(1) [8] Evaluate

$$\int_{\sqrt{2}}^{2} \frac{1}{t^2\sqrt{t^2-1}}\,dt$$

Let $t = \sec\theta$

$dt = \sec\theta\tan\theta\,d\theta$

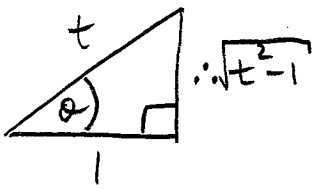
$\therefore I = \int \frac{1}{t^2\sqrt{t^2-1}}\,dt$

$= \int \frac{1}{\sec^2\theta\sqrt{\sec^2\theta-1}}\sec\theta\tan\theta\,d\theta$

$= \int \frac{1}{\sec^2\theta\tan\theta}\cdot\sec\theta\tan\theta\,d\theta$

$= \int \cos\theta\,d\theta$

$= \sin\theta + C$



$\therefore I = \sin\theta + C$

$= \frac{\sqrt{t^2-1}}{t} + C.$

$\therefore \int_{\sqrt{2}}^{2} \frac{1}{t^2\sqrt{t^2-1}}\,dt$

$= \left[\frac{\sqrt{t^2-1}}{t}\right]_{\sqrt{2}}^{2}$

$= \frac{\sqrt{3}}{2} - \frac{1}{\sqrt{2}}$

$= \boxed{\frac{\sqrt{6}-2}{2\sqrt{2}}}$

(2) [7] Determine

$$I = \int \frac{x-9}{(x+5)(x-2)}\,dx$$

$$\frac{x-9}{(x+5)(x-2)} = \frac{A}{x+5} + \frac{B}{x-2}$$

$$= \frac{Ax - 2A + Bx + 5B}{(x+5)(x-2)}$$

$$= \frac{(A+B)x - 2A + 5B}{(x+5)(x-2)}$$

$\therefore A + B = 1$

$-2A + 5B = -9$

$\therefore -2A + 5(1-A) = -9$

$-7A = -14$

$A = 2$

$B = -1$

$$\therefore I = \int \frac{2}{x+5} - \frac{1}{x-2}\,dx$$

$$= \boxed{2\ln|x+5| - \ln|x-2| + C.}$$