THE INTEGRALS IN GRADSHTEYN AND RHYZIK. PART 17: LEGENDRE FUNCTIONS.
PRELIMINARY VERSION: LAST UPDATE SEPTEMBER 11, 2006.

VICTOR H. MOLL

ABSTRACT. We present a systematic derivation of some of the definite integrals in the classical table of Gradshteyn and Rhyzik that can be reduced to the Legendre function.

1. Introduction

The table of integrals [1] contains some evaluations that can be derived from the *Legendre function of the second kind*, defined by

$$Q_n(z) = \frac{1}{2^{n+1}} \int_{-1}^{1} \frac{(1-t^2)^n}{(z-t)^{n+1}} \, dt. \tag{1.1}$$

• 3.249.3 Our goal is to present in a systematic manner, the evaluations appearing in the classical table of Gradshteyn and Rhyzik [1], that involve this function. The definition itself appears as 3.249.3.

2. Some elementary changes of variables

Acknowledgments. The author acknowledges the partial support of NSF-DMS 0409968.

References

[1] I.S. Gradshteyn and I.M. Rhyzik. *Table of Integrals, Series, and Products.* Edited by A. Jeffrey and D. Zwillinger. Academic Press, New York, 6th edition, 2000.

Department of Mathematics, Tulane University, New Orleans, LA 70118
E-mail address: vhm@math.tulane.edu

Date: September 14, 2006.
1991 *Mathematics Subject Classification.* Primary 33.
Key words and phrases. Integrals.