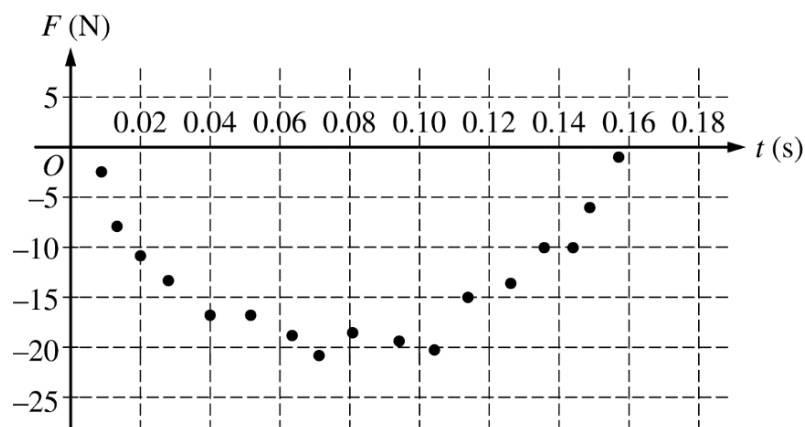


2. Two carts are on a horizontal, level track of negligible friction. Cart 1 has a sensor that measures the force exerted on it during a collision with cart 2, which has a spring attached. Cart 1 is moving with a speed of $v_0 = 3.00 \text{ m/s}$ toward cart 2, which is at rest, as shown in the figure above. The total mass of cart 1 and the force sensor is 0.500 kg , the mass of cart 2 is 1.05 kg , and the spring has negligible mass. The spring has a spring constant of $k = 130 \text{ N/m}$. The data for the force the spring exerts on cart 1 are shown in the graph below. A student models the data as the quadratic fit $F = (3200 \text{ N/s}^2)t^2 - (500 \text{ N/s})t$.



- (a) Using integral calculus, calculate the total impulse delivered to cart 1 during the collision.
- (b)
- Calculate the speed of cart 1 after the collision.
 - In which direction does cart 1 move after the collision?
____ Left ____ Right
____ The direction is undefined, because the speed of cart 1 is zero after the collision.
- (c)
- Calculate the speed of cart 2 after the collision.
 - Show that the collision between the two carts is elastic.
- (d)
- Calculate the speed of the center of mass of the two-cart–spring system.
 - Calculate the maximum elastic potential energy stored in the spring.