[1]   Evaluate each integral.

(a) $\int \dfrac{x^2 + x + 3}{x^4 + 6x^2 + 9}\,dx$

(b) $\int \tan^3 x \sec^5 x\,dx$

(c) $\int_0^2 e^{-x} \cos(x) \, dx$

(d) $\int x^3 \sin 3x \, dx$

(e) $\displaystyle\int_{-\pi}^{\pi} \sin(3\theta)\cos(\theta)\,d\theta$

(f) $\displaystyle\int \sqrt{4-9x^2}\,dx$

(g) $\int \cos(\ln x)\, dx$

(h) $\int \dfrac{1}{x - \sqrt{x}}\, dx$

(i) $\int \sqrt{3 - 2x - x^2}\, dx$

(j) $\int \dfrac{2x^2 + 13}{(1-x)(x^2 + 4)}\, dx$

[2] Evaluate each limit. Your answer should be a number, $\infty, -\infty$, or DNE.

(a) $\lim\limits_{x \to 2^-} \dfrac{\sqrt{4 - x^2}}{x - 2}$, form:

(b) $\lim\limits_{x \to 1} \dfrac{\arctan(x) - \left(\pi/4\right)}{x - 1}$, form:

(c) $\lim\limits_{x \to +\infty} \dfrac{\sin(x)}{x - \pi}$, form:

(d) $\lim\limits_{x \to 0^+} \left(e^x + x\right)^{2/x}$, form:

(e) $\lim\limits_{x \to +\infty} (1+x)^{1/x}$, form:

(f) $\lim\limits_{x \to 1^+} (\ln x)^{(x-1)}$, form:

(g) $\displaystyle\lim_{x\to+\infty} x\tan\left(\frac{1}{x}\right)$, form:

[3] Determine if each improper integral converges or diverges. If it converges, state its value.

(a) $\displaystyle\int_0^\infty \frac{1}{4+x^2}\,dx$