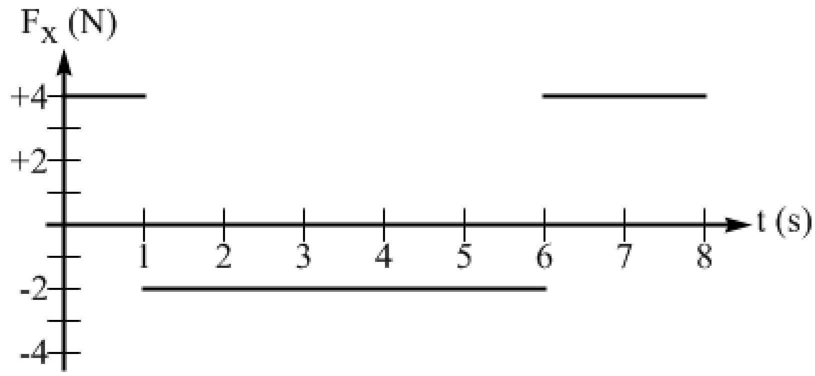
Impulse and Momentum

Let's extend our methods by bringing in new ideas, including momentum.

One useful idea is that an object's change in momentum is equal to the area under the curve of the net force versus time graph. Let's explore this idea a little.

A cart with a mass of 500 g is subjected to the net force shown in the graph. At $t = 0$ the cart has a velocity of 4.0 m/s in the positive x-direction.



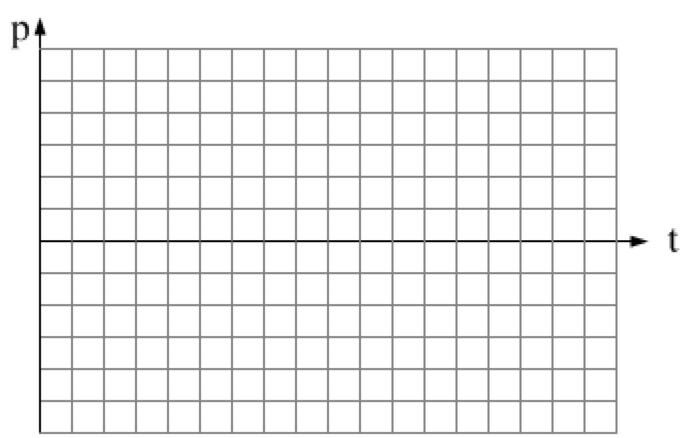
What is the cart's velocity at $t = 5.0$ s?

Does the cart change direction at any time? If so, at what time(s)?

Create a table showing the cart's momentum at 1-second intervals.

Time (s)	Momentum (kg m/s)
0	
1	
2	
3	
4	
5	
6	
7	
8	

Plot a graph of the cart's momentum as a function of time.



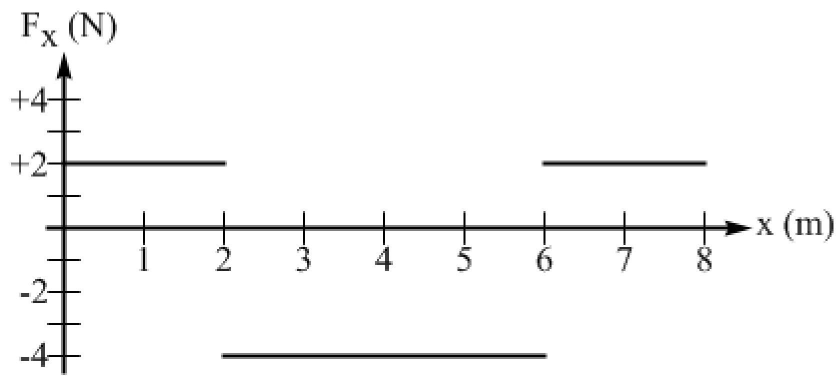
Connecting Force and Energy

We've looked at the connection between force and momentum. Let's look at the analogous connection between force and energy.

An object's change in kinetic energy is equal to the area under the curve of the net force versus position graph. Let's explore this idea a little.

A cart with a mass of 500 g is subjected to the net force shown in the graph below. When the cart is at $x = 0$ the cart has a velocity of 4.0 m/s in the positive x-direction.

What is the cart's speed when it passes through $x = 3.0$ m?



What minimum kinetic energy must the cart have at $x = 0$ to reach $x = 8$ m?

Make a table of the cart's kinetic energy as a function of position.

Position (m)	Kinetic Energy (J)
0	
1	
2	
3	
4	
5	
6	
7	
8	

Plot a graph of the cart's kinetic energy as a function of position.