MAT 121 Writing Project #1 ~~Fall, 2017~~ Spring, 2018 Name KEY

FORMATTING: This is semi-formal writing, here. That means show some professionalism. You don't have to type it out, but you do need to be very clear. See Course Schedule for due dates. **Staple this page, with your name on it, as a cover sheet for your project. Do not staple your project to your test.**

1. Write on only one side of each page. I will not award (or deduct) points for anything on the backs of pages.
2. Plain white paper without lines (8 ½ x 11-inch A4 copier paper works just fine).
3. Staple top left corner.
4. Leave margins. "MAT 121" in big letters in top left corner of every page solves all problems with margins.
5. Write DARK. I don't mind if you use pen. Just put a line through mistakes. Pencil's good, but make sure you're getting it DARK.
6. Leave ROOM between problems and between steps on your work. I have bad eyes, so being stingy with space and paper is a mistake on Writing Projects. **Don't do work in 2 columns!**
7. I prefer that you type up the last question on a wordprocessor.
8. Early Bird Bonus: Submit this project in a nice PDF, electronically, by Friday, before Test 1, for 5 extra points.

#s 1 – 3 Find all real (or non-real) solutions of the following quadratic equations using the quadratic formula. Be sure to compute the discriminant, first, and separately. I'm looking for that on tests, as well, *whenever* you face a quadratic expression. It modularizes the work, and it tells you what you're getting into.

1. (5 pts) $x^2+5x-14=0$
2. (5 pts) $6.23x^2-12.22x-15.68=0$ (Round your final answer to 4 decimal places.)

BONUS: (5 pts) Give an *exact* answer for #2, in simplified radical form, and NO DECIMALS.

3. (5 pts) $49x^2-28x+7=0$ (Give an exact answer, in simplified radical form.
4. (5 pts) $ax^2-5rx-6z=0$ (Solve for x. Your answers will have letters in them. That's OK!)

#s 5, 6 Solve the following by factoring. You may use a sledgehammer, if you wish, but write the polynomial in factored form, after you find the solutions, to show you understand the connection between factors and solutions, frontwards and backwards! Give answers as integers or fractions, in lowest terms.

5. (5 pts) $x^2-5x-24=0$
6. (5 pts) $16x^2+61x-42=0$

#s 7 – 10 Solve the following by completing the square. Do not use decimals; rather, use *fractions*, as needed, to complete the square. No 2.5^2 copping-out for #8. Add a symbolic $\left(\frac{5}{2}\right)^2$ to the left side, (5 pts) Why? and a $\frac{25}{4}$ as a fraction on the right side. The messy part is the $15+\frac{25}{4}$ on the right side, and there's no ducking it. I expect final answers in simplified radical form, with no decimal points, anywhere. To take your calculator to the next level, you need to know how to write these things, symbolically.

7. (5 pts) $x^2-8x-15=0$
8. (5 pts) $x^2-5x-24=0$
9. (5 pts) $3x^2+2x+5=0$
10. (5 pts) $3x^2-4x-17=0$
11. (5 pts) Discuss the pro's and con's each of the methods. I won't grade a wall of words. Paragraphs, people!

121 Writing Project #1 Spring, 2018

(1) (5pts) $x^2+5x-14=0$

$a=1, b=5, c=-14$

$b^2-4ac = 5^2-4(1)(-14)$

$= 25+56$

$= 81$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$= \frac{-5 \pm \sqrt{81}}{2(1)} = \frac{-5 \pm 9}{2}$

$\frac{-5+9}{2} = \frac{4}{2} = 2$

$\frac{-5-9}{2} = \frac{-14}{2} = -7$

$x \in \{-7, 2\}$

up to 2pts off for wrong delimeters: {} -vs- ( ) or [ ]

(2) (5pts) $6.23x^2 - 12.22x - 15.68 = 0$

$623x^2 - 1222x - 1568 = 0$

$a=623, b=1222, c=-1568$

$b^2-4ac = (1222)^2 - 4(623)(-1568)$

$= 1493284 + 3907456$

$= 5400740$

$\sqrt{5400740} = 2\sqrt{1350185}$

≈ 2323.949224

$x = \frac{1222 \pm 2\sqrt{1350185}}{2(623)}$ BONUS (5pts)

$= \frac{611 \pm \sqrt{1350185}}{623} \approx$

$\approx 2.845866152 \approx x$

OR

$-0.884389426 \approx x$

121 WP #1

(3) Sol'n b

$49x^2 - 28x + 7 = 0$

$a = 49,\ b = -28,\ c = 7 \Rightarrow$

$b^2 - 4ac = (-28)^2 - 4(49)(7)$

$= 784 - 1372$

$= -588 \Rightarrow \sqrt{-588}$

$= 14i\sqrt{3}$

$2 \mid 588$
$2 \mid 294$
$3 \mid 147$
$7 \mid 49$
7

$x = \frac{28 \pm 14i\sqrt{3}}{2(49)}$

$= \frac{14 \pm 7i\sqrt{3}}{49} = \frac{2 \pm i\sqrt{3}}{7} = x$

$x \in \left\{ \frac{2 \pm i\sqrt{3}}{7} \right\}$

Check: $49\left(x - \frac{2+i\sqrt{3}}{7}\right)\left(x - \frac{2-i\sqrt{3}}{7}\right)$

$= (7x - (2+i\sqrt{3}))(7x - (2-i\sqrt{3}))$

$= (7x - 2 - i\sqrt{3})(7x - 2 + i\sqrt{3})$

$= 49x^2 - 14x + 7i\sqrt{3}x - 14x + 4 - 2i\sqrt{3}$

$- 7i\sqrt{3}x + 2i\sqrt{3} - i^2\sqrt{3}^2$

$= 49x^2 - 28x + 4 + 3$

$= 49x^2 - 28x + 7$ ✓

121 WP #1

5 pts

$ax^2 - 5rx - 6z = 0$

$a = a,\ b = -5r,\ c = -6z$

$b^2 - 4ac = (-5r)^2 - 4(a)(-6z)$

$= 25r^2 + 24az$

$$x = \frac{5r \pm \sqrt{25r^2 + 24az}}{2a}$$

121 WP#1

5 5pts $x^2 - 5x - 24 = 0$

$(x-8)(x+3) = 0$

$x \in \{-3, 8\}$

6 5pts $16x^2 + 61x - 42 = 0$

$a = 16, b = 61, c = -42$

$b^2 - 4ac = 61^2 - 4(16)(-42)$

$= 3721 + 2688$

$= 6409 \rightarrow$

$\sqrt{6409} \approx 80.05623024$

Not a perfect square?!

$x = \frac{-61 \pm \sqrt{6409}}{2(16)} = \frac{-61 \pm \sqrt{6409}}{32} = x$

If it factors like this:

$16\left(x - \left(\frac{-61 + \sqrt{6409}}{32}\right)\right)\left(x - \left(\frac{-61 - \sqrt{6409}}{32}\right)\right)$!

ugh!

121 WP #1

(7) (5pts) $x^2 - 8x - 15 = 0$

$x^2 - 8x + 4^2 = 15 + 16$

$(x-4)^2 = 31$

$x - 4 = \pm\sqrt{31}$

$\boxed{x = 4 \pm \sqrt{31}}$

$\frac{24}{1} \cdot \frac{4}{4} + \frac{25}{4}$

$= \frac{96+25}{4} = \frac{121}{4}$

(8) (5pts) $x^2 - 5x - 24 = 0$

$x^2 - 5x + \left(\frac{5}{2}\right)^2 = 24 + \frac{25}{4}$

$\left(x - \frac{5}{2}\right)^2 = \frac{121}{4}$

$x - \frac{5}{2} = \pm\sqrt{\frac{121}{4}} = \pm\frac{11}{2}$

$x = \frac{5 \pm 11}{2}$ → $\frac{16}{2} = 8$; → $\frac{-6}{2} = -3$

$\boxed{x \in \{-3, 8\}}$

121 WP #1

(9) (5pts) $3x^2 + 2x + 5 = 0$

$x^2 + \frac{2}{3}x + \frac{5}{3} = 0$

$x^2 + \frac{2}{3}x + \left(\frac{1}{3}\right)^2 = -\frac{5}{3} + \frac{1}{9}$

$\left(x + \frac{1}{3}\right)^2 = \frac{-15+1}{9} = \frac{-14}{9}$

$x + \frac{1}{3} = \pm\sqrt{\frac{-14}{9}} = \pm\frac{i\sqrt{14}}{3}$

$x = \frac{-1 \pm i\sqrt{14}}{3}$ → $\frac{-1+i\sqrt{14}}{3}$, $\frac{-1-i\sqrt{14}}{3}$

$x \in \left\{\frac{-1 \pm i\sqrt{14}}{3}\right\}$

Check: $3\left(x - \left(\frac{-1-i\sqrt{14}}{3}\right)\right)\left(x - \left(\frac{-1+i\sqrt{14}}{3}\right)\right)$

$= 3\left(x^2 - \left(\frac{-1+i\sqrt{14}}{3}\right)x - \left(\frac{-1-i\sqrt{14}}{3}\right) + \frac{1}{9}(1+14)\right)$

$= 3\left(x^2 + \frac{1}{3}x + \frac{1}{3}x + \frac{15}{9}\right)$

$= 3x^2 + 2x + \frac{3(15)}{9}$ $= 3x^2 + 2x + 5$ ✓

121 WP #1

(10)

$3x^2 - 4x - 17 = 0$

$x^2 - \frac{4}{3}x - \frac{17}{3} = 0$

$x^2 - \frac{4}{3}x + \left(\frac{2}{3}\right)^2 = \frac{17}{3} + \frac{4}{9}$

$\left(x - \frac{2}{3}\right)^2 = \frac{55}{9}$

$x - \frac{2}{3} = \pm \frac{\sqrt{55}}{3}$

$$x = \frac{2 \pm \sqrt{55}}{3}$$

$\frac{17.3+4}{9} = \frac{51+4}{9} = \frac{55}{9}$

$(2+\sqrt{55})(2-\sqrt{55})$

$= 4 - 55 = -51$

Check

$3\left(x - \left(\frac{2+\sqrt{55}}{3}\right)\right)\left(x - \left(\frac{2-\sqrt{55}}{3}\right)\right)$

$3\left(x^2 - \left(\frac{2+\sqrt{55}}{3}\right)x - \left(\frac{2-\sqrt{55}}{3}\right)x + \frac{-51}{9}\right)$

$= 3\left(x^2 - \frac{2}{3}x - \frac{2}{3}x - \frac{17}{3}\right)$

$= 3x^2 - 4x - 17$ ✓