YOUNG MASTER CHALLENGE

Student Learning Pack
Little Bee (MATHEMATICS)

Resources:

Maths Topics

Article: Maths in Engineering:
From Simple Machines to Mighty Pyramids

Short Videos

Activity 1: Geometry and Tools for Engineers 🛠️

Concept: Before moving heavy blocks, ancient Egyptian engineers had to use geometry and careful measurement to design the pyramid's shape and use math to manage their tools and work teams.

Part 1: Pyramid Design and Measurement (Perimeter)

The engineers of the Great Pyramid made the base a perfect square. This square base helped make sure the pyramid was strong and perfectly balanced.

1. Measuring the Base: If one side of the square pyramid base measures 230 meters long, what is the total distance around the entire base (the perimeter)? (Remember a square has 4 equal sides!)
   - Calculation: 4×230 m= m

Answer: _____ meters (perimeter)

2. Checking the Plan: An engineer checks the side lengths of a new pyramid.
   - Side 1: 185 meters
   - Side 2: 185 meters
   - Side 3: 185 meters
   - Side 4: 185 meters
   - What is the total difference between the perimeter of this small pyramid and the perimeter of the Great Pyramid base from Question 1?
   - Calculation:
     - Small Pyramid Perimeter: 4×185 m= m
     - Difference: (Perimeter from Q1)- (Small Pyramid Perimeter)= m

Answer: _____ meters difference

Part 2: Managing Work and Tools (Multiplication and Time)

1. Tool Inventory: A team is responsible for moving stone blocks up a ramp. They have 7 work crews. If each crew needs 3 large ropes and 4 wooden sledges, how many total ropes are needed for the entire team?
   - Calculation: 7 crews×3 ropes/crew= ropes

Answer: _____ total ropes

2. Sledge Count: Using the same team (7 crews), how many total wooden sledges are needed?
   - Calculation: 7 crews×4 sledges/crew= sledges

Answer: _____ total sledges

3. Work Shift Time: A standard work shift for a pyramid crew is 10 hours. The workers spend 4 hours cutting stone, 3 hours moving blocks, and 1 hour eating and resting. How many hours are left in the shift for the engineer to plan the next day's work?
   - Calculation: 10 hours-4 hours-3 hours-1 hour= hours left

Answer: _____ hours left

Activity 2: Advanced Pyramid Block Counts 🧱
Concept: Ancient engineers used fractions, area, and large-scale arithmetic to calculate the size and number of blocks needed for massive structures.

Part 1: Block Counts (Addition, Subtraction, Fractions, Area, and Patterns)

1. Total Blocks: A small pyramid model has three layers.
   - Layer 1 (Bottom): 52 blocks
   - Layer 2 (Middle): 35 blocks
   - Layer 3 (Top): 13 blocks
   - Calculation: 52+35+13= blocks

Total Blocks: _____ blocks

2. If an engineer plans to use 2,400,000 total blocks for the pyramid, and they have already moved a quarter of the blocks, how many blocks are left to move?

Answer: _____ blocks left

3. a) Bottom Layer Blocks (Area): The pyramid's bottom layer (Layer 1) is a large square measuring 400 meters on each side. If engineers use cube blocks that measure 2 meters on each side, how many blocks are needed to cover one side of the bottom layer?

- Calculation:
  - Total Length of one side (400 m) ÷ Block side (2 m) = Blocks per side

Answer: _____ blocks per side

b)How many blocks are there on the bottom layer?

- Calculation

(Use the area of a square: number of blocks per side x number of blocks per side)

Answer: _____ blocks

c) Layer Reduction (Pattern): The pyramid is built layer by layer. If each subsequent layer has 2 blocks less on each side than the layer directly below it, what is the side length (in blocks) of Layer 10?

- Calculation:
  - Layer 1 Side Length (from Q2): _____ blocks
  - Total Reductions needed (for 9 layers): 9×2= blocks
  - Layer 10 Side Length: (Layer 1 Side) - (Total Reductions) = _____ blocks

Answer: _____ blocks

Part 2: Calculating Total Weight (Simple Multiplication)

1. Heavy Lift: An engineer needs to move 5 very large foundation blocks. Each block weighs 2,000 kg. What is the total weight of the 5 blocks?
   - Calculation: 5×2,000 kg= kg

   Total Weight: _____ kg
2. Small Stone Weight: A worker can pull 10 kg of force. If 3 workers pull together, how much total weight can they pull (without a ramp)?
   - Calculation: 3×10 kg= kg

   Total Pulling Force: _____ kg

Activity 3: The Power of the Ramp 📐

Concept: Engineers use simple machines like the Inclined Plane (Ramp) to make work easier by spreading the force needed over a longer distance. This helps us move heavy objects, like the giant stones for the pyramids!

Part 1: Workers and Weight (Division Practice)

A typical stone block for the Great Pyramid weighed about 1,000 kg. One strong Egyptian worker could pull 10 kg of weight.

1. Direct Lift Challenge: If the workers had to lift the stone block straight up without a ramp, how many workers would be needed?
   - Calculation: 1,000 kg÷10 kg/worker= workers

   Answer: _____ workers

2. The Ramp's Advantage: The engineers built a long ramp that made the job 10 times easier. If the job is 5 times easier, you need 5 times fewer workers!
   - Calculation: (Answer from Question 1)÷5= workers

   Answer: _____ workers

3. Find the Force: If a stone block needs 900 kg of force to move directly, but a special machine makes the job 9 times easier, how much force is actually needed now?
   - Calculation: 900 kg÷9= kg

   Answer: _____ kg

Part 2: Measurement and Comparison & Simple Machines (Simple Subtraction and Ratios)

1. The top of a pyramid is 120 meters high. The first layer of stones is only 5 meters high. How much height is left to build after the first layer?
   - Calculation: 120 m-5 m= m

   Answer: _____ meters

2. If every layer of stone is 5 meters high, how many total layers are there in the entire 120-meter pyramid?
   - Calculation: 120 m÷5 m/layer= layers

   Answer: _____ layers

3. If each 3-meter-high stone were used in the layers instead, how many more layers would there be in the same pyramid of 120m high?

   Answer: _____layers

4. True or False: Two ramps are built to the same height (1 meter). A heavy stone (100 kg) is pushed up each ramp.

- Ramp A (Short): 3 meters long. It takes 4 workers and 10 minutes to move the stone.
- Ramp B (Long): 6 meters long.

Statement: Because Ramp B is twice as long as Ramp A (6m÷3m=2), you will need more than 4 workers OR more than 10 minutes to push the stone to the top.

True or False? _____