

8. [13 pts.] A large tank is being filled with fresh drinking water. The water flows into the tank at a rate of $r(t) = 50 + 10 \cos\left(\frac{\pi}{2}t\right)$ gallons/hour, where t denotes the number of hours elapsed since we began watching the tank fill.

(a) How fast is the rate of flow changing when $t = 1$? Include appropriate units.

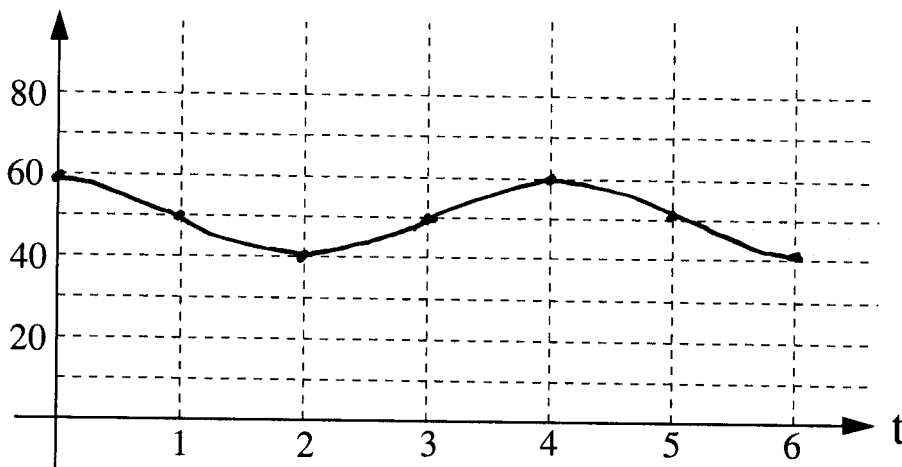
$$r'(1) = 10 \cdot \frac{\pi}{2} (-\sin(\frac{\pi}{2}t)) \Big|_{t=1} = -5\pi \sin(\frac{\pi}{2})$$

$$= -5\pi$$

Final answer to (a):

$$-5\pi \text{ gal/hr}$$

(b) Sketch the graph of $r(t)$ on the axes.



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(c) Use the definite integral to express the area of the region under the graph of $r(t)$, above the t -axis and between the lines $t = 0$ and $t = 3$. (Leave your answer as a definite integral. Do not evaluate it.)

Final answer to (c):

$$\int_0^3 50 + 10 \cos\left(\frac{\pi t}{2}\right) dt$$