Example 3

The upward velocity of a rocket is given as a function of time in Table 3.

Table 3 Velocity as a function of time.

t	v(t)
s	m/s
0	0
10	227.04
15	362.78
20	517.35
22.5	602.97
30	901.67

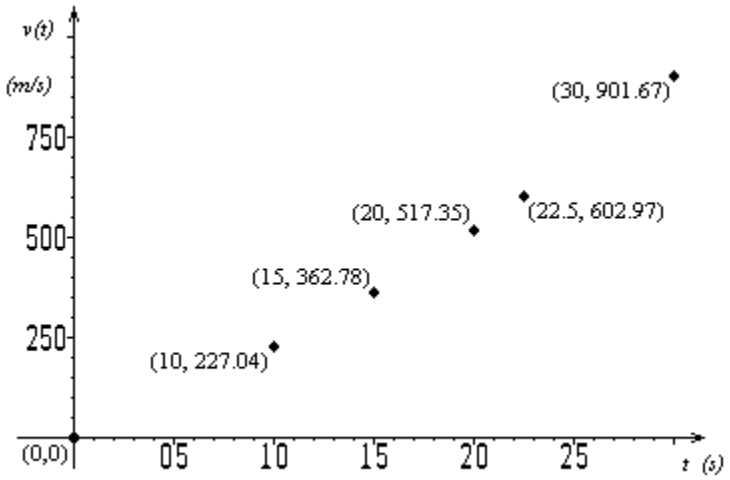

Figure 2 Velocity vs. time data for the rocket example.

Determine the distance, s, covered by the rocket from $t = 0$ to $t = 30$ using the velocity data provided and the trapezoidal rule for discrete data with unequal segments.

Solution

$$\int_0^{30} v(t)dt = \int_0^{10} v(t)dt + \int_{10}^{15} v(t)dt + \int_{15}^{20} v(t)dt + \int_{20}^{22.5} v(t)dt + \int_{22.5}^{30} v(t)dt$$

$$= (10-0)\frac{v(0)+v(10)}{2} + (15-10)\frac{v(10)+v(15)}{2}$$

$$+ (20-15)\frac{v(15)+v(20)}{2} + (22.5-20)\frac{v(20)+v(22.5)}{2}$$

$$+ (30-22.5)\frac{v(22.5)+v(30)}{2}$$

$$= (10)\frac{0 + 227.04}{2} + (5)\frac{227.04 + 362.78}{2}$$

$$+ (5)\frac{362.78 + 517.35}{2} + (2.5)\frac{517.35 + 602.97}{2}$$

$$+ (7.5)\frac{602.97 + 901.67}{2}$$

$$= 1135.2 + 1474.55 + 2200.325 + 1399.9 + 5642.4$$

$$= 11852\,\text{m}$$

Can you find the value of $\int_{10}^{20} v(t)dt$?