

- 5 1. A pneumotachograph measures the air flow through the throat (in liters per second). The integral of the air flow equals the volume of air exhaled. Using Simpson's Rule, from the following data, estimate the volume of the air exhaled:

$t(\text{sec})$	0	0.2	0.4	0.6	0.8	1.0	1.2
$f(t)(\text{liters/sec})$	0	0.2	0.35	1.0	1.6	1.9	2.2

Solution. Using Simpson's formula we have

$$\begin{aligned} V &\approx \frac{.2}{3} [0 + 4(.2) + 2(.35) + 4(1.0) + 2(1.6) + 4(1.9) + 2.2] \\ &= \frac{.2}{3} (18.5), \\ &= 1.233 \text{ liters} \end{aligned}$$

- 5 2. Evaluate $\int_3^{10} \frac{2x}{\sqrt{x^2-9}} dx$.

Solution. The denominator goes to zero at $x = 3$. Thus

$$\int_3^{10} \frac{2x}{\sqrt{x^2-9}} dx = \lim_{a \rightarrow 3^+} \int_a^{10} \frac{2x}{\sqrt{x^2-9}} dx.$$

Use the substitution $u = x^2 - 9$, $du = 2x dx$ to obtain

$$\begin{aligned} &= \lim_{a \rightarrow 3^+} \int_{a^2-9}^{91} \frac{du}{\sqrt{u}}, \\ &= \lim_{a \rightarrow 3^+} 2\sqrt{u} \Big|_{a^2-9}^{91}, \\ &= \lim_{a \rightarrow 3^+} [2\sqrt{91} - 2\sqrt{a^2-9}], \\ &= 2\sqrt{91} \end{aligned}$$