Problem 3: Hungry Huskies (14 points)

Feeling the pangs of hunger, you cannot wait to rush to a study break taking place on the 4th floor of MSB. However, as a proud "Hungry Husky," you follow Kevin Ollie's lead in "taking the stairs" instead of skipping to the elevators.[3] As you climb up the (death) spiral staircase, you follow along a trajectory C which is parametrized by

$$\vec{r}(t) = \langle x(t), y(t), z(t) \rangle = \langle 4\cos t, 4\sin t, 3t \rangle \qquad (0 \le t \le 8\pi).$$

The rate at which you burn your calories depends on your coordinate (x, y, z) according to

$$f(x, y, z) = \frac{7}{32\pi^2} \left(z\sqrt{x^2 + y^2} \right).$$

Find $\displaystyle\int_C f \, ds$, the amount of calories burned as you make your way up the stairs to the 4th floor of MSB.

[*Hint:* If you feel the numbers are too large to compute by hand, you may leave them as is, although you might miss out on a surprise.]

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[3]which by the way are awfully unreliable. Where is the 6th floor when you need it?