1. Find each limit, (if it exists).

(a) $\lim_{x\to\infty} \dfrac{2x^2-1}{5x^2+3x}$

(b) $\lim_{x\to 0+} \dfrac{\ln x}{\csc x}$

(c) $\lim_{x\to 1} \dfrac{2x^2-(3x+1)\sqrt{x}+2}{x-1}$

(d) $\lim_{x\to\infty} \dfrac{\sqrt{9x+1}}{\sqrt{x+1}}$

(e) $\lim_{x\to\frac{\pi}{4}} \dfrac{\sin x-\cos x}{x-\frac{\pi}{4}}$

(f) $\lim_{x\to 0} \dfrac{x\tan x}{1-\cos x}$

(g) $\lim_{x\to 3} \dfrac{x-3}{x^2-3}$

(h) $\lim_{x\to\infty} \dfrac{\ln x}{\sqrt{x}}$

(i) $\lim_{x\to 0} x\cot x$

(j) $\lim_{x\to 0} \left(\dfrac{\sin x}{x}\right)^{\frac{1}{x^2}}$

(k) $\lim_{x\to 0^+} (1+ax)^{\frac{b}{x}}$

(l) $\lim_{x\to 0^+} x^x$

2. Find a value of c that makes the function

$$f(x) = \begin{cases} \frac{9x - 3\sin 3x}{5x^3} & \text{if } x \neq 0 \\ c & \text{if } x = 0 \end{cases}$$

continuous at $x = 0$

3. (a) The **sine integral** $Si(x) = \int_0^x \frac{\sin u}{u}\, du$ is a useful function in applied mathematics.

Find $\lim_{x \to 0} \frac{Si(x)}{x}$

(b) The **Fresnel cosine integral** $C(x) = \int_0^x \cos(u^2)\, du$ is used in the analysis of the diffraction of light.

Find: $\lim_{x \to 0} \frac{C(x) - x}{x^5}$