Problem 1. Use part I of the fundamental theorem of calculus to find the derivative of the following functions.

1. * $f(x) = \displaystyle\int_2^{1/x} \sin^4 t\, dt.$
2. $f(x) = \displaystyle\int_1^{\sqrt{x}} \frac{z^2}{z^4+1}\, dz.$
3. $f(x) = \displaystyle\int_{3x}^{2x} \frac{t}{1+t^2}\, dt.$
4. $f(x) = \displaystyle\int_{\sqrt{x}}^{x^3} \cos(\theta^2)\, d\theta.$

Problem 2. Evaluate the following definite integrals using part II of the fundamental theorem of calculus.

1. * $\displaystyle\int_1^2 \frac{s^4+1}{s^2}\, ds.$
2. $\displaystyle\int_{-1}^{2} (3u-2)(u+1)\, du.$
3. $\displaystyle\int_0^{\pi} f(x)\, dx$ where $f(x) = \max\{\sin x, \cos x\}$.
4. $\displaystyle\int_1^{18} \sqrt{\frac{3}{z}}\, dz.$

Problem 3. Evaluate the following indefinite integrals.

1. * $\displaystyle\int \frac{1+\sqrt{x}+x}{\sqrt{x}}\, dx.$
2. $\displaystyle\int \frac{1-\sin^3 t}{\sin^2 t}\, dt.$
3. $\displaystyle\int \frac{\sin 2x}{\sin x}\, dx.$
4. $\displaystyle\int \frac{\sin\theta + \sin\theta\tan^2\theta}{\sec^2\theta}\, d\theta.$

Problem 4. Use the net change theorem to find the distance travelled by a particle moving in a straight line in the given time interval when its velocity $v(t)$ varies with time t as folllows.

1. * $v(t) = t - 3$ for $2 \le t \le 5$.
2. $v(t) = \sin t$ for $0 \le t \le 3\pi/2$.
3. $v(t) = 3t - 5$ for $0 \le t \le 3$.
4. $v(t) = t^2 - 2t - 3$ for $2 \le t \le 4$.