PROBLEM SET 5. DUE TUESDAY, 12 SEPTEMBER

Reading. *Quick Calculus*, pp. 138–142; 148–167.
Supplementary reading. Simmons, Sections 5.1–5.3.

1. (2pts) Approximate the following numbers, using the tangent line approximation.
   (a) $\sqrt[3]{28}$
   (b) $\sqrt{102}$
2. (2pts) Find the Taylor series (at $x = 0$) for $f(x) = \frac{1}{1-x}$.
3. (4pts) A sphere of radius r has volume
   $$V(r) = \frac{4}{3}\pi r^3,$$
   and surface area
   $$A(r) = 4\pi r^2.$$
   Approximate the volume and surface area of a sphere of radius 7.02cm. You can check your answer by using a calculator to compute the volume and surface area exactly.
4. (4pts) Compute the following integrals.
   (a) $\int x^3 \, dx$
   (b) $\int \sin(x) \, dx$
   (c) $\int e^x \, dx$
   (d) $\int \sqrt{x} \, dx$
5. (4pts) Compute the following integrals by substitution, using the substitution given.
   (a) $\int \sqrt{5+7x} \, dx, \; u = 5 + 7x$
   (b) $\int \frac{2x}{\sqrt{3+x^2}} \, dx, \; u = \sqrt{3+x^2}$
   (c) $\int 2xe^{x^2} \, dx, \; u = x^2$
   (d) $\int \frac{dx}{(x-4)^5}, \; u = x - 4$
6. (4pts) Integrals satisfy
   $$\int (f(x) + g(x)) \, dx = (\int f(x) \, dx) + (\int g(x) \, dx),$$
   just like derivatives do. Again like derivatives, they do **not** satisfy a simple product rule:
   $$\int (f(x) \cdot g(x)) \, dx \neq (\int f(x) \, dx) \cdot (\int g(x) \, dx),$$
   Check that this is indeed not true by using $f(x) = x$ and $g(x) = x$, and computing both sides of the above equation.