

## Equation 9.6

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### Information Theory - Prof. Dr. Joseph Picone

The equation 9.6 shows how *probability of error* varies with varying *power to noise ratio* (P/N).

```
clc; clear; close all;

syms phix(t) phi(x) Pe(x)
% x = sqrt(P/N)

phix(t) = exp(-t^2/2)/sqrt(2*pi)
```

phix(t) =

$$\frac{2251799813685248 e^{-\frac{t^2}{2}}}{5644425081792261}$$

```
phi(x) = int(phix(t),-inf,x); %% this is eq 9.7
```

Equation 9.6 takes this form:

```
Pe(x) = 1 - phi(x) %% this is eq 9.6
```

Pe(x) =

$$1 - \frac{1125899906842624 \sqrt{2} \sqrt{\pi} \left( \operatorname{erf}\left(\frac{\sqrt{2} x}{2}\right) + 1 \right)}{5644425081792261}$$

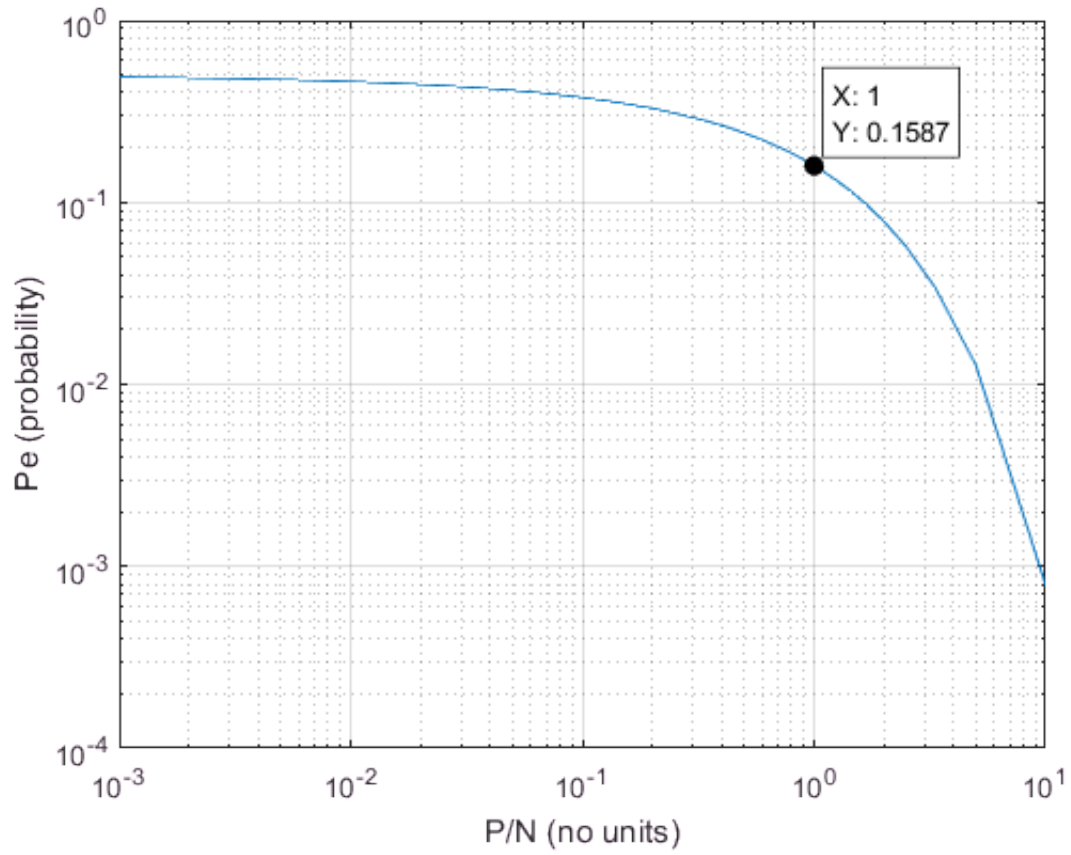
Maximum possible value of Probability of error (Pe) is for P/N = 0 is given as:

```
maxPe = double(Pe(sqrt(0))) % -----> max possible value of Probability Pe for P/N = 0
```

```
maxPe = 0.5000
```

Now, viewing eq 9.6 graphically as follows:

```
P = 10; N = 0:10000;
loglog(P./N, double(Pe(sqrt(P./N))))
xlabel('P/N (no units)'); ylabel('Pe (probability)');
grid
```



Alexander already posted the other form as follows:

Probability of Error for various P/N

