Name: _____

Period: _____

UNIT: UKULELE

ACT-BASED MATH: STRING TENSION & ALGEBRAIC RELATIONSHIPS

OBJECTIVE:

Solve **algebraic equations** related to **string tension**.

ACT SCORE TARGET: 33-36

EQUATION: T = (4 × L² × f² × m), where

- T = tension (N)
- L = string length (m)
- f = frequency (Hz)
- m = mass per unit length (kg/m)

STUDENT DIRECTIONS:

Goal:

Use an advanced algebraic formula to calculate the **tension** in a ukulele string based on its **length**, **frequency**, and **mass per unit length**. This will help you connect math to physics and real-world music applications—targeted for students aiming for an **ACT Math score of 33–36**.

✏️ **Step 2: Plug in the Values**

You'll be given different values for L, f, and m, like:

- **L** = 0.6 m
- **f** = 440 Hz
- **m** = 0.0002 kg/m

Insert those into the formula:

$$T = 4(0.6)^2(440)^2(0.0002)$$

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Step 3: Solve Step by Step

1. Square the string length:

$$L^2 = (0.6)^2 = 0.36$$

2. Square the frequency:

$$f^2 = (440)^2 = 193600$$

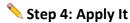3. Multiply all terms:

$$T = 4 \times 0.36 \times 193600 \times 0.0002$$

4. Final answer:

$$T = 55.6032 \approx 55.6 \text{ N}$$

(Note: Actual values may vary slightly depending on rounding in each step.)

✏️ Step 4: Apply It

Use this formula to:

- Calculate **tension** for different string types and sizes.
- Compare the effect of changing frequency or length.
- Analyze how musicians tune strings by changing **tension**.

ACT-STYLE QUESTION:

- If a ukulele string is **0.6 m long**, with a frequency of **440 Hz** and a mass of **0.0002 kg/m**, what is its tension?

    A. 15.4 N
    B. 30.8 N
    C. 61.6 N
    D. 123.2 N