MAT 121Writing Project #1 Spring, 2019 Name KEY
Early Bird (10% Bonus): Friday, Feb 1. Delivered or postmarked by Feb. 1. Otherwise, bring to Test 1 with you.

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. **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. Type up the last question on a wordprocessor.
8. Do Not Send Me GIFs or JPEGs of your work. If you can't make a PDF, then don't bother submitting it electronically. I can't process your image very efficiently.

#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) $x^2+7x-18=0$
2. (5 pts) $8.82x^2+1.89x-22.01=0$ (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) $3x^2-7x+6=0$ (Give an exact answer, in simplified radical form.
4. (5 pts) $\pi x^2-5rx-8w=0$ (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) $x^2+5x-36=0$
6. (5 pts) $21x^2+47x-110=0$

#s 7 – 10 Solve the following by completing the square. **Do not use decimals**; rather, use *fractions*, as needed, to complete the square. No 1 copping-out for #9. Add a symbolic $\left(\frac{3}{2}\right)^2$ to the left side, and a $\frac{9}{4}$ as a fraction on the right side. The messy part is the $-7+\frac{9}{4}$ on the right, and there's no ducking it. Final Answers in Simplified Radical Form.

7. (5 pts) $x^2-14x+4=0$
8. (5 pts) $2x^2-6x-23=0$
9. (5 pts) $2x^2+3x+7=0$
10. (5 pts) $23x^2-4x+5=0$
11. (5 pts) Discuss the pro's and con's each of the methods. I won't grade a wall of words. Paragraphs, people!

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(1) Sp13 $x^2+7x-18=0$

M1 $\Rightarrow (x+9)(x-2)=0$

$\Rightarrow \boxed{x \in \{-9, 2\}}$

M2 $b^2-4ac = 7^2-4(1)(-18)$

$a=1, b=7, c=-18 = 49+72 = 121$

$= 11^2$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-7 \pm 11}{2}$

$= \frac{4}{2} = 2$

$= -\frac{18}{2} = -9$

(2) Sp13 $8.82x^2+1.89x-22.01=0$

TIMES 100: $882x^2+189x-2201=0$ $\Rightarrow$

$a=882, b=189, c=-2201$

$b^2-4ac = 189^2-4(882)(-2201)$

$= 35721 + 7765128$

$= 7800849 = 2793^2$

$x = \frac{-189 \pm 2793}{2(882)} = \frac{-189 \pm 2793}{1764}$

$\frac{2604}{1764}$

$\frac{2982}{1764}$

$\Rightarrow x \in \{1.476190476, -1.690476190\}$

$\approx \{1.4762, -1.6905\}$

12) WP1

BONUS 5 pts

$\frac{2604}{1764}$:

2	2604
2	1302
3	651
7	217
	31

2	1764
2	882
3	441
3	147
	49
	7

$= \frac{2^2 \cdot 3 \cdot 7 \cdot 31}{2^2 \cdot 3^2 \cdot 7^2}$

$= \frac{31}{3 \cdot 7} = \frac{31}{21}$

$\frac{2982}{1764}$:

2	2982
3	1491
7	497
	71

$= \frac{2 \cdot 3 \cdot 7 \cdot 71}{2^2 \cdot 3^2 \cdot 7^2}$

$= \frac{71}{42}$

$x \in \left\{ \frac{31}{21}, -\frac{71}{42} \right\}$

13) $3x^2 - 7x + 6 = 0$

$a = 3, \; b = -7, \; c = 6$

$b^2 - 4ac = 7^2 - 4(3)(6)$

$= 49 - 72$

$= -23$

$\Rightarrow \quad x = \frac{7 \pm \sqrt{-23}}{2(3)} = \frac{7 \pm i\sqrt{23}}{6} = x$

OR $x \in \left\{ \frac{7 \pm i\sqrt{23}}{6} \right\}$

121 WP1

(4) (5 pts) $\pi x^2 - 5rx - 8w = 0$

$a=\pi,\ b=-5r,\ c=-8w \Rightarrow$

$b^2-4ac = (-5r)^2 - 4(\pi)(-8w)$

$= 25r^2 + 32\pi w \Rightarrow$

$$x = \frac{5r \pm \sqrt{25r^2+32\pi w}}{2\pi}$$

(5) (5 pts) $x^2 + 5x - 36 = (x-4)(x+9) = 0$

$\Rightarrow x \in \{-9, 4\}$

(6) (5 pts) $21x^2 + 47x - 110 = 0$

$(21)(-110) = -2310$

(M1) $47 = 54 - 7$ — -3708 higher!

$= 64 - 17$ — -1088 higher!

$= 84 - 37$ — -3108 lower!

$= 74 - 27$ — -1988 higher!

$= 80 - 33$ — -2640 lower!

$= 77 - 30$ — -2310 Sweet!

(M2) Solve by quadratic formula. Then $21(x+\frac{11}{3})(x-\frac{10}{7})$ $= (3x+11)(7x-10)$ is factored form!

$21x^2 + 77x - 30x - 110 = 7x(3x+11) - 10(3x+11)$

$= (3x+11)(7x-10) = 0 \Rightarrow x \in \{-\frac{11}{3}, \frac{10}{7}\}$

121 WP1

(7) 5pts

$x^2 - 14x + 4 = 0$

$x^2 - 14x + 7^2 = -4 + 49$

$(x-7)^2 = 45$

$x - 7 = \pm\sqrt{45} = \pm 3\sqrt{5}$

$3 \mid 45$
$3 \mid 15$
5

$\Rightarrow \boxed{x = 7 \pm 3\sqrt{5}}$ or $x \in \{7 \pm 3\sqrt{5}\}$

(8) 5pts

$2x^2 - 6x - 23 = 0$

$x^2 - 3x - \frac{23}{2} = 0$

$x^2 - 3x + \left(\frac{3}{2}\right)^2 = \frac{23}{2} + \frac{9}{4} = \frac{46+9}{4} = \frac{55}{4}$

$\left(x - \frac{3}{2}\right)^2 = \frac{55}{4}$

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

$\boxed{x = \frac{3 \pm \sqrt{55}}{2}}$ or $\boxed{x \in \left\{\frac{3 \pm \sqrt{55}}{2}\right\}}$

121 WP 1

(9) (5pts) $2x^2+3x+7=0$

$\Rightarrow x^2+\frac{3}{2}x = -\frac{7}{2}$

$x^2+\frac{3}{2}x+\left(\frac{3}{4}\right)^2 = -\frac{7}{2}\cdot\frac{8}{8}+\frac{9}{16} = \frac{-56+9}{16}$

$\left(x+\frac{3}{4}\right)^2 = \frac{-47}{16}$

$x+\frac{3}{4} = \pm\sqrt{\frac{-47}{16}} = \pm i\frac{\sqrt{47}}{4}$

$\Rightarrow \boxed{x = -\frac{3}{4}\pm\frac{\sqrt{47}}{4}i}$ OR $\boxed{x\in\left\{\frac{-3\pm i\sqrt{47}}{4}\right\}}$

(10) (5pts) ?! $23x^2-4x+5=0$

$x^2-\frac{4}{23}x = -5 \rightarrow -\frac{5}{23}$, silly

$x^2-\frac{4}{23}x+\left(\frac{2}{23}\right)^2 = -5\cdot\frac{529}{529}+\frac{4}{529}$

$\left(x-\frac{2}{23}\right)^2 = \frac{-2645+4}{529} = \frac{-2641}{529}$

$x-\frac{2}{23} = \pm\sqrt{\frac{-2641}{529}}$

$x = \frac{2}{23}\pm\frac{\sqrt{2641}}{23}i$

OR $x\in\left\{\frac{2\pm\sqrt{2641}\,i}{23}\right\}$

$19\overline{)2641}$
139

$\sqrt{139}\approx 11.8$

so prime because already checked up to 19 as factors.

121 WP 1

(10) (Spt3) Re-do

$$x^2 - \frac{4}{23}x = -\frac{5}{23}$$

$$x^2 - \frac{4}{23}x + \left(\frac{2}{23}\right)^2 = -\frac{5}{23}\cdot\frac{23}{23} + \frac{4}{529}$$

$$\left(x - \frac{2}{23}\right)^2 = \frac{-115+4}{529} = -\frac{111}{529}$$

$3\overline{)111}$
37, 3 prime

$$x - \frac{2}{23} = \pm\sqrt{-\frac{111}{529}} = \pm i\cdot\frac{\sqrt{111}}{23}$$

$$\Rightarrow \boxed{x = \frac{2 \pm i\sqrt{111}}{23}} \quad \text{OR} \quad \boxed{x \in \left\{\frac{2 \pm i\sqrt{111}}{23}\right\}}$$