1. Find the exact value of each of the following.

   (a) $\cos^{-1}(1)$

   (b) $\sec^{-1}(2)$

   (c) $\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

   (d) $\tan^{-1}\left(\sqrt{3}\right)$

   (e) $\csc^{-1}\left(-\sqrt{2}\right)$

   (f) $\cos^{-1}\left(-\frac{\sqrt{2}}{2}\right)$

   (g) $\sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)$

   (h) $\cos^{-1}\left(\frac{1}{2}\right)$

   (i) $\tan^{-1}(-1)$

   (j) $\sin^{-1}\left(-\frac{1}{2}\right)$

   (k) $\tan^{-1}(0)$

   (l) $\sin^{-1}(2)$

2. Find *exact* solutions to the following equation in the interval $[0, 2\pi)$.

   $2\cos^2(t) + 3\cos(t) + 1 = 0$

3. Approximate the solutions to the following equation in the interval $[0, 2\pi)$ (to four significant figures).

   $6\cos^3(x) + 18\cos^2(x) - 5\cos(x) - 15 = 0$

4. Find the derivative of each of the following.

(a) $y = \sec^{-1}\left(5x^2 - 2\right)$

(b) $f(x) = x^3 \cos^{-1}(x)$

(c) $g(x) = \sin^{-1}(2x) + \sin\left(x^{-1}\right) + (\sin(2x))^{-1}$

(d) $y = \dfrac{\arctan(x)}{1 + x^2}$

5. Evaluate the following integrals.

(a) $\displaystyle\int \frac{9}{x^2 + 4}\, dx$

(b) $\displaystyle\int \frac{6x}{x^2 + 9}\, dx$

(c) $\displaystyle\int \frac{2}{\sqrt{16 - x^2}}\, dx$

(d) $\displaystyle\int \frac{7}{x\sqrt{x^2 - 25}}\, dx$

(e) $\displaystyle\int \frac{e^{3x}}{\sqrt{1 - e^{6x}}}\, dx$

(f) $\displaystyle\int \frac{1}{x\sqrt{x^4 - 1}}\, dx$

6. (From the 200? AP Calculus AB exam) Let R be the region in the first and second quadrants bounded above by the graph of $y = \dfrac{20}{1+x^2}$ and below by the horizontal line $y = 2$. Find the area of R.

7. (From the 200? AP Calculus AB exam) A particle moves along the y-axis so that its velocity v at time $t \geq 0$ is given by $v(t) = 1 - \tan^{-1}\left(e^t\right)$. At time $t = 0$, the particle is at $y = -1$.

   (a) Find the acceleration of the particle at time $t = 2$.

   (b) Is the speed of the particle increasing or decreasing at time $t = 2$? Give a reason for your answer. (Note: Speed is the absolute value of velocity.)

   (c) Find the time $t \geq 0$ at which the particle reaches its highest point. Justify your answer.