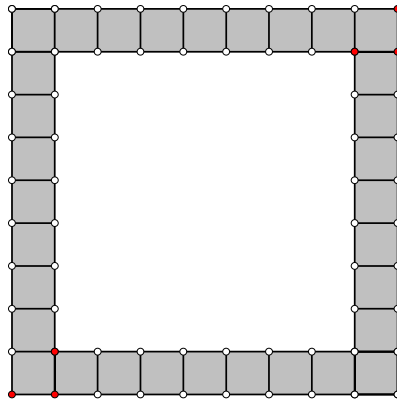


The figure below represents an  $n \times n$  swimming pool surrounded by a walkway made of  $1 \times 1$  tiles. (The figure shown is the  $7 \times 7$  case.)



(a) Come up with as many *different* expressions as you can for the number of  $1 \times 1$  tiles it takes to surround an  $n \times n$  pool.

(b) Repeat the exercise if the walkway is  $m$  tiles wide.

## Ten Things We Learned Teaching Advanced Algebra with the Nspire+CAS

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1. Assessments must change
  - No Calculator Sections
  - COBRA
  - Shorter: Calculator  $\neq$  Faster

- Most Important: Focus on Writing, not just computing

Examples:

In an application involving rational functions, give a real-world interpretation of the asymptotes

Consider the inequality  $\frac{x-2}{x+4} \leq -5$ .

- a. Explain why multiplying both sides by  $(x + 4)$  is incorrect. (It is!)
- b. Compute the solution set to the original inequality. (COBRA)

No calculator: solve  $xy + 4x = 6y - 3x$  for  $y$ .

## 2. Students still don't check answers

- Teachers have to provide frequent exercises to develop number sense.

e.g. Find the domain of  $f(x) = \frac{1}{x-3}$

## 3. Expect unexpected formats

Examples:

Solve for  $r$ :  $V = \frac{4}{3}\pi r^3$

Factor  $\sqrt{2} \cdot x^2 - 4x + 2\sqrt{2}$

Factor  $\sqrt{2} \cdot x^2 - 4x + 2\sqrt{2}$

4. Bring back some traditional topics

Ex. Factor  $x^2 + 6x + 2$  over the reals.

If  $a_n = \frac{7^n}{3^{2n-4}}$ , compute  $\frac{a_{n+1}}{a_n}$ .

5. Use CAS to solve step-by-step

$$\text{Solve } \begin{cases} \frac{5}{4}x + 7y = 13 \\ 3x - \frac{11}{3}y = 4 \end{cases}$$

Step 1: Type the following--

$$\frac{5}{4}x + 7y = 13 \quad \text{ctrl} \rightarrow \text{sto} \rightarrow \text{var} \quad \text{eq1}$$

$$3x - \frac{11}{3}y = 4 \quad \text{ctrl} \rightarrow \text{sto} \rightarrow \text{var} \quad \text{eq2}$$

6. Warnings generate discussion

Solve  $x^2 + 4x = 6x$  for  $x$ .

$$\text{Solve } 2x - 2 = \sqrt{x + 2}$$

7. Verify student conjectures

- We can represent mathematical ideas that are beyond students' manipulative powers.
- Generalization is less time consuming, more natural, and included more often.

Example:

The pool problem: a 1 tile wide walkway; an  $m$  tile wide walkway, an  $n$  by  $m$  pool with a  $p$  tile wide walkway; applying each approach to the 1 tile wide case to the more general problems; a triangular pool.

8. Solve problems in multiple ways.

- The calculator guarantees a second approach
- The calculator allows easy comparison of approaches
- Polya's last phase of problem solving (another approach, a new problem)

Examples:

Diagonals of a polygon: (1)no diagonals to myself or my neighbors; overcounting); (2)  $n$  choose 2 overcounts how?

Similarly, handshakes

9. Use the "Peterson No"

- "What would the calculator do if...?"
- "Is this right?"
- The Difference Quotient

## 10. Top Nspire tips

I	Ctrl-i, Ctrl-x, Ctrl->, Ctrl-<
II	Be abstract!

A termn...	B term	C partsum
=seqn(n,2		
1	a	a
2	a+d	2*a+d
3	a+2*d	3*a+3*d
4	a+3*d	4*a+6*d
5	a+4*d	5*a+10*d
6	a+5*d	6*a+15*d
7	a+6*d	7*a+21*d
8	a+7*d	8*a+28*d
9	a+8*d	9*a+36*d
10	a+9*d	10*a+45*d
11	a+10*d	11*a+55*d

$\text{expand}((x-a)\cdot(x-b)\cdot(x-c))$	$x^3 - a\cdot x^2 - b\cdot x^2 - c\cdot x^2 + a\cdot b\cdot x + a\cdot c\cdot x + b\cdot c\cdot x - a\cdot b\cdot c$
$nCr(n,2)$	$\frac{n\cdot(n-1)}{2}$
$nCr(n,r)$	$\frac{n!}{r!\cdot(n-r)!}$
$\text{propFrac}\left(\frac{x^2+4\cdot x+3}{x-1}\right)$	$\frac{8}{x-1} + x + 5$

III	How to Delete a Table
IV	Why you don't need to be able to do #III
V	Use fractions, not parentheses
VI	Have students explore parameters (Example: logs and exponentials)
VII	Use Sliders
VIII	Be Prepared (for anything!)