

## NUMERICAL AND ALGEBRAIC

Gain in decibels of  $P_2$  relative to  $P_1$

$$G = 10 \log_{10}(P_2/P_1).$$

To within two percent

$$(2\pi)^{1/2} \approx 2.5; \quad \pi^2 \approx 10; \quad e^3 \approx 20; \quad 2^{10} \approx 10^3.$$

Euler-Mascheroni constant<sup>1</sup>  $\gamma = 0.57722$

Gamma Function  $\Gamma(x + 1) = x\Gamma(x)$ :

$\Gamma(1/6) = 5.5663$	$\Gamma(3/5) = 1.4892$
$\Gamma(1/5) = 4.5908$	$\Gamma(2/3) = 1.3541$
$\Gamma(1/4) = 3.6256$	$\Gamma(3/4) = 1.2254$
$\Gamma(1/3) = 2.6789$	$\Gamma(4/5) = 1.1642$
$\Gamma(2/5) = 2.2182$	$\Gamma(5/6) = 1.1288$
$\Gamma(1/2) = 1.7725 = \sqrt{\pi}$	$\Gamma(1) = 1.0$

Binomial Theorem (good for  $|x| < 1$  or  $\alpha =$  positive integer):

$$(1 + x)^\alpha = \sum_{k=0}^{\infty} \binom{\alpha}{k} x^k \equiv 1 + \alpha x + \frac{\alpha(\alpha - 1)}{2!} x^2 + \frac{\alpha(\alpha - 1)(\alpha - 2)}{3!} x^3 + \dots$$

Rothe-Hagen identity<sup>2</sup> (good for all complex  $x, y, z$  except when singular):

$$\begin{aligned} \sum_{k=0}^n \frac{x}{x + kz} \binom{x + kz}{k} \frac{y}{y + (n - k)z} \binom{y + (n - k)z}{n - k} \\ = \frac{x + y}{x + y + nz} \binom{x + y + nz}{n}. \end{aligned}$$

Newberger's summation formula<sup>3</sup> [good for  $\mu$  nonintegral,  $\operatorname{Re}(\alpha + \beta) > -1$ ]:

$$\sum_{n=-\infty}^{\infty} \frac{(-1)^n J_{\alpha - \gamma n}(z) J_{\beta + \gamma n}(z)}{n + \mu} = \frac{\pi}{\sin \mu \pi} J_{\alpha + \gamma \mu}(z) J_{\beta - \gamma \mu}(z).$$