

⑧ A faucet is turned on at 9:00am and water starts to flow into a tank at the rate of $r(t) = 10\sqrt{t}$ where t is time in hours after 9:00am and the rate $r(t)$ is in cubic feet per hour.

① How much water, in cubic feet, flows into the tank from 10:00am to 1:00pm?

$$9:00\text{am} \Rightarrow t=0 \quad \int_1^4 10t^{1/2} dt = 10 \cdot \left[\frac{2}{3} t^{3/2} \right]_1^4 = \frac{20}{3} (4)^{3/2} - \frac{20}{3} (1)^{3/2}$$

$$10:00\text{am} \Rightarrow t=1 \quad = 140/3$$

$$1:00\text{pm} \Rightarrow t=4$$

② How many hours after 9:00am will there be 211 cubic feet of water in the tank?

Solution: $\int_0^x 10t^{1/2} dt = 211$

$$\left[\frac{20}{3} t^{3/2} \right]_0^x = 211$$

$$\frac{20}{3} x^{3/2} = 211$$

$$x^{3/2} = \frac{633}{20}$$

$$x = \left(\frac{633}{20} \right)^{2/3} \approx 10$$