

toc,lof,lot

```
syms C
syms x
syms y
syms xi
syms eta
syms Sigma
```

```
P_xi_eta = C * exp((-1/2)*(2*x^2 + 4*x*y + ...
5*y^2 - 12*y + 12))
```

```
P_xi_eta =
C e-x2-2xy-5y2/2+6y-6
```

1. q.

```
(2*x^2 + 4*x*y + 5*y^2 - 12*y + 12)
```

```
ans =
2 x2 + 4 x y + 5 y2 - 12 y + 12
```

```
2*(x+2)^2 + 4*(x+2)*(y-2) + 5*(y-2)^2
```

```
ans =
2 (x+2)2 + 5 (y-2)2 + (4 x + 8) (y-2)
```

```
E = sym([-2;2])
```

```
E =
⎛ -2 ⎞
⎝ 2 ⎠
```

```
Sigma__ = [2,2;2,5]
```

$$\text{Sigma\_} = \begin{matrix} 2 \times 2 \\ 2 & 2 \\ 2 & 5 \end{matrix}$$

$$\text{Sigma} = \text{Sigma\_}^{-1}$$

$$\text{Sigma} = \begin{matrix} 2 \times 2 \\ 0.8333 & -0.3333 \\ -0.3333 & 0.3333 \end{matrix}$$

$$d = \text{sym}(\det(\text{Sigma}))$$

$$d = \frac{1}{6}$$

$$\text{cov\_xi\_xi} = \text{sym}(\text{Sigma}(1,1))$$

$$\text{cov\_xi\_xi} = \frac{5}{6}$$

$$\text{cov\_eta\_eta} = \text{sym}(\text{Sigma}(2,2))$$

$$\text{cov\_eta\_eta} = \frac{1}{3}$$

$$\text{cov\_xi\_eta} = \text{sym}(\text{Sigma}(1,2))$$

$$\text{cov\_xi\_eta} = -\frac{1}{3}$$

$$\text{Rho} = \frac{\text{cov\_xi\_eta} * \dots}{1/\sqrt{\text{cov\_xi\_xi} * \text{cov\_eta\_eta}}}$$

$$\text{Rho} = -\frac{\sqrt{2}\sqrt{5}}{5}$$

$$C = 1/(2 * \pi * \text{sym}(\sqrt{\det(\text{Sigma})}))$$

$$C = \frac{\sqrt{6}}{2\pi}$$

```
syms x
syms y
```

```
c = [sym(sqrt(2))*x + ...
      sym(sqrt(2))*y;sym(sqrt(3))*y - sym(sqrt(3))*2]
```

$$c = \begin{pmatrix} \sqrt{2}x + \sqrt{2}y \\ \sqrt{3}y - 2\sqrt{3} \end{pmatrix}$$

```
vec = [x;y]-E
```

$$vec = \begin{pmatrix} x + 2 \\ y - 2 \end{pmatrix}$$

```
B = sym([sqrt(2),sqrt(2);0,sqrt(3)])
```

$$B = \begin{pmatrix} \sqrt{2} & \sqrt{2} \\ 0 & \sqrt{3} \end{pmatrix}$$

```
simplify(c) == simplify(B*vec)
```

$$ans = \begin{pmatrix} \sqrt{2}(x+y) = \sqrt{2}(x+y) \\ \sqrt{3}(y-2) = \sqrt{3}(y-2) \end{pmatrix}$$

```
B*Sigma*B. '
```

$$ans = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

```
Sigma _
```

$$\text{Sigma}_{\text{2}}^{\text{2x2}} = \begin{pmatrix} 2 & 2 \\ 2 & 5 \end{pmatrix}$$

```
[Q,lambda] = eig (Sigma _ ,"vector");  
labmda = sym(lambda)
```

$$\text{labmda} = \begin{pmatrix} 1 \\ 6 \end{pmatrix}$$

```
Q = sym(Q)
```

$$Q = \begin{pmatrix} -\frac{2\sqrt{5}}{5} & \frac{\sqrt{5}}{5} \\ \frac{\sqrt{5}}{5} & \frac{2\sqrt{5}}{5} \end{pmatrix}$$

```
D = Q*Sigma*Q. '
```

$$D = \begin{pmatrix} 1 & 0 \\ 0 & \frac{1}{6} \end{pmatrix}$$

```
sym(det (Sigma))
```

$$\text{ans} = \frac{1}{6}$$

$$\begin{bmatrix} \xi_1 \\ \xi_2 \end{bmatrix}$$

```
disp ( 'N( '
```

```
N(
```

```
disp(E/sym(sqrt(5)))
```

$$\begin{pmatrix} -\frac{2\sqrt{5}}{5} \\ \frac{2\sqrt{5}}{5} \end{pmatrix}$$

```
disp(' ','')
```

```
,
```

```
disp(D)
```

$$\begin{pmatrix} 1 & 0 \\ 0 & \frac{1}{6} \end{pmatrix}$$

```
disp(' ')
```

```
)
```

```
B = sym([-2,-5;-5,-5])
```

```
B =
```

$$\begin{pmatrix} -2 & -5 \\ -5 & -5 \end{pmatrix}$$

```
E_1 = B*B
```

```
E_1 =
```

$$\begin{pmatrix} -6 \\ 0 \end{pmatrix}$$

```
Sigma_1 = B*(Sigma)*B.'
```

```
Sigma_1 =
```

$$\begin{pmatrix} 5 & 5 \\ 5 & \frac{25}{2} \end{pmatrix}$$

```
Sigma_1_ = Sigma_1 ^ (-1)
```

```
Sigma_1_ =
```

$$\begin{pmatrix} \frac{1}{3} & -\frac{2}{2^{15}} \\ -\frac{2}{15} & \frac{1}{15} \end{pmatrix}$$

$$\mathbf{x\_vec} = [\text{sym}('x'), \text{sym}('y')] . '$$

$$\mathbf{x\_vec} = \begin{pmatrix} x \\ y \end{pmatrix}$$

$$\mathbf{P} = \dots (1/(\sqrt{\text{sym}(2*\pi)})*\sqrt{\det(\text{Sigma\_1})}))*\exp(\text{sym}(-1/2)*(\mathbf{x\_vec}-\mathbf{E\_1})).'*\text{Sig}$$

$$\mathbf{P} = \frac{\sqrt{3}e^{y\left(\frac{x}{15}-\frac{y}{15}+\frac{2}{5}\right)-(x+6)\left(\frac{x}{6}-\frac{y}{15}+1\right)}}{15\sqrt{\pi}}$$

$$\mathbf{P\_xi\_eta} = \mathbf{C} * \exp((-1/2)*(2*x^2 + 4*x*y + \dots 5*y^2 - 12*y + 12))$$

$$\mathbf{P\_xi\_eta} = \frac{\sqrt{6}e^{-x^2-2xy-\frac{5y^2}{2}+6y-6}}{2\pi}$$

$$\mathbf{P\_eta} = \text{int}(\mathbf{P}, \text{sym}('x'), -\text{inf}, \text{inf})$$

$$\mathbf{P\_eta} = \frac{\sqrt{2}e^{-\frac{y^2}{25}}}{5}$$

$$\mathbf{p\_xi\_g\_eta} = \mathbf{P}/\mathbf{P\_eta}$$

$$\mathbf{p\_xi\_g\_eta} = \frac{\sqrt{2}\sqrt{3}e^{\frac{y^2}{25}}e^{y\left(\frac{x}{15}-\frac{y}{15}+\frac{2}{5}\right)-(x+6)\left(\frac{x}{6}-\frac{y}{15}+1\right)}}{6\sqrt{\pi}}$$

$$\text{simplify}(\mathbf{p\_xi\_g\_eta})$$

$$\mathbf{ans} = \frac{\sqrt{6}e^{-\frac{(5x-2y+30)^2}{150}}}{6\sqrt{\pi}}$$