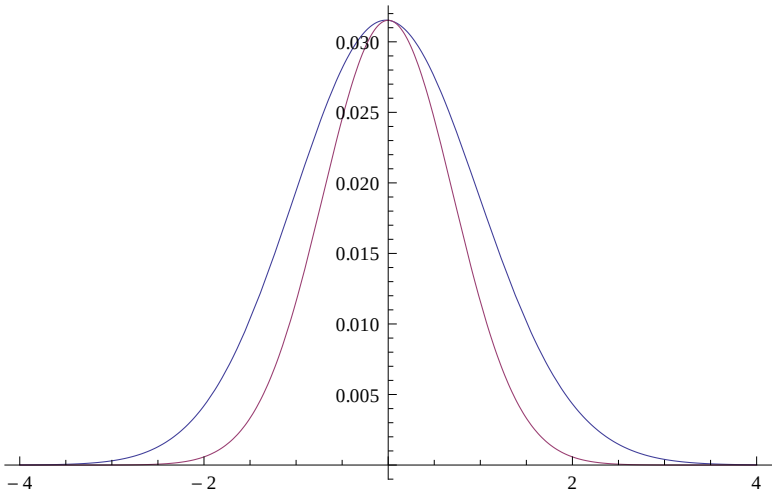
```
P[k_, n_, p_] := n! / (n - k)! / k! * p^k * (1 - p)^(n - k)
```

```
Plot[ {R[z, 1000, 0.2], Exp[-z^2] * R[0, 1000, 0.2]}, {z, -4, 4}, PlotRange → All]
```

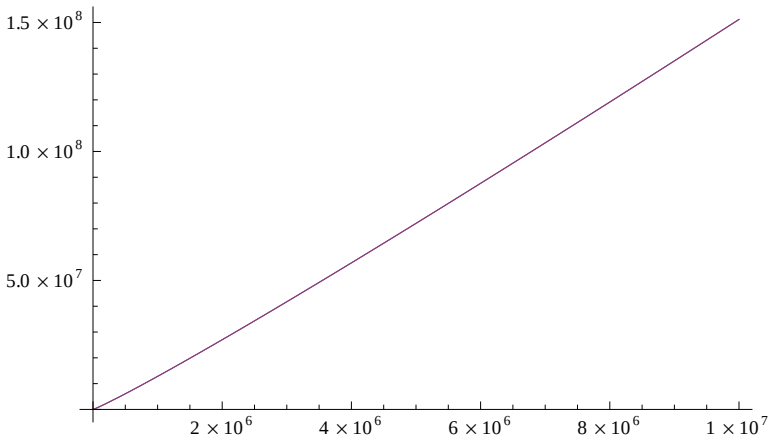



```
R[z_, n_, p_] := P[z * Sqrt[p * (1 - p) * n] + n * p, n, p];
```

```
Log[R[z, n, p]]
```

$$\text{Log}\left[\frac{(1-p)^{n-n\,p-\sqrt{n\,(1-p)\,p}\;\;z}\;p^{n\,p+\sqrt{n\,(1-p)\,p}\;\;z}\;n!}{\left(n-n\,p-\sqrt{n\,(1-p)\,p}\;\;z\right)!\;\left(n\,p+\sqrt{n\,(1-p)\,p}\;\;z\right)!}\right]$$

```
Plot[{Log[n!], n * (Log[n] - 1)}, {n, 1, 10000000}, PlotRange → All]
```




```
f[n_] := n * (Log[n] - 1)
```

$$\text{Log}\left[(1-p)^{n-n\,p-\sqrt{n\,(1-p)\,p}\;z}\;p^{n\,p+\sqrt{n\,(1-p)\,p}\;z}\right]+$$
$$f[n]-f\left[n-n\,p-\sqrt{n\,(1-p)\,p}\;z\right]-f\left[n\,p+\sqrt{n\,(1-p)\,p}\;z\right]$$

$$n\,(-1+\text{Log}[n])+\text{Log}\left[(1-p)^{n-n\,p-\sqrt{n\,(1-p)\,p}\;z}\;p^{n\,p+\sqrt{n\,(1-p)\,p}\;z}\right]-$$
$$\left(n-n\,p-\sqrt{n\,(1-p)\,p}\;z\right)\left(-1+\text{Log}\left[n-n\,p-\sqrt{n\,(1-p)\,p}\;z\right]\right)-$$
$$\left(n\,p+\sqrt{n\,(1-p)\,p}\;z\right)\left(-1+\text{Log}\left[n\,p+\sqrt{n\,(1-p)\,p}\;z\right]\right)$$

```
Limit[%, n → Infinity]
```

$Aborted

```
Exp[Log[Pi]]
```

π