> # Matt

> # 10 31 date

> $h := n^2 + n + 41;$

$$h := n^2 + n + 41 \quad (1)$$

> $xa[1, 2] := z^2 + 40;$

$$xa_{1, 2} := z^2 + 40 \quad (2)$$

> $both[1, 2] := factor(subs(n = xa[1, 2], h))$

$$both_{1, 2} := (z^2 + z + 41)\,(z^2 - z + 41) \quad (3)$$

> $ya[1, 2] := z^2 + z + 41$

$$ya_{1, 2} := z^2 + z + 41 \quad (4)$$

> # I might have chozen the wrong factored expression. The other option is $z^2 - z + 41$

> # I skipped a little.

> $xa[3, 1] := 3 z^2 + 2 z + 122;$

$$xa_{3, 1} := 3 z^2 + 2 z + 122 \quad (5)$$

> $both[3, 1] := factor(subs(n = x[3, 1], h));$

$$both_{3, 1} := (z^2 + z + 41)\,(9 z^2 + 3 z + 367) \quad (6)$$

> $first[1, 2] := eliminate([x = xa[1, 2], y = ya[1, 2]], z)$

$$first_{1, 2} := [\{z = y - 1 - x\}, \{x + 41 + y^2 - 2 y - 2 y x + x^2\}] \quad (7)$$

> $first[3, 1] := eliminate([x = x[3, 1], y = ya[1, 2]], z)$

$$first_{3, 1} := [\{z = -x - 1 + 3 y\}, \{-4 y + 41 + x^2 + x - 6 y x + 9 y^2\}] \quad (8)$$

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> $xa[3, 2] := 6 z^2 + z + 244;$

$$xa_{3, 2} := 6 z^2 + z + 244 \quad (9)$$

> $both[3, 2] := factor(subs(n = xa[3, 2], h));$

$$both_{3,2} := (4z^2+163)(9z^2+3z+367) \quad (10)$$

> ya[3, 2] := 9 z^2 + 3 z + 367;

$$ya_{3,2} := 9z^2+3z+367 \quad (11)$$

> first[3, 2] := eliminate([x = xa[3, 2], y = ya[3, 2]], z);

$$first_{3,2} := \left[\left\{z = \frac{2}{3}\,y - \frac{2}{3} - x\right\}, \{9x+369-7y+4y^2-12yx+9x^2\}\right] \quad (12)$$

> # There could be many of these observations.

> xa[4, 1] := 4 z^2 + 3 z + 163;

$$xa_{4,1} := 4z^2+3z+163 \quad (13)$$

> both[4, 1] := factor(subs(n = xa[4, 1], h));

$$both_{4,1} := (16z^2+8z+653)(z^2+z+41) \quad (14)$$

> ya[4, 1] := 16 z^2 + 8 z + 653;

$$ya_{4,1} := 16z^2+8z+653 \quad (15)$$

> first[4, 1] := eliminate([x = xa[4, 1], y = ya[4, 1]], z);

$$first_{4,1} := \left[\left\{z = -\frac{1}{4}\,y + \frac{1}{4} + x\right\}, \{16x+656-5y+y^2-8yx+16x^2\}\right] \quad (16)$$

> #last one for today 10-31

> xa[4, 3] := 12 z^2 + 5 z + 489 :

> bothFactors[4, 3] := factor(subs(n = xa[4, 3], h));

$$bothFactors_{4,3} := (16z^2+8z+653)(9z^2+3z+367) \quad (17)$$

> ya[4, 3] := 16 z^2 + 8 z + 653 :

> MoreStableFactor[4, 3] := 9 z^2 + 3 z + 367 :

> first[4, 3] := eliminate([x = xa[4, 3], y = ya[4, 3]], z);

$$first_{4,3} := \left[\left\{z = \frac{3}{4}\,y - \frac{3}{4} - x\right\}, \{16x+656-13y+9y^2-24yx+16x^2\}\right] \quad (18)$$

> # yea

> xa[5, 1] := 5 z^2 + 4 z + 204 :

> BothFactors[5, 1] := factor(subs(n = xa[5, 1], h));

$$BothFactors_{5,1} := (z^2+z+41)(25z^2+15z+1021) \quad (19)$$

> # the BothFactors expression describes cases when h(n) is composite

> ya[5, 1] := 25 z^2 + 15 z + 1021

$$ya_{5,1} := 25z^2+15z+1021 \quad (20)$$

> #five squared is 25 and 5 is the subscript above

> # there are Row Factors and Column Facgtors

> BothFactors[5, 1] := factor(subs(n = xa[5, 1], h));

$$BothFactors_{5,1} := (z^2+z+41)(25z^2+15z+1021) \quad (21)$$

> # this 4th order expression above factors algebraically

> xa[5, 1] := 25 z^2 + 15 z + 1021 :

> $first[5, 1] := eliminate([x = xa[5, 1], y = ya[5, 1]], z);$

$$first_{5, 1} := \left[\left\{z = -\frac{3}{10} - \frac{1}{10}\sqrt{-4075 + 4y}\right\}, \{-y + x\}\right], \left[\left\{z = -\frac{3}{10} + \frac{1}{10}\sqrt{-4075 + 4y}\right\}, \{-y + x\}\right] \quad \textbf{(22)}$$

> *# expression 22 doesn't look right.*

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