1. Use the definition of the definite integral to evaluate
$$\int_{-1}^{1} (3x - x^2)\, dx.$$

2. Use integration by substitution to show that $\int f(\sqrt{x})\, dx = \int 2uf(u)\, du$. Calculate $\int \sin\sqrt{x}\, dx$.

3. A mathematical operation that takes a function as input and produces another function as output is sometimes referred to as a *transform*. An important example is the *Laplace transform* $\mathcal{L}$, defined by
$$\mathcal{L}[f(x)] = \int_0^\infty e^{-px} f(x)\, dx = F(p).$$
Notice that $\mathcal{L}$ turns a function of x into a function of the parameter p. Find the Laplace transform of the functions

   (a) $f(x) = 1$,

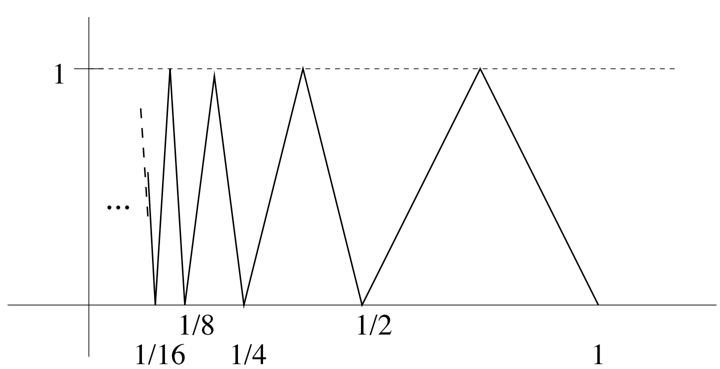
   (b) $g(x) = x$, and

   (c) $h(x) = e^{5x}$

   (assume in the first two cases that $p > 0$ and in the third case $p > 5$).

4. Find the limit:
$$\lim_{h \to 0} \frac{\int_1^{1+h} \sqrt{x^5 + 8}\, dx}{h}.$$

5. Evaluate the definite integral
$$\sum_0^1 f(x)\, dx$$
where f is the function whose graph is shown below



6. Use either a direct comparison of the limit comparison test to decide the convergence or divergence of each of the following:

$$\sum_{n=1}^{\infty} \frac{1}{\sqrt{1+n^5}} \qquad \sum_{n=3}^{\infty} \frac{n}{(n+3)^2} \qquad \sum_{n=1}^{\infty} \frac{1}{2n^2-n} \qquad \sum_{n=1}^{\infty} \frac{5\sin^2 n}{n\sqrt{n}}$$

7. If $F(x) = \int_0^3 t\sqrt{t+9}\,dt$, then $F'(1) = 0$. Why?

8. (a) Use Taylor's Theorem to find the Maclaurin series for $f(x) = e^x$.

   (b) Use part (a) to find the Maclaurin series for e^{-x^3}.

   (c) Estimate

$$\int_0^{0.2} e^{-x^3}\,dx$$

   to 4 decimal places using the first four terms of the Maclaurin series you obtained in part (b).