## Solution 21.19

The required quantities can be computed at the sample points and tabulated as

<i>y</i> , m	<i>H</i> , m	<i>U</i> , m/s	HU (m <sup>2</sup> /s)
0	0	0	0
1	1	0.1	0.1
3	1.5	0.12	0.18
5	3	0.2	0.6
7	3.5	0.25	0.875
8	3.2	0.3	0.96
9	2	0.15	0.3
10	0	0	0

The cross-sectional area can be computed with a combination of the trapezoidal rule and two applications of Simpson's 3/8 rule,

$$A_c = \int_0^y H(y) \, dy = (1 - 0) \frac{0 + 1}{2} + (7 - 1) \frac{1 + 3(1.5 + 3) + 3.5}{8} + (10 - 7) \frac{3.5 + 3(3.2 + 2) + 0}{8}$$
$$= 0.5 + 13.5 + 7.1625 = 21.1625 \text{ m}^2$$

The average depth is

$$H = \frac{A_c}{v} = \frac{21.1625 \text{ m}^2}{10 \text{ m}} = 2.11625 \text{ m}$$

The flow is

$$Q = \int_0^y H(y)U(y) \, dy = (1-0)\frac{0+0.1}{2} + (7-1)\frac{0.1 + 3(0.18 + 0.6) + 0.875}{8} + (10-7)\frac{0.875 + 3(0.96 + 0.3) + 0}{8}$$
$$= 0.05 + 2.48625 + 1.745625 = 4.281875 \frac{\text{m}^2}{\text{s}}$$

The average velocity is

$$U = \frac{Q}{A_c} = \frac{4.281875 \text{ m}^3/\text{s}}{21.1625 \text{ m}^2} = 0.202333 \frac{\text{m}}{\text{s}}$$

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