PROOF OF FORMULA 3.225.1

$$\int_1^\infty \frac{(x-1)^{p-1}}{x^2}\,dx = \frac{(1-p)\pi}{\sin \pi p}$$

Let $t = 1/x$ to obtain

$$\int_1^\infty \frac{(x-1)^{p-1}}{x^2}\,dx = \int_0^1 t^{1-p}(1-t)^{p-1}\,dt = B(p, 2-p).$$

The result follows from

$$\Gamma(x+1) = x\Gamma(x) \text{ and } \Gamma(x)\Gamma(1-x) = \frac{\pi}{\sin \pi x}.$$