MAT 1340 Writing Project #1 1

#s 1-3 Find ALL sol'ns using quadratic formula
Compute Discriminant 1st !!

1 $x^2+7x-18=0 \longrightarrow$

$a=1, b=7, c=-18 \longrightarrow$

$b^2-4ac = 7^2-4(1)(-18) = 49+72 = 121$

$\Longrightarrow x = \dfrac{-b \pm \sqrt{b^2-4ac}}{2a} = \dfrac{-7 \pm \sqrt{121}}{2(1)} = \dfrac{-7 \pm 11}{2}$

$= \begin{cases} \dfrac{-7+11}{2} = \dfrac{4}{2} = 2 \\ \dfrac{-7-11}{2} = -\dfrac{18}{2} = -9 \end{cases} \Longrightarrow \boxed{x \in \{-9, 2\}}$

1pt Discriminant 1st
1pt Plug in directly to quadratic formula
1 pt = -vs- ≈
1pt Use "=" to connect equal objects.
1pt Final Ans

$x = -9, 2$ accepted

After the 1st 2 ≈ -vs- = errors, stop deducting, but point out.

$x = \{-9, 2\}$

$\to \in$ $\frac{1}{2}$ pt

MAT 1340

(2) $5.89x^2 - 13.09x + 7.26 = 0$

$\Rightarrow 589x^2 - 1309x + 726 = 0 \Rightarrow$

$a = 589,\ b = 1309,\ c = 726 \Rightarrow$

$b^2 - 4ac = 1309^2 - 4(589)(726)$

$= 3025.$ Check $\sqrt{3025} = 55$!

Perfect Square! FACTORS OVER the rationals!

Continue QF: See #6 !

$$x = \frac{-(-1309) \pm 55}{2(589)} = \frac{1309 \pm 55}{1178} \quad \frac{22}{19},\ \frac{33}{31}$$

$\Rightarrow x \in \left\{ \frac{22}{19}, \frac{33}{31} \right\}$ EXACT

$$\approx \boxed{\{1.1579, 1.0645\}}$$

Same Rubric, but more likely to see "=" vs "≈" errors

(3) EXACT ANS. Simplified radical form

$25x^2 - 20x + 7 = 0$

$b^2 - 4ac = (-20)^2 - 4(25)(7) = 400 - 700$

$= -300$

NOT PERFECT square & NEGATIVE

$$x = \frac{-(-20) \pm \sqrt{-300}}{2(25)}$$

Simplify

$$\begin{array}{r|l} 2 & 300 \\ 2 & 150 \\ 3 & 75 \\ 5 & 25 \\ & 5 \end{array} \Rightarrow \sqrt{300} = 2 \cdot 5\sqrt{3} = 10\sqrt{3}$$

$$x = \frac{20 \pm 10i\sqrt{3}}{50} = \frac{10(2 \pm i\sqrt{3})}{10 \cdot 5} =$$

$$= \boxed{\frac{2 \pm i\sqrt{3}}{5} = x}$$

or write

$$\boxed{x \in \left\{\frac{2 \pm i\sqrt{3}}{5}\right\}}$$

MAT 1340 WP #1 4

4 $3mx^2 - 2wx + 5r = 0 \Longrightarrow$

$a = 3m,\ b = -2w,\ c = 5r \longrightarrow$

$$b^2 - 4ac = (-2w)^2 - 4(3m)(5r)$$

$$= 4w^2 - 60mr = 4(w^2 - 15mr)$$

$$\Longrightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{2w \pm \sqrt{4(w^2 - 15mr)}}{2(3m)}$$

$$= \frac{2w \pm 2\sqrt{w^2 - 15mr}}{6m}$$

$$= \frac{2(w \pm \sqrt{w^2 - 15mr})}{6m} = \boxed{\frac{w \pm \sqrt{w^2 - 15mr}}{3m}}$$

OR

$$\boxed{x \in \left\{ \frac{w \pm \sqrt{w^2 - 15mr}}{3m} \right\}}$$

#55,6 Solve by factoring (or simulate it with sledgehammer!)

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

$(x+9)(x-2)=0$ →

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

(6) $589x^2-1309x+726=0$

SEE SLEDGE-HAMMER NEXT PAGE.

$b^2-4ac = 3025 = 55$ ✓

NEED FACTORS OF

$(726)(589) = \underline{427614}$ whose sum is 1309

$1309 = 1308 + 1$ 1308 Higher

$= 1307 + 2$ 2614 Higher!

$= 500 + 809$ 404500 Higher!

$= 501 + 808$ 404800 Higher!

$= 502 + 807$ 405714 Higher!

$= 510 + 799$ 407490

$= 550 + 759$ 417450

$= 560 + 749$ 419440 HIGHER!

$= 600 + 709$ 425400 ALMOST!

MAT 1340 WP#1 (6)

#6 cnt'd MAGIC 8 427614

$= 650 + 659$ 428350 Lower!

$= 625 + 684$ 427500 HIGHER!

$= 630 + 679$ 427770 LOWER!

$= 627 + 682$ 427614 ! SWEET !

So $589x^2 - 1309x + 726$

$= 589x^2 - 627x - 682x + 726$

$19 \overline{)589}$ → 31 $\quad$ $3 \overline{)627}$ → $11 \overline{)209}$ → 19 $\quad$ $2 \overline{)682}$ → $11 \overline{)341}$ → 31 $\quad$ $2 \overline{)726}$ → $3 \overline{)363}$ → $11 \overline{)121}$ → 11

$= 19x(31x - 33) - 22(31x - 33)$

$= (31x - 33)(19x - 22) = 0 \Rightarrow$

$$\boxed{x \in \left\{ \frac{33}{31}, \frac{22}{19} \right\}}$$

See SLEDGE HAMMER NEXT PAGE

MAT 1340 WP#1 7

#6 Sledgehammer.

By #2, we have

$x \in \left\{ \frac{33}{31}, \frac{22}{19} \right\}$ by quadratic formula.

This means

$589\left(x - \frac{33}{31}\right)\left(x - \frac{22}{19}\right)$

$= (19)(31)\left(x - \frac{33}{31}\right)\left(x - \frac{22}{19}\right)$

$= (31x - 33)(19x - 22) = 0$

$\Rightarrow x \in \left\{ \frac{33}{31}, \frac{22}{19} \right\}$

I <u>NEED</u> to see the factored form.

without that, $\boxed{1_p + \text{Max}}$

MAT 1340 WP #1

#s 7–10 Solve by completing the square.

7. $x^2+7x-18$

$= x^2+7x+\left(\frac{7}{2}\right)^2-\frac{49}{4}-\frac{18(4)}{4}$

$=\left(x+\frac{7}{2}\right)^2-\frac{121}{4}=0 \longrightarrow$

$\left(x+\frac{7}{2}\right)^2=\frac{121}{4} \Longrightarrow$

$x+\frac{7}{2}=\pm\frac{11}{2}$

$\boxed{x=-\frac{7\pm 11}{2}}$

OTHER METHOD:

$x^2+7x-18=0$

$x^2+7x \quad =18$

$x^2+7x+\left(\frac{7}{2}\right)^2=18+\frac{49}{4}$

$\left(x+\frac{7}{2}\right)^2=\frac{121}{4}$

etc.

8. $x^2-24x-9=0$

$x^2-24x+12^2=9+144$

$(x-12)^2=153$

$x-12=\pm\sqrt{153}$

$\boxed{x=12\pm\sqrt{153}}$ or $\boxed{x\in\{12\pm\sqrt{153}\}}$

Either is OK

MAT 1340 WP #1 9

9 $5x^2+2x+3=0$

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

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

$5\left(x+\frac{1}{5}\right)^2=-3+5\left(\frac{1}{25}\right)=-3+\frac{1}{5}=\frac{-15+1}{5}$

$5\left(x+\frac{1}{5}\right)^2=\frac{-14}{5}$

$\left(x+\frac{1}{5}\right)^2=-\frac{14}{25}$

$x+\frac{1}{5}=\pm\frac{\sqrt{-14}}{5}$

$\Rightarrow \boxed{x=\frac{-1\pm i\sqrt{14}}{5}}$

MAT 1340 WP #1 10

(10) $4x^2 - 16x + 11 = 0$

$4(x^2 - 4x \quad) = -11$

$4(x^2 - 4x + 2^2) = -11 + 4(2^2)$

$4(x-2)^2 = -11 + 4(4) = -11 + 16 = 5$

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

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

$\Rightarrow \boxed{x = 2 \pm \frac{\sqrt{5}}{2}}$

ALTERNATE solve $f(x) = 4x^2 - 16x + 11 = 0$

$f(x) = 4x^2 - 16x + 11$

$\frac{f(x)}{4} = x^2 - 4x + \frac{11}{4}$ SET 0

$\Rightarrow x^2 - 4x = -\frac{11}{4}$

$x^2 - 4x + 2^2 = -\frac{11}{4} + 4 = \frac{-11+16}{4} = \frac{5}{4}$

$(x-2)^2 = \frac{5}{4}$ etc.

The advantage: we can re-write $f(x)$

$\frac{f(x)}{4} = (x-2)^2 + \frac{5}{4} \Rightarrow$ FOR CHAPTER 7

$f(x) = 4(x-2)^2 - 5$