Solution 23.27

The first forward difference formula of $O(h^2)$ from Fig. 23.1 can be used to estimate the velocity for the first point at t = 10,

$$\frac{dc}{dt}(10) = \frac{-1.75 + 4(2.48) - 3(3.52)}{2(10)} = -0.1195$$

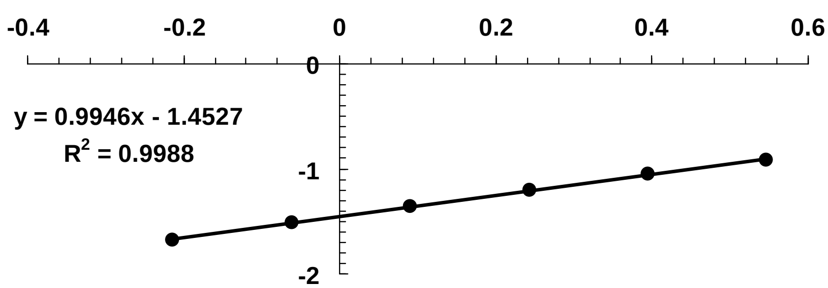
For the interior points, centered difference formulas of $O(h^2)$ from Fig. 23.3 can be used to estimate the derivatives. For example, at the second point at t = 20,

$$\frac{dc}{dt}(20) = \frac{1.75 - 3.52}{2(10)} = -0.0885$$

For the final point, backward difference formulas of $O(h^2)$ from Fig. 23.2 can be used to estimate the derivative. The results for all values are summarized in the following table.

t	***c***	**−*dc*/*dt***	**log *c***	**log(−*dc*/*dt*)**
10	3.52	0.1195	0.546543	-0.92263
20	2.48	0.0885	0.394452	-1.05306
30	1.75	0.0625	0.243038	-1.20412
40	1.23	0.044	0.089905	-1.35655
50	0.87	0.031	-0.06048	-1.50864
60	0.61	0.021	-0.21467	-1.67778

A log-log plot can be developed



The resulting best-fit equation can be used to compute $k = 10^{-1.45269} =$ 0.035262 and n = 0.994579.