1)

$$1-\left(\frac{5}{6}\right)^2=\frac{11}{36}$$
$$1-\left(\frac{5}{6}\right)^{10}=\frac{50700551}{60466176}$$
$$1-\left(\frac{5}{6}\right)^n$$

2)

Say if we flip a coin 10 times and we say that heads will be called 5 times, by using the formula, this says that when flipping the coin 10 times, there are, in this case, 252 possible configurations where exactly 5 heads get called when running this trail, dubbed the coefficient of binomials.

3)

If we were to hypothetically toss a coin n times, and flipping heads is k times, with a probability is p. we do the previous of the probability of not getting the right outcome, to the power of the amount of times it needs to be wrong, time the probability the right outcome to the amount of times it needs to occur times the binomial coefficient to obtain the probability to obtain the sequence.

4)

$$\int_{-\infty}^{\infty} e^{-\frac{x^2}{2}}\,dx$$
$$\textit{replace the x variable with another}$$
$$c^2=\left(\int_{-\infty}^{\infty} e^{-\frac{x^2}{2}}\,dx\right)\left(\int_{-\infty}^{\infty} e^{-\frac{y^2}{2}}\,dy\right)=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} e^{\frac{x^2+y^2}{2}}\,dxdy$$

Change to polar cords

$$c^2=\int_0^{\infty} re^{-\frac{r^2}{2}}\,d\theta dr$$
$$=2\pi\int_0^{\infty} re^{-\frac{r^2}{2}}\,dr$$
$$=-e^{-\frac{r^2}{2}}=-e^{-\infty}--e^0=1$$