

$$a) \int x^2 \sin \frac{x}{2} \cos \frac{x}{2} dx = \frac{1}{2} \int x^2 \sin x dx$$

$$\sin \frac{x}{2} \cos \frac{x}{2} = \frac{1}{2} \sin x$$

$$\int x^2 \sin x = -x^2 \cos x + \int 2x \cos x dx = -x^2 \cos x + 2x \sin x - \int 2 \sin x dx$$

$$= -\frac{1}{2} x^2 \cos x + x \sin x + \cos x + c$$

$$b) \int_0^{\pi/2} \frac{3 \cos x}{4 + \cos^2 x} dx = \int_0^{\pi/2} \frac{3 \cos x}{5 - \sin^2 x} dx = \int_0^1 \frac{3 dt}{5 - t^2}$$

$$\sin x = t \quad \cos x dx = dt$$

$$= 3 \int_0^1 \frac{1}{(\sqrt{5}-t)(\sqrt{5}+t)} dt = \frac{3}{2\sqrt{5}} \int_0^1 \left[\frac{1}{\sqrt{5}-t} + \frac{1}{\sqrt{5}+t} \right] dt$$

$$= \frac{3}{2\sqrt{5}} \lg \left| \frac{t+\sqrt{5}}{t-\sqrt{5}} \right| \Big|_0^1 = \frac{3}{2\sqrt{5}} \lg \frac{\sqrt{5}+1}{\sqrt{5}-1}$$