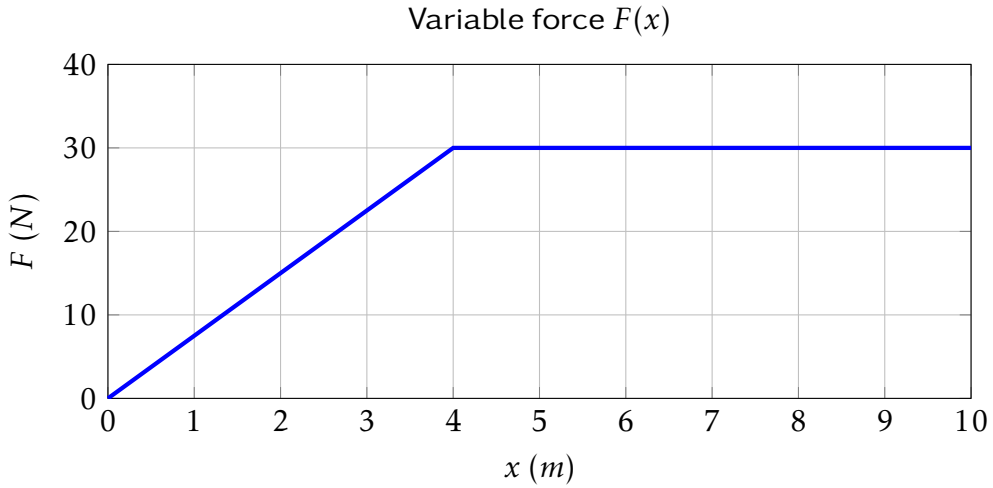
Chapter 6 Applications of the Definite Integral

6.6 – Work

6.6.1 Basic class examples

1. A variable force $F(x)$ in the positive $x-$direction is graphed. How much is done by the force in moving an object a distance of 8 m.



2. A force of 40 N is required to hold a spring that has been stretched from its natural length of 10 cm to a length of 15 cm.
   How much work is done in stretching the spring from 15 cm to 18 cm?
   (We must convert the units cm to meters; 10 cm = 0.1 m and 15 cm = 0.15 m)

3. A water tank has the form of a right circular cylinder with radius 6 ft and height 20 ft. If the tank is full find the work required to pump all of the water to a point 10 ft above the top of the tank.
   The weight density of water is $\rho = 62.4$ lb/ft^3.

4. A cylindrical tank of radius of 6 ft and height 20 ft contains water. If the tank is $\frac{3}{4}$ filled, find the work required to pump all of the water to a point 10 ft above the top of the tank.
   The weight density of water is $\rho = 62.4$ lb/ft^3.

6.6.2 Work - class examples, with geometry complications

1. A tank in the shape of a circular cone (inverted) with height 10 m and radius 4 m across the top. It is filled with water to a height of 8 m. Find the work required to pump all of the water to the top of the tank.

   The weight density of water is $\rho = \left(1000\ kg/m^3\right)\left(9.81 m/s^2\right) = 9810\ N/m^3$.
   You must indicate and clearly label the coordinate system you use.

2. A tank in the shape of a circular cone (inverted) with height 10 m and radius 4 m across the top. It is filled with water to a height of 8 m. Find the work required to pump all of the water to a point 4 m above the top of the tank. *What changes?*

3. A tank has the form of a right cylinder laying on its side (horizontal) has radius 4 ft and length 12 ft is full of gasoline. Find the work to pump all the gasoline to a level 10 ft above the top of the tank. The weight density of gasoline is $\rho = 42$ lb/ft^3.