ENGR122 Assignment 8

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DUE: 1pm on 28 September 2018 online

Integration.

1. Use integration by parts to find:
   (a) $\int t \ln t \cdot dt$
   (b) $\int x^2 e^x \cdot dx$
   (c) $\int_{-\infty}^{3} x e^x dx$
2. Use integration by substitution to find:
   (a) $\int (1-x)^{\frac{1}{3}} dx$
   (b) $\int \frac{1}{x \ln x} dx$ (Hint: let $u = \ln x$)
   (c) $\int \cos x \sqrt{\sin x} \cdot dx$
   (d) $\int \frac{2x+1}{x^2+x+1} dx$
3. Calculate the average value of
   (a) $f(x) = \sqrt{x-1}$ on $[1, 4]$.
   (b) $f(x) = \frac{1}{(x+1)^2}$ on $[0, 3]$.
   (c) $f(x) = \frac{1}{x-1}$ on $[2, 3]$.
4. Calculate the r.m.s. value of each function in #3.
5. Use the trapezium rule, with 4 strips, to estimate
   (a) $\int e^{-x^2} dx$ on $[0, 1]$.
   (b) $\int \cos(\pi x^2) dx$ on $[0, 1]$.

   What is the maximum error in each case? What would the maximum error be with 100 strips?
6. Repeat #5 using Simpson's rule.

Tutorial Questions for 24 – 27 Sep 2018, ENGR122

1. Use integration by parts to find:
   (a) $\int \ln t \cdot dt$
   (b) $\int (x-5)e^x dx$
   (c) $\int x^2 \cos(x) \cdot dx$
   (d) $\int_0^2 \frac{1}{x^2-1}$.
   Note: function goes to ∞ *at* $x = 1$.
2. Compute $\int \frac{\ln t}{t} dt$ using
   (a) Integration by parts
   (b) Integration by substitution.
3. Use integration by substitution to find:
   (a) $\int \frac{t^2}{t^3+1} dt$
   (b) $\int x \cdot \sin\left(\frac{\pi - x^2}{2}\right) \cdot dx$
   (c) $\int \sin x \cdot (\cos x)^{\frac{1}{3}} \cdot dx$
4. Calculate the average value of
   (a) $f(x) = (x+1)^2$ on $[0, 1]$.
   (b) $f(x) = (x-1)^{\frac{1}{4}}$ on $[1, 2]$.
   (c) $f(x) = x + e^x$ on $[0, 1]$.
5. Calculate the r.m.s. value of each function in #4.
6. Use the trapezium rule, with 4 strips, to estimate
   (a) $\int e^{x^2} dx$ on $[0, 2]$.
   (b) $\int \sin(x^3)\, dx$ on $\left[0, \pi^{\frac{1}{3}}\right]$.

   What is the maximum error in each case? What would the maximum error be with 100 strips?
7. Repeat #6 using Simpson's rule.