

### Solution 21.9

Analytical solution:

$$z(t) = \int_0^t \sqrt{\frac{gm}{c_d}} \tanh\left(\sqrt{\frac{gc_d}{m}} t\right) dt = \left[ \frac{m}{c_d} \ln \left[ \cosh\left(\sqrt{\frac{gc_d}{m}} t\right) \right] \right]_0^t$$
$$z(10) = \left[ \frac{68.1}{0.25} \ln \left[ \cosh\left(\sqrt{\frac{9.81(0.25)}{68.1}} (10)\right) \right] \right]_0^{10} = 334.1782$$

Thus, the result to 3 significant digits is 334. Here are results for various multiple-segment trapezoidal rules:

$n$	$I$
1	247.1068
2	314.6304
3	325.7253
4	329.4623
5	331.1708
6	332.0937
7	332.6485
8	333.0079
9	333.254
10	333.4298
11	333.5599

Thus, an 11-segment application gives the result to 3 significant digits.