2023 AB/BC #1
(calculator-active)

(a)

$\int_{60}^{135} f(t)\,dt$ is the number of gallons of gasoline pumped into the gas tank from $t = 60$ seconds until $t = 135$ seconds from when the pumping began.

Using a right Riemann sum,

$$\int_{60}^{135} f(t)\,dt \approx (90-60)f(90)+(120-90)f(120)+(135-120)f(135)$$

$$= \boxed{(90-60)(0.15)+(120-90)(0.1)+(135-120)(0.05)\ gallons} = 8.25\ gallons$$

(b)

Since f is differentiable on the given interval, then it is continuous on that interval.

Hence f is differentiable and continuous on the interval [60,120].

So by the Mean Value Theorem there must exist a time $t = c$, for $60 < c < 120$, such that

$$f'(c) = \frac{f(120)-f(60)}{120-60} = \frac{0.1-0.1}{60} = 0.$$

(c)

The average rate of flow on $[0,150] = \dfrac{1}{150-0}\int_{0}^{150} g(t)\,dt = \boxed{0.0959966962\dfrac{gal}{\text{sec}}}$ or 0.095 or 0.096

(d)

$g'(140) = \boxed{-0.004908888}$ or -0.004 or -0.005

The rate of flow of the gasoline into the tank is decreasing at 0.00490888 $\dfrac{gal/\text{sec}}{\text{sec}}$

140 seconds after pumping began.