

# ECE 302: Homework 1

Purdue University, Fall 2008

Due September 3, 2008 in class

- Prove that  $1 + x + x^2 + \dots + x^{n-1} = \frac{1-x^n}{1-x}$  for  $x \neq 1$  and integer  $n \geq 1$ .
  - What is  $1 + 2x + 3x^2 + \dots + nx^{n-1}$ ? (Hint: differentiate part (a).)
- Let  $f$  be the function defined by  $f(x) = \frac{2}{e^x+1}$  for  $-\infty < x < \infty$ . Let  $g$  denote the inverse function of  $f$ , so that  $g(f(x)) = x$  for all  $x$ . Find  $g$ . (Hint: The domain of  $g$  can be smaller than the whole real line. Draw a picture.)
- Evaluate the following **definite** two-dimensional integrals over the specified domains of integration:
  - $f(x, y) = \max(x, y)$ , over the region  $\{(x, y) : 0 \leq x \leq 1, 0 \leq y \leq 1\}$ .
  - $f(x, y) = (x^2 + y^2)^{-4}$ , over the region  $\{(x, y) : x^2 + y^2 > 1\}$ .
- An ice cream manufacturer makes unflavored ice cream and then creates specialty flavors by blending in one or more of the five essences: vanilla, chocolate, fudge, mint, and almond into the ice cream. How many specialty flavors can the manufacturer create?