Solution 23.12

(*a*) This problem amounts to solving the following integral:

$$x = \int_0^t v(t)\ dt$$

We can use Simpson's 1/3 and 3/8 rule to make this evaluation,

$$x = (16-0)\frac{0+4(34.7+82.8)+2(61.8)+99.2}{3(4)} + (28-16)\frac{99.2+3(112+121.9)+129.7}{8}$$
$$= 923.7333 + 1395.9 = 2319.633 \text{ m}$$

(b) Because the points around t = 28 are equispaced, a centered finite divided difference provides a good estimate

$$a = \frac{dv}{dt} = \frac{135.7-121.9}{32-24} = 1.725\frac{\text{m}}{\text{s}^2}$$

(c) For this case, an $O(h^2)$ forward difference can be used,

$$a = \frac{dv}{dt} = \frac{-61.8+4(34.7)-3(0)}{8-0} = 9.625\frac{\text{m}}{\text{s}^2}$$