1. Let $f(x) = \sqrt{x+3} + x^3$. Given that f is one-to-one, find $g'(3)$ where $g = f^{-1}$.

2. True or False:

   (a) $\frac{d}{dx}10^x = x10^{x-1}$

   (b) $\frac{d}{dx}\ln 10 = \frac{1}{10}$

   (c) $\ln(x+y) = \ln x + \ln y$

   (d) $\ln x - \ln y = \frac{\ln x}{\ln y}$

   (e) $\ln 5x^2 = 2\ln 5x$

3. If $y = (\sec x)^{\ln x}$ find y'.

4. Find the derivative of the following functions. (Do not simplify)

   (a) $f(x) = \sqrt{1 + xe^{-3x}}$

   (b) $f(x) = e^{x^2+5x}\sin^{-1}3x$

   (c) $f(x) = x^2\ln(x^2 - 3x - 7)$

   (d) $f(x) = \ln\sqrt{\dfrac{3x-2}{5x-3}}$

   (e) $f(x) = 3^{2x^2+5x-7}$

   (f) $f(x) = \ln\left(e^3 + e^{2x+1}\right)$

5. Find $\displaystyle\int_0^{1/4} \frac{1}{\sqrt{1-4x^2}}\,dx$.

6. Evaluate the following integrals.

   (a) $\displaystyle\int \frac{e^{-\sqrt{x}}}{\sqrt{x}}\,dx$

   (b) $\displaystyle\int \frac{e^{2x}}{e^{4x}+4}\,dx$

   (c) $\displaystyle\int \frac{dx}{x\ln x^2}$

   (d) $\displaystyle\int \frac{\sin \pi x}{7 + \cos \pi x}\,dx$

7. Evaluate the following limits.

   (a) $\displaystyle\lim_{x\to 0} \frac{\cos 3x - \cos 5x}{x^2}$

   (b) $\displaystyle\lim_{x\to \pi/2} \left(\frac{\pi}{2} - x\right)\tan x$

   (c) $\displaystyle\lim_{x\to\infty} x^{1/x}$

ANSWERS

1. $\dfrac{4}{13}$

2. (a) F

   (b) F

   (c) F

   (d) F

   (e) F

3. $y' = (\sec x)^{\ln x} \left[(\ln x)\tan x + \dfrac{\ln(\sec x)}{x} \right]$

4. (a) $f'(x) = \dfrac{1}{2}(1 + xe^{-3x})^{-1/2}(-3xe^{-3x} + e^{-3x})$

   (b) $f'(x) = e^{x^2+5x}\dfrac{3}{\sqrt{1-9x^2}} + (2x+5)e^{x^2+5x}\sin^{-1}3x$

   (c) $f'(x) = x^2 \cdot \dfrac{2x-3}{x^2-3x-7} + 2x\ln(x^2-3x-7)$

   (d) $f'(x) = \dfrac{1}{2}\cdot\dfrac{3}{3x-2} - \dfrac{1}{2}\cdot\dfrac{5}{5x-3}$ (This comes from rewriting f as

   $f(x) = \dfrac{1}{2}\ln(3x-2) - \dfrac{1}{2}\ln(5x-3)$)

   (e) $f'(x) = 3^{2x^2+5x-7}(4x+5)\ln 3$

   (f) $f'(x) = \dfrac{2e^{2x+1}}{e^3 + e^{2x+1}}$

5. $\dfrac{\pi}{12}$

6. (a) $-2e^{-\sqrt{x}} + C$

   (b) $\dfrac{1}{4}\tan^{-1}\left(\dfrac{e^{2x}}{2}\right) + C$

   (c) $\dfrac{1}{2}\ln\left|\ln x^2\right| + C$

   (d) $-\dfrac{1}{\pi}\ln|7+\cos\pi x| + C$

7. (a) 8

   (b) 1

   (c) 1