Math in Music: Try other music challenges
Answer Key

The Hip Hop group DobleFlo is trying to mix an electronic drum track with an instrumental sample, but the tempos don't match.

Your challenge is to help DobleFlo mix the tracks by calculating the tempo (speed) of the instrumental sample in BPM (beats per minute).

Go online to www.getthemath.org, click on "The Challenges," then scroll down and click on "Math in Music: Try other music challenges." Select "Next" to begin.

1. **Choose your music. Play the samples and drum tracks and select one of each:**

    Instrumental sample # _____   Electronic drum track # _____
    [See possible combinations on the next page.]

2. **Identify what you already know.**   Select "Next" to continue. Count the number of beats in the sample and write down the length of the sample (in seconds) as indicated above the sample on the screen:

    • The number of beats in the instrumental sample is _____.
    • The length of the instrumental sample is _____ seconds.
      [See possible combinations on the next page.]

3. **Plan it out.**   What is the problem you want to solve? How will you do it?

4. **Solve your problem** in the space below. Show all your steps and be sure to label, for example: seconds, beats.

    Solution: The tempo of the instrumental sample in BPM is:_____
    (Round your answer to the nearest whole beat.)
    [See possible solutions on the next page.]

5. **Listen to the sound of your mixed track.**

    • Do the tempos of the sample and the drum track match up? Explain why your plan did or didn't work. [Student responses will vary depending on their strategy/solutions.]

6. **How did you figure out your final solution?** If you were going to email DobleFlo to explain your strategy, what would you tell them?   [Student responses will vary depending on their strategy/solutions.]

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POSSIBLE COMBINATIONS AND SOLUTIONS
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Here are the possible instrumental sample and drum track combinations and three possible ways to solve the problem for each combination:

COMBINATION A:
Sample #   1   Drum Track #   1, 2 or 3   # of beats   8   Sample Length 5 seconds

Possible Strategies for Combination A:
- **Strategy A1:**
  - **Figure out the length of one beat:** 5 seconds/8 beats = 0.625 seconds per beat
  - **Divide 60 seconds by that length to determine # of beats per minute**:
    60 seconds per minute/0.625seconds per beat = 96 BPM

- **Strategy A2:**
  - **Determine how many samples there are in one minute:**
    Divide 60 seconds by 5 seconds = about 12 samples per minute.
  - **Multiply by the number of beats in the sample:**
    8 beats per sample x 12 samples per minute = 96 BPM.

- **Strategy A3:**
  - **Set up a proportion:**
    Beats in the sample/length of sample = x beats per minute/60 seconds
    8 beats/5 seconds = x beats/60 seconds
    Solving the proportion for x should yield an answer of approximately 96 BPM.

Tempo (in BPM):   96 BPM   *(Note: Round answers to the nearest whole beat.)*

COMBINATION B:
Sample # 2   Drum Track# 1, 2 or 3 # of beats   16   Sample Length   8.571 seconds

Possible Strategies for Combination B:
- **Strategy B1:**
  - **Figure out the length of one beat:** 8.571 seconds/16 beats ≈ 0.5357 seconds per beat
  - **Divide 60 seconds by that length to determine how many beats in a minute:**   60 seconds per minute/0.5357 seconds per beat ≈ 112 BPM

- **Strategy B2**
  - **Determine how many samples there are in one minute:**
    Divide 60 seconds by 8.571 seconds ≈ about 7 samples per minute.
  - **Multiply by the number of beats per sample:**
    16 beats per sample x 7 samples per minute = 112 BPM.

- **Strategy B3:**
    - o **Set up a proportion:**
      Beats in the sample/length of sample = x beats per minute/60 seconds
      16 beats/8.571 seconds = x beats/60 seconds
      Solving the proportion for x should yield an answer of approximately 112 BPM.

Tempo (in BPM):   112 BPM *(Note: Round answers to the nearest whole beat.)*

COMBINATION C:
Sample #   3   Drum Track #   1, 2 or 3   # of beats   8   Sample Length   6   seconds

Possible Strategies for Combination C:
- **Strategy C1:**
    - o **Figure out the length of one beat:** 6 seconds/8 beats = 0.75 seconds per beat
    - o **Divide 60 seconds by that length to determine how many beats in a minute:** 60 seconds per minute/0.75seconds per beat = 80 BPM

- **Strategy C2:**
    - o **Determine how many samples there are in one minute:** Divide 60 seconds by 6 seconds = 10 samples per minute.
    - o **Multiply by the number of beats per sample:**
      8 beats per sample x 10 samples per minute = 80 BPM.

- **Strategy C3:**
    - o **Set up a proportion:**
      Beats in the sample/length of sample = x beats per minute/60 seconds
      8 beats/6 seconds = x beats/60 seconds
      Solving the proportion for x should yield an answer of approximately 80 BPM.

Tempo (in BPM):   80 BPM *(Note: Round answers to the nearest whole beat.)*

7. **If you had the find the tempo of a new instrumental sample, with a different number of beats (let's say, *b* beats) and a different length (*t* seconds),** explain what steps you would take.

Possible Strategies:
- **Set up a proportion:**
  Beats in the sample / length of sample = x beats per minute / 60 seconds
  OR ***b* / *t* = x / 60**
- **Figure out the length of one beat, then divide 60 seconds by that length to determine how many beats in a minute.**
- **Determine how many samples there are in one minute, then multiply by the number of beats in the sample.**