MATH2260 - Calculus II for Science and Engineering

Assignment 1 - Due Monday February 5, 2018

1 Integrals

Evaluate the following using the techniques covered in class:

a) $\displaystyle\int_0^3 (x^2+1)e^x \mathrm{d}x$ b) $\displaystyle\int \frac{1}{e^s-1}\mathrm{d}s$ c) $\displaystyle\int \tan^3(\theta)\mathrm{d}\theta$ d) $\displaystyle\int \frac{\sqrt{1-v^2}}{v^2}\mathrm{d}v$

e) $\displaystyle\int \frac{2x+1}{x^2(9x^2+4)}\mathrm{d}x$ f) $\displaystyle\int_{-\frac{\pi}{4}}^{\pi} \sin^3(r)\cos^3(r)\mathrm{d}r$ g) $\displaystyle\int \frac{w^3+1}{w^3-1}\mathrm{d}w$ h) $\displaystyle\int \arctan(3r)\mathrm{d}r$

i) $\displaystyle\int \cos^2(x)\sin^2(x)\cos(2x)\mathrm{d}x$ j) $\displaystyle\int e^{3r}\sin(4r)\mathrm{d}r$ k) $\displaystyle\int \frac{\log(x)}{x^3}\mathrm{d}x$

2 Trigonometric Power Reduction - Integration by Parts

a) In class, we noticed that integrals of the form

$$\int \sin^n x \cos^m x\, dx, \text{ where both } n \text{ and } m \text{ are even} \qquad (1)$$

can be evaluated using double angle formulas.

A power reduction formula represents an alternate method of solution.

Using IBP, establish the following relationship (which holds true for any $n \geq 2$):

$$\int \sin^n(x)\, dx = -\frac{1}{n}\cos(x)\sin^{n-1}(x) + \frac{n-1}{n}\int \sin^{n-2}(x)\, dx \qquad (2)$$

Why is the result in (2) enough to evaluate all integrals of the form (1)?

b) Using the result in (2), evaluate the following:

i) $\displaystyle\int \sin^2(x)\, dx$ ii) $\displaystyle\int \sin^4(x)\, dx$ iii) $\displaystyle\int \cos^4(x)\sin^2(x)\, dx$ iv) $\displaystyle\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos^4(x)\sin^4(x)\, dx$