48. Let $X(t) = -1$ for $0 \leq t < 1$, $X(t) = 1$ for $1 \leq t < 2$, and $X(t) = 2$ for $2 \leq t \leq 3$. Find
$$\int_0^3 X(t)\mathrm{d}W(t)$$
and its distribution.

49. Finish the proof of Theorem 6.4 if $l = k$.

50. Let W be Brownian motion. Verify directly that
$$\int_0^t s\mathrm{d}W(s) = tW(t) - \int_0^t W(s)\mathrm{d}s.$$

51. Let W be Brownian motion. Verify directly that
$$\int_0^t W^2(s)\mathrm{d}W(s) = \frac{1}{3}W^3(t) - \int_0^t W(s)\mathrm{d}s.$$

52. Let W be Brownian motion. Show that
$$\mathbb{E}\left(\left(\int_0^T W(s)\mathrm{d}W(s)\right)^2\right) = \int_0^T \mathbb{E}(W^2(s))\mathrm{d}s.$$

53. Use Itô's formula to find an expression for $\int_0^T W^m(t)\mathrm{d}W(t)$ for $m \in \mathbb{N}$.

54. What does Itô's formula for BM say if $f(t,x) = e^{\lambda x - \frac{\lambda^2 t}{2}}$ with $\lambda \in \mathbb{R}$?

55. Let W be Brownian motion. Use Itô's formula to find
    (a) $\mathrm{d}e^{W(t)}$;
    (b) $\mathrm{d}\sin(W(t))$;
    (c) $\mathrm{d}\cos(W(t))$;
    (d) $\mathrm{d}e^{iW(t)}$.