

(1) [5] Evaluate $\int_0^1 x(\sqrt[3]{x} + \sqrt[4]{x}) dx$.

$$\begin{aligned}
 \int_0^1 x(x^{1/3} + x^{1/4}) dx &= \int_0^1 (x^{4/3} + x^{5/4}) dx \\
 &= \left[\frac{3}{7} x^{7/3} + \frac{4}{9} x^{9/4} \right]_0^1 \\
 &= \left(\frac{3}{7} + \frac{4}{9} \right) - (0+0) \\
 &= \frac{27+28}{63} \\
 &= \boxed{\frac{55}{63}}
 \end{aligned}$$

(2) [5] Find the derivative of $h(x) = \int_2^{1/x} \arctan(t) dt$.

$$\begin{aligned}
 \frac{d}{dx} \int_2^{1/x} \arctan(t) dt \\
 &= \arctan\left(\frac{1}{x}\right) \cdot \left(-\frac{1}{x^2}\right) \\
 &= \boxed{\frac{-\arctan\left(\frac{1}{x}\right)}{x^2}}
 \end{aligned}$$

(3) [5] Evaluate $\int_1^4 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$.

$$\begin{array}{l|l} \text{Let } u = \sqrt{x} & x=1 \Rightarrow u = \sqrt{1} = 1 \\ du = \frac{1}{2\sqrt{x}} dx & x=4 \Rightarrow u = \sqrt{4} = 2 \end{array}$$

$$\therefore \int_1^4 \frac{e^{\sqrt{x}}}{\sqrt{x}} dx = 2 \int_1^4 e^{\sqrt{x}} \frac{1}{2\sqrt{x}} dx$$

$$= 2 \int_1^2 e^u du$$

$$= 2 [e^u]_1^2$$

$$= \boxed{2(e^2 - e)}$$