

7. [9 points] Gwen lifts a bucket of sand straight up from the ground to a height of 10 meters at a constant speed of 0.5 meters per second. The sand is leaking out of the bucket at a rate of $r(t) = \frac{1}{t+1}$ kilograms per second, t seconds after she begins lifting. The bucket and the sand in the bucket together weigh 10 kg when she starts lifting. Recall the gravitational constant is $g = 9.8 \text{ m/s}^2$.
- a. [4 points] Suppose $M(x)$ is the mass of the bucket of sand (in kilograms) when she has lifted it x meters from the ground. Find an expression involving integrals for the work Gwen does lifting the bucket. Your answer can include the function M .
- b. [5 points] Find an expression, possibly involving integrals, for $M(x)$, the mass of the bucket of sand after Gwen has lifted it x meters.