

## Quiz 9

1. Adrien Marie Legendre worked on Number Theory and wrote 'Elements de géométrie'
2. Victor Poncelet was Monge's original pupil and he wrote 'Traité des Propriétés projectives des figures', with novel geometrical concepts on cross ratio, perspectivity, projectivity...
3. Evariste Galois' father was a mayor
4. Voltaire shared Cauchy's views.

5.  $\int_{-\infty}^{\infty} e^{-x^2/2} dx = \sqrt{2\pi}$

Proof:

Take integral  $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} e^{-x^2/2} e^{-y^2/2} dx dy$

This becomes:  $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} e^{-(x^2+y^2)/2} dx dy$

Now convert to polar coordinates with

$$r^2 = x^2 + y^2 \quad \text{and} \quad r dr = dx dy$$

Here  $0 < r < \infty$  and  $0 < \theta < 2\pi$ .

Then:

$$\int_0^{\infty} \int_0^{2\pi} r e^{-r^2/2} d\theta dr = 2\pi \int_0^{\infty} r e^{-r^2/2} dr$$

$$= 2\pi (e^{-r^2/2} \Big|_0^{\infty}) = 2\pi (e^{-\infty/2} - e^{0/2}) = 2\pi$$

Since  $\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(x) f(y) = 2\pi$  where  $f = e^{-x^2/2}$

it follows that  $\int_{-\infty}^{\infty} f(x) dx = \sqrt{2\pi}$ . //