1. Find the derivative of $\int_{2x}^{3x} \frac{u^2 - 1}{u^2 + 1} \, du$.

2. Use $\int_0^{\pi/2} \sin(x) \, dx$ to compute $\int_0^1 \arcsin(x) \, dx$.
   (Hint: Interpret these integrals as areas and be sure to sketch pictures.)

3. (a) If $f(x)$ is the slope of a trail at a distance of $x$ miles from the start of the trail, what does $\int_3^5 f(x) \, dx$ represent?
   (b) The current in a wire is defined as the derivative of the charge: $I(t) = Q'(t)$. What does $\int_a^b I(t) \, dt$ represent?
   (c) If $x$ is measured in metres and $f(x)$ is measured in newtons, what are the units for $\int_0^{100} f(x) \, dx$?

4. Compute the definite integrals.
   (a) $\int_0^{\pi/4} \tan x \, dx$
   (b) $\int_0^\pi \sin^2 \theta \, d\theta$
   (c) $\int_0^{\pi/2} \cos(u) \sin(\sin(u)) \, du$
   (d) $\int_{\sqrt{\ln 8}}^{\sqrt{\ln 3}} 4t e^{t^2} \sqrt{e^{t^2} + 7} \, dt$
   (e) $\int_{-\pi/2}^{\pi/2} e^{x^2 + 3x^4 + 7} \cos(x) \sin(\sin(\sin(x))) \, dx$
   (f) $\int_0^1 \frac{e^z + 1}{e^z + z} \, dz$

5. (a) Find the indefinite integrals.
   i. $\int \cos^2 \theta \sin^3 \theta \, d\theta$
   ii. $\int \cos^3 \theta \sin^2 \theta \, d\theta$
   iii. $\int \cos^2 \theta \sin^2 \theta \, d\theta$
   (b) Come up with a strategy for finding $\int \cos^m(\theta) \sin^n(\theta) \, d\theta$ for any arbitrary pair of natural numbers $m$ and $n$. 

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