

**PROOF OF FORMULA 3.225.3**

$$\int_0^{\infty} \frac{x^p dx}{(x+1)^3} = \frac{p(1-p)\pi}{2 \sin \pi p}$$

Let  $t = x/(1+x)$  to obtain

$$\int_0^1 t^p (1-t)^{1-p} dt.$$

The integral is  $B(1+p, 2-p)$ . This is simplified using  $\Gamma(a+1) = a\Gamma(a)$  and  $\Gamma(a)\Gamma(1-a) = \pi/\sin \pi a$ .