1. Compute the integrals.

   (a) (6%) $\int x(\sin 2x + \cos x)dx$.　　　(b) (9%) $\int \frac{8x-4}{x^2(x^2+4)}dx$.

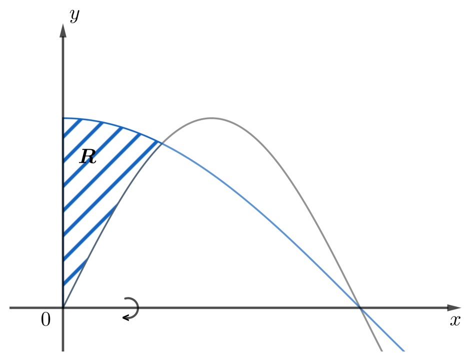
2. (a) (3%) Evaluate and simplify $\frac{d}{dx}\ln\left(\sqrt{x^2+1}+x\right)$.

   (b) (5%) Evaluate $\int \sec x\, dx$.

   (c) (7%) Use (b) and trigonometric substitution to find $\int_0^1 \frac{1}{\sqrt{x^2+1}}dx$.

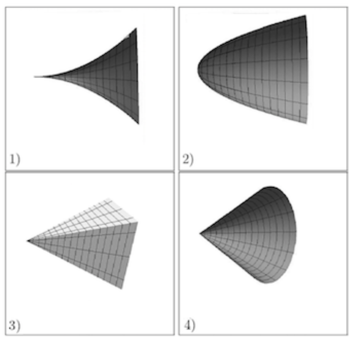
   (d) (7%) Use (a) and integration by parts to evaluate the integral $\int_0^1 \ln\left(\sqrt{x^2+1}+x\right) dx$.

3. (a) (10%) Let R be the region bounded by $y = \cos x$, $y = \sin 2x$ and $x = 0$ in the first quadrant. Rotate R about the x-axis. Find the volume of the resulting solid.



   (b) (6%) (A) $\int_0^1 \pi x\, dx$. (B) $\int_0^1 \pi x^4\, dx$. (C) $\int_0^1 \pi x^2\, dx$. (D) $\int_0^1 x^2\, dx$.
   Match each solid with the integral that represents its volume.

Integrals	A	B	C	D
Solid				



4. (8%) Find the length of the curve

$$y = f(x) = \int_1^x \sqrt{t^3-1}\, dt, \quad 1 \le x \le 4.$$

5. Let $f(x) = xe^x$. (When finding the following Taylor series, you don't need to specify the range of x for which the series equals the function.)

   (a) (4%) Find the Taylor series for $f(x)$ at $x = 0$.

   (b) (7%) Calculate $\int_0^x te^t\, dt$ and find its Taylor series at $x = 0$.

   (c) (4%) Find the sum $\sum_{n=0}^{\infty} \frac{1}{n!(n+2)}$.

6. (a) (6%) Find the Taylor series for $f(x) = \ln(1-x^2)$, $g(x) = \cos x - 1$, and $h(x) = \sin(2x^4)$ at $x = 0$. (You don't need to specify the range of x for which the function equals its Taylor series.)

(b) (4%) Evaluate $\lim_{x \to 0} \frac{(\cos x - 1)\ln(1 - x^2)}{\sin(2x^4)}$.

7. (a) (6%) Compute $\lim_{x \to 0} \frac{\int_0^{4x^2} \cos(\sqrt{t})dt}{x^2}$ by L'Hospital's Rule.

(b) (8%) Compute $\lim_{x \to \infty} (1 + x)^{1/\ln x}$.