Main problems:

1. We begin by solving some more straight forward examples
   (a) $\int x\cos(x)\,dx$
   (b) $\int_0^1 xe^x\,dx$
   (c) $\int xe^{x^2}\,dx$
   (d) $\int_1^2 x\ln(x)\,dx$
2. We now solve some trickier problems
   (a) Find the average value of $\ln(x)$ between $x = 1$ and $x = 5$.
   (b) Compute $\int e^{\sqrt{x}}\,dx$
   (c) Compute $\int x^2\sin(x)\,dx$
   (d) Compute $\int_0^1 \arcsin(x)\,dx$
   (e) Compute $\int e^{2x}\cos(x)\,dx$
   (f) Compute $\int x\sin(x)\cos(x)\,dx$
   (g) Compute $\int e^{6x}\sin(e^{3x})\,dx$

Challenge problems

1. (a) Prove that the following equation is correct for any differentiable functions $f(x), g(x)$ and $h(x)$.

$$\int_a^b f'(x)g(x)h(x)\,dx = f(x)g(x)h(x)\Big|_a^b - \int_a^b f(x)g'(x)h(x)\,dx - \int_a^b f(x)g(x)h'(x)\,dx$$

   (b) Use the above equation to compute $\int_1^2 xe^x\ln(x)\,dx$.
   (c) Could standard integration by parts have been used to solve 1(b)? Explain your answer.