

6. [13 points] Toby listens to music as he walks to class in the morning and notices an interesting phenomenon: the tempo of the music affects his walking speed and thus the time it takes him to get to class. Let $C(b)$ be the number of minutes it takes Toby to get to class when he is listening to music with a tempo of b beats per minute (bpm). You may assume Toby's house is 1.2 miles from his first class.

For parts (a)-(c), write a single mathematical equation using C , C^{-1} , and/or their derivatives that describes the given situation.

- a. [3 points] The tempo of the music Toby is listening to when it takes him 32 minutes to get to class is 89 bpm.

$$\boxed{\text{Solution: } C^{-1}(32) = 89 \text{ or } C(89) = 32.}$$

- b. [3 points] If Toby gets to class in 30 minutes, and he wants to take 31 minutes to get there instead, he should decrease the tempo of his music by approximately 4 bpm.

$$\boxed{\text{Solution: } (C^{-1})'(30) = -4 \text{ or } (C^{-1})'(31) = -4.}$$

- c. [3 points] Toby's average velocity when he listens to music with a tempo of 115 bpm is 0.047 miles per minute.

$$\boxed{\text{Solution: } \frac{1.2}{C(115)} = 0.047}$$

For part (d) give a practical interpretation of the given mathematical equation.

- d. [4 points] $C'(81) = -0.5$

$$\boxed{\text{Solution: } \text{If Toby increases the tempo of his music from 81 to 82 bpm, he will get to class approximately 30 seconds faster.}}$$