -4$ or $[-4, \infty)$

(d) What is the axis of symmetry of $f(x)$?

$x = 1$