Overview: learners will review the concepts of expanded form vs exponential form of a power and design (without actually writing the code) a program

Learning goals:

- I will related a power to expanded form
- I will break down a problem into the steps required to write a program

Success criteria:

- ☐ I can design a program using pseudocode
- ☐ I can convert between exponential form and expanded form of a power

Curricular connections:

- B2.2 analyse, through the use of patterning, the relationships between the exponents of powers and the operations with powers, and use these relationships to simplify numeric and algebraic expressions
- C2.1 use coding to demonstrate an understanding of algebraic concepts including variables, parameters, equations, and inequalities
- C2.2 create code by decomposing situations into computational steps in order to represent mathematical concepts and relationships, and to solve problems

SEL focus:

- Learn to identify and manage emotions, to recognize sources of stress and cope with challenges.
- Learn to maintain positive motivation and perseverance as they apply the mathematical processes or problem solving (develop, select, and apply problem-solving strategies), reasoning and proving (develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to justify thinking, make and investigate conjectures, and construct and defend arguments), and reflecting (demonstrate that as they solve problems, they are pausing, looking back, and monitoring their thinking to help clarify their understanding (e.g., by comparing and adjusting strategies used, by explaining why they think their results are reasonable, by recording their thinking in a math journal)

CRRP:

- All students have the opportunity to contribute to group discussions while working in groups.
- Students are encouraged to explore multiple ways of finding answers
- Students learn from and with each other

Prepwork:

Prerequisites

- Access to a Smart Board and Smart Notebook software to display the lesson file

Technology

- They can do this without using a computer but as an extension you can have them try to write the code from their design

Lesson:

Minds On: have a discussion about the difference between what a computer needs to be told vs. a person
You can use an example such as “please go to the table on the other side of the room and bring me back a worksheet” … how a person does this compared to how a computer needs to be told…
Ie. check if there is anything in the way, if not then step forward, if yes then turn right 90 degrees and step forward, etc.

Action:

Open the Smart Notebook file ….Coding Without Coding Exponents Exercise

The goal of this lesson is to get the students to problem solve using a “coding mindset” so that they analyze the problem and apply it to the expanded form of a power (which they should be familiar with)

The first page of the file is just a review of what is represented with a power

On the 2nd page they are presented with a problem

Have them brainstorm in groups (good opportunity for vertical learning at the whiteboard) what some of the key ideas they will need to consider
Examples might be … exponent needs to be at least 1, exponent should not have decimals
How do I keep track of how many “x 5” need to be displayed, etc.

Once they have come up with some of the key considerations, have them design the program
… you can have them focus on just writing out the steps in “pseudo code” format … there is an example of pseudo code on the 3rd page of the notebook file

The 4th page of the notebook file is a pseudo code example for the example … after they have worked on developing their own this can be used as an example

The 5th page is a reflective part to discuss what this exercise has taught them and how they might approach a problem like that differently in the future

Consolidation: the consolidation for this piece is really just the discussion on page 4 and 5 of the notebook file …. Explain how pseudocode works, what types of things they need to be aware of when coding, how much detail is required, etc.

Assessment:

- Student Self Assessment Tool

Knowledge and Understanding – Subject-specific content acquired in each grade (knowledge), and the comprehension of its meaning and significance (understanding)

Categories	50–59% (Level 1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Knowledge of content *(e.g., terminology, procedural skills, mathematical models)*	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Understanding of content *(e.g., concepts, principles, mathematical structures and processes)*	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough understanding of content

Thinking – The use of critical and creative thinking skills and/or processes

Categories	50–59% (Level 1)	60–69% (Level 2)	70–79% (Level 3)	80–100% (Level 4)
Use of planning skills *(e.g., understanding the problem; generating ideas; formulating a plan of action; selecting strategies, models, and tools; making conjectures and hypotheses)*	uses planning skills with limited effectiveness	uses planning skills with some effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness

Use of processing skills* *(e.g., carrying out a plan: questioning, testing, revising, modelling, solving, inferring, forming conclusions; looking back at a solution: evaluating reasonableness, making arguments in support of a solution, reasoning, justifying, proving, reflecting)*	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness
Use of critical/creative thinking processes* *(e.g., posing and solving problems, critiquing solutions, using mathematical reasoning, evaluating mathematical models, making inferences and testing conjectures and hypotheses)*	uses critical/ creative thinking processes with limited effectiveness	uses critical/ creative thinking processes with some effectiveness	uses critical/ creative thinking processes with considerable effectiveness	uses critical/ creative thinking processes with a high degree of effectiveness

Extensions:

Later on when some experience with scratch has occurred you could have students go back and attempt to code their program design