1. Find the limits:

   a. $\lim_{n\to\infty} \frac{n(3n+1)^2}{5n^3+23n^2+10n+4}$

   b. $\lim_{n\to\infty} \frac{1}{n}\sum_{k=1}^{n} \frac{k+5}{n}$

2. Compute the integral $\int_0^5 3x^2 dx$ via the following steps:

   a. Write down a sum which approximates the integral. The sum should use n rectangles of equal width, and the height of each rectangle should be determined by the right endpoint of the rectangle. (Your answer should be a summation involving the variables k and n.)

   b. Use the summation formulas to express the summation in part (a) in simpler terms. (This should be a variable expression only involving n.)

   c. Compute the limit as the number of rectangles increases to infinity.

3. Write down a sum which approximates the integral $\int_1^4 (5x+1)\,dx$ as in 2(a) above.

4. Given that the area of the ellipse $30x^2 + y^2 = 30$ is $\sqrt{30}\pi$, evaluate the integral $\int_0^1 \sqrt{30-30x^2}\,dx$.

5. Consider the limit $\lim_{n\to\infty} \frac{4}{n}\sum_{k=1}^{n} \sqrt{4^2 - \left(k\frac{4}{n}\right)^2}$.

   a. This limit is obtained by applying the definition of the definite integral to $\int_0^4 f(x)\,dx$ for what function $f(x)$?

   b. Use a graph of $f(x)$, and geometry, to evaluate this definite integral (and thus, the limit).

1. Find the indefinite integrals:
   a. $\int \left(t^3 + 4t^2 - 8t + 3\right) dt$
   b. $\int \frac{9}{\sqrt{t}} dt$
   c. $\int \frac{9x^5 + 5x^3 - 4x + 1}{x^3} dx$
2. Use the fundamental theorem of calculus to find the derivative of $F(x)$ for $F(x) = \int_2^x \sqrt{t^3 + 5t - 8}\, dt$.
3. Use the fundamental theorem of calculus to evaluate the definite integrals:
   a. $\int_0^8 (4x - 7)\, dx$
   b. $\int_1^2 (4x - 7)\, dx$
   c. $\int_1^T \left(\frac{x+1}{x^4}\right) dx$
4. Find the value of x for which $F(x) = \int_{-8}^x \left(|t| + 200\right) dt$ takes its maximum on the interval $[-8, 40]$.

1. Find the definite integrals using the fundamental theorem of calculus. You may need to use a substitution.

   a. $\int_0^x e^t dt$

   b. $\int_0^x (t+3)^2\, dt$

   c. $\int_0^x \sqrt{t+9}dt$

   d. $\int_0^x \frac{3}{(4t+5)}dt$

   e. $\int_0^x 6e^{3t-2}dt$

   f. $\int_0^x 3t^2 e^{t^3+2}dt$

2. Consider the function $F(x) = \int_{-2}^{x} \frac{1}{1+t^2}dt$.

   Determine the intervals on which $F(x)$ is increasing.

3. Find the average value of $g(x) = e^{2x}$ on the interval $[1,4]$.

4. A rock is dropped from a cliff. The velocity of the rock, measured in feet per second, after t seconds, is $v(t) = -32t$. The rock hits the ground 10 seconds later. How high is the cliff?