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| Unit 2 Problem: How Thick Is a Pile of Paper? |

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Problem:**

Calculate the height of a stack of paper using the knowledge that we have learned regarding exponents and exponent laws.



**Materials:**

* Pencil
* 8 ½ x 11 sheet of paper
* Metric ruler
* Calculator

**Your work must show:**

* An understanding of the problem
* A correctly completed table
* Expression of the pattern using exponents
* An accurate measurement of 100 sheets of paper in mm (to 1 decimal place)
* Calculation for one sheet of paper in mm (to 4 decimal places)
* Calculation of the height of pile of paper after 25 folds
* Expression of the calculated height in many different SI units
* Relation of the calculated height to an object of similar size

**Procedure:**

**Part 1**

1. Using a piece of standard sheet of 8 ½ x 11 paper, fold the paper in half to form 2 layers. Fold it in half again. Keep folding the paper until you cannot make the next fold.
2. Complete the table for the number of folds you were able to make.
3. Look for the pattern in the number of layers. Express the pattern in the number of layers as a power.
4. Complete the table and write a power for number of layers after 25 folds. Calculate the power.

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Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_\_\_\_

Please use this as your final copy. Use your own paper to complete the rough copy.

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| **Number**  **of**  **Folds** | **Number**  **of**  **Layers** | ***Number of Layers as Powers*** |
| **0** | 1 |  |
| **1** | 2 |  |
| **2** |  |  |
| **3** |  |  |
| **4** |  |  |
| **5** |  |  |
| **6** |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |
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| 21 |  |  |
| 22 |  |  |
| 23 |  |  |
| 24 |  |  |
| 25 |  |  |

**Part 2**

1. Accurately measure the thickness of 100 sheets (200 pages) in your math textbook using a metric ruler. Record you measurement in mm (to one decimal place).

**Thickness of 100 sheets:**

1. Use this measurement to calculate the thickness of 1 sheet of paper. Record your answer in millimetres (to four decimal places).

*(Show your work)* **Thickness of one sheet:**

1. Calculate how high the layers would be after 25 folds. Record your answer in millimetres (to one decimal place).

*(Show your work)* **Height of stack of paper:**

1. Give your answer in as many different units as you can.

cm m km

1. Give an example of something in real life that is approximately this height or length.

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

1. What have you learned about powers and their exponents laws?
2. What ways can you think of to remember the laws and how to use them?

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Performance Assessment Rubric:   
How Thick Is a Pile of Paper?

**Outcome:**

**N9.1**

Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by:

* representing repeated multiplication using powers
* using patterns to show that a power with an exponent of zero is equal to one
* solving problems involving powers

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|  | | Not Yet | Getting There | Yes | Yes and | Wow |
|  | Conceptual Understanding | | | | | |
| Shows understanding by applying and explaining the patterns that result from folding paper | | shows very limited understanding; unable to use or explain patterns | shows partial understanding; some use of patterns; parts are incomplete or somewhat confusing | shows understanding; uses and explains patterns | Shows thorough understanding | shows advanced understanding; uses and explains patterns effectively and thoroughly |
|  | Procedural Knowledge | | | | | |
| Accurately:  – completes a table showing number of folds and layers; and powers  – uses powers to express the pattern  – evaluates the power for 25 folds  – calculates thickness of 1 layer and the height after 25 folds  – relates thickness to other objects | | limited accuracy; major errors or omissions in:  – completing the table  – using powers to express the pattern  – evaluating the power for 25 folds  – calculating thickness of 1 layer and height after 25 folds  – relating thickness to other objects | partially accurate; many errors or omissions in:  – completing the table  – using powers to express the pattern  – evaluating the power for 25 folds  – calculating thickness of 1 layer and height after 25 folds  – relating thickness to other objects | generally accurate; some errors or omissions in:  – completing the table  – using powers to express the pattern  – evaluating the power for 25 folds  – calculating thickness of 1 layer and height after 25 folds  – relating thickness to other objects | Very accurate; few errors or omission in:  – completing the table  – using powers to express the pattern  – evaluating the power for 25 folds  – calculating thickness of 1 layer and height after 25 folds  – relating thickness to other objects | accurate and precise; no errors in:  – completing the table  – using powers to express the pattern  – evaluating the power for 25 folds  – calculating thickness of 1 layer and height after 25 folds  – relating thickness to other objects |
|  | Problem-Solving Skills | | | | | |
| Uses appropriate strategies to solve the problem successfully and explain the solution | | uses few effective strategies; does not solve the problem successfully (answer is not reasonable) | uses some appropriate strategies, with partial success; may have difficulty explaining the solution | Mostly uses appropriate strategies to successfully solve the problem and explain solutions | uses appropriate strategies to successfully solve the problem and explain solutions | uses effective and often innovative strategies to successfully solve the problem and explain solutions |
|  | Communication | | | | | |
| Presents work and explanations clearly, using appropriate mathematical terminology (e.g., exponent, power, base) | | does not present work and explanations clearly, uses few appropriate mathematical terms | presents work and explanations with some clarity, using some appropriate mathematical terms | presents work and explanations clearly, using appropriate mathematical terms | presents work and explanations clearly and correctly, using appropriate a range of mathematical terms | presents work and explanations precisely and correctly in full sentences, using a range of appropriate mathematical terms |