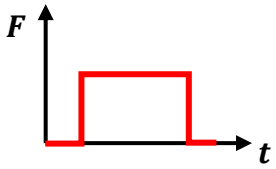
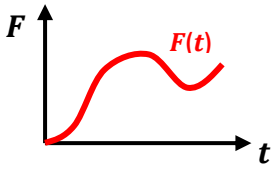
CONCEPT: CALCULATING IMPULSE BY INTEGRATING FORCE-TIME FUNCTIONS

● When given a $F(t)$ function and asked for Impulse between 2 times, take the _____:



● **IMPULSE** ⇒ Area under F vs. t graph



● **IMPULSE** ⇒ Integral of $F(t)$ function ⇒ J = _____

EXAMPLE: A 3000 kg rocket in space fires its engines which exert an increasing force on it given by $F(t) = 6000t^2$. **a)** Calculate the impulse exerted by the rocket engines during the 2 second interval starting 1.5 seconds after the engines are turned on. **b)** Calculate the change in the rocket's velocity during this interval. Assume *constant mass* for the rocket.

PROBLEM**:** A 0.25 kg puck is initially at rest on an icy surface**.** At t = 0, a horizontal force given by $\boldsymbol{F(t)} = 12 - 3t^2$ begins to move it**.** The force acts until its magnitude is zero**. a)** What is the magnitude of the impulse on the puck between t = 0.5s and t = 1.25s? **b)** What is the change in momentum of the puck between t = 0 and the instant at which $\boldsymbol{F} = 0$?

MOMENTUM & IMPULSE
$\boldsymbol{p = mv}$
$\boldsymbol{J = F\Delta t = \Delta p = mv_f - mv_0}$
$\boldsymbol{J = \int_{t1}^{t2} F\, dt}$

PROBLEM**:** A 40kg object slides on a smooth, horizontal surface with an initial eastward momentum of +90 kg·m/s when a force given by $F(t)$ = –8t acts on the object**.** At what value of t does the object have a *westward* momentum of –60 kg·m/s?

MOMENTUM & IMPULSE
$\boldsymbol{p = mv}$
$\boldsymbol{J = F\Delta t = \Delta p = mv_f - mv_0}$
$\boldsymbol{J = \int_{t1}^{t2} F\, dt}$