Pensieve header: Examples for the UCLA FDA talk.

Startup

```
In[•]:= SetDirectory["C:\\drorbn\\AcademicPensieve\\Talks\\UCLA-191101"];
```

hm

```
hm
In[•]:= {x̂ = ((0 1 0) (0 0 0) (0 0 0)), ŷ = ((0 0 0) (0 0 ħ) (0 0 0)), ĉ = ((0 0 1) (0 0 0) (0 0 0))};
        {x̂.ŷ - ŷ.x̂ == ħ ĉ, x̂.ĉ == ĉ.x̂, ŷ.ĉ == ĉ.ŷ}
hm
Out[•]= {True, True, True}

hm
In[•]:= Λ = -ħ η_i ξ_j c_k + (ξ_i + ξ_j) x_k + (η_i + η_j) y_k;
        Simplify@With[{𝔼 = MatrixExp},
          𝔼[x̂ ξ_i].𝔼[ŷ η_i].𝔼[x̂ ξ_j].𝔼[ŷ η_j] == 𝔼[x̂ ∂_{x_k} Λ].𝔼[ŷ ∂_{y_k} Λ].𝔼[ĉ ∂_{c_k} Λ]]
hm
Out[•]= True
```

sl2

```
In[•]:= Λ0 = HoldForm[(η_i + e^(-α_i - ϵ β_i) η_j / (1 + ϵ η_j ξ_i)) y_k + (β_i + β_j + Log[1 + ϵ η_j ξ_i] / ϵ) b_k +
            (α_i + α_j + Log[1 + ϵ η_j ξ_i]) a_k + (e^(-α_j - ϵ β_j) ξ_i / (1 + ϵ η_j ξ_i) + ξ_j) x_k];
        TeXForm[Λ0]
        Λ = ReleaseHold[Λ0]
Out[•]= a_k (Log[1 + ϵ η_j ξ_i] + α_i + α_j) +
        b_k (Log[1 + ϵ η_j ξ_i] / ϵ + β_i + β_j) + y_k (η_i + e^(-α_i - ϵ β_i) η_j / (1 + ϵ η_j ξ_i)) + x_k (e^(-α_j - ϵ β_j) ξ_i / (1 + ϵ η_j ξ_i) + ξ_j)

\left(\eta _i+\frac{e^{-\alpha _i-\epsilon  \beta _i} \eta _j}{1+\epsilon  \eta _j \xi _i}
   _i+\beta _j+\frac{\log \left(1+\epsilon  \eta _j \xi _i\right)}{\epsilon }\right) b_k+\
   _j+\log \left(1+\epsilon  \eta _j \xi _i\right)\right) a_k+\left(\frac{e^{-\alpha _j-\e
   _i}}{1+\epsilon  \eta _j \xi _i}+\xi _j\right) x_k

sl2
In[•]:= {ŷ = ((0 0) (ϵ 0)), b̂ = ((0 0) (0 -ϵ)), â = ((1 0) (0 0)), x̂ = ((0 1) (0 0))};
        {â.x̂ - x̂.â == x̂, â.ŷ - ŷ.â == -ŷ, b̂.ŷ - ŷ.b̂ == -ϵ ŷ, b̂.x̂ - x̂.b̂ == ϵ x̂, x̂.ŷ - ŷ.x̂ == b̂ + ϵ â}
sl2
Out[•]= {True, True, True, True, True}
```

sl2

In[•]:=
```
Simplify@With[{𝔼 = MatrixExp},
  𝔼[η_i ŷ].𝔼[β_i b̂].𝔼[α_i â].𝔼[ξ_i x̂].𝔼[η_j ŷ].𝔼[β_j b̂].𝔼[α_j â].𝔼[ξ_j x̂] ==
   𝔼[ŷ ∂_{y_k} Λ].𝔼[b̂ ∂_{b_k} Λ].𝔼[â ∂_{a_k} Λ].𝔼[x̂ ∂_{x_k} Λ]]
```

sl2

Out[•]= True

sl2

In[•]:=
```
Series[Λ, {ϵ, 0, 2}]
```

sl2

Out[•]=
$$\left(a_k\ (\alpha_i+\alpha_j)+y_k\ \left(\eta_i+e^{-\alpha_i}\ \eta_j\right)+b_k\ (\beta_i+\beta_j+\eta_j\ \xi_i)+x_k\ \left(e^{-\alpha_j}\ \xi_i+\xi_j\right)\right)+$$
$$\left(a_k\ \eta_j\ \xi_i-\frac{1}{2}\ b_k\ \eta_j^2\ \xi_i^2-e^{-\alpha_i}\ y_k\ \eta_j\ (\beta_i+\eta_j\ \xi_i)-e^{-\alpha_j}\ x_k\ \xi_i\ (\beta_j+\eta_j\ \xi_i)\right)\epsilon+$$
$$\left(-\frac{1}{2}\ a_k\ \eta_j^2\ \xi_i^2+\frac{1}{3}\ b_k\ \eta_j^3\ \xi_i^3+\frac{1}{2}\ e^{-\alpha_i}\ y_k\ \eta_j\ \left(\beta_i^2+2\ \beta_i\ \eta_j\ \xi_i+2\ \eta_j^2\ \xi_i^2\right)+\right.$$
$$\left.\frac{1}{2}\ e^{-\alpha_j}\ x_k\ \xi_i\ \left(\beta_j^2+2\ \beta_j\ \eta_j\ \xi_i+2\ \eta_j^2\ \xi_i^2\right)\right)\epsilon^2+O[\epsilon]^3$$