** Mathematics Assignment 4**

**Cubes and Patterns**

**Date:** Due

**Overview:**

You can use diagrams, models, tables of values, scatter plots, and algebraic expressions to explore patterns involving cubes of different sizes. Build large cubes out of linking cubes. Place stickers on or mark all the outside faces of the linking cubes that make each large cube.

**Cube 1:** 2 × 2 × 2 **Cube 2:** 3 × 3 × 3 **Cube 3:** 4 × 4 × 4 **Cube 4:** 5 × 5 × 5



**Preparation Work and Tasks:**

1. How many linking cubes were used to make the different sized cubes? **(2)**
2. If all of the cubes were taken apart, how many linking cubes will have stickers on them: **(4)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Cube** | **0 Faces** | **1 Face** | **2 Faces** | **3 Faces** |
| 2 × 2 × 2 |  |  |  |  |
| 3 × 3 × 3 |  |  |  |  |
| 4 × 4 × 4 |  |  |  |  |
| 5 × 5 × 5 |  |  |  |  |

1. What strategies could you use to help you complete this project? **(1)**
2. What will you do first? **(1)**
3. In words, what is the pattern rule that tells how many linking cubes you need to build each large cube? **(2)**
4. What is the pattern rule for the number of faces that have stickers on them for the different-sized cubes? **(2)**
5. Make one or more tables of values to record information about the cubes. Include information about the numbers of linking cubes as well as information about the number of linking cubes with stickers. How will you organize each table so that it is easy to find the patterns? **(3)**
6. Write algebraic expressions for each of the patterns. **(3)**
7. What strategies helped you find the pattern rules? **(1)**
8. What did you find most confusing? How did you get around this difficulty? **(1)**
9. Explain why a 1 × 1 × 1 cube is not part of the sequence. **(1)**
10. Explain how to find the *n*th terms in each of your patterns. **(2)**
11. Use your tables of values to draw scatter plots for the large cubes showing term values for 3 faces, 2 faces, 1 face, and 0 faces with stickers. **(2)**

**Evaluation:**

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| --- | --- | --- | --- | --- | --- |
| **Category** | **Level 4** | **Level 3** | **Level 2** | **Level 1** | **%** |
| Depth of Understanding | Demonstrates thorough understanding of concepts. | Demonstrates considerable understanding of concepts. |  |  | 20 |
| Problem Solving / Thinking | Use of procedure includes almost no errors or omissions. | Use of procedures is mostly correct, but there may be a few minor errors and / or omissions. |  |  | 20 |
| Application of Learning | Demonstrates sophisticated ability to make connections between mathematics learning and the real world. | Demonstrates considerable ability to make connections between mathematics learning and the real world. |  |  | 20 |
| Explanation and Justification of Concepts, Procedures, and Problem Solving | Provides thorough, clear and insightful explanations / justifications, using a range of words, pictures, symbols, and / or numbers. | Provides complete, clear and logical explanations / justifications, using appropriate words, pictures, symbols, and / or numbers. |  |  | 20 |
| Use of Mathematical Vocabulary | Uses a broad range of mathematical vocabulary to communicate clearly and precisely. | Uses mathematical vocabulary with considerable clarity and precision. |  |  | 20 |