In[1]:=

```
ClearAll["Global`*"]
```

$$\eta = \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & -1 \end{pmatrix};$$

```
id = IdentityMatrix[4];
```

$$\gamma 0 = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix}; \gamma 1 = \begin{pmatrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & 0 \end{pmatrix}; \gamma 2 = \begin{pmatrix} 0 & 0 & 0 & -I \\ 0 & 0 & I & 0 \\ 0 & I & 0 & 0 \\ -I & 0 & 0 & 0 \end{pmatrix}; \gamma 3 = \begin{pmatrix} 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & -1 \\ -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \end{pmatrix};$$

```
γ5 = I γ0.γ1.γ2.γ3;
```

$$p = \begin{pmatrix} Ep \\ p1 \\ p2 \\ p3 \end{pmatrix}; k = \begin{pmatrix} Ek \\ k1 \\ k2 \\ k3 \end{pmatrix};$$

```
γ = {γ0, γ1, γ2, γ3};
pSlash = Sum[γ[[μ]] (η.p)[[μ, 1]], {μ, 1, 4}];
kSlash = Sum[γ[[μ]] (η.k)[[μ, 1]], {μ, 1, 4}];
```

In[10]:=

$$\mathrm{Tr}\left[\frac{\gamma 5.(kSlash + pSlash + m_{\phi r}\, id).\gamma 5.(kSlash + m_{\phi r}\, id)}{\left(\left((k+p)^{\mathsf{T}}.\eta.(k+p) - m_{\phi r}{}^{2}\right)\left(k^{\mathsf{T}}.\eta.k - m_{\phi r}{}^{2}\right)\right)[[1,1]]}\right] \text{ // FullSimplify}$$

Out[10]=

$$\frac{4\left(-Ek\,(Ek+Ep) + k1\,(k1+p1) + k2\,(k2+p2) + k3\,(k3+p3) + m_{\phi r}^{2}\right)}{\left(-Ek^{2} + k1^{2} + k2^{2} + k3^{2} + m_{\phi r}^{2}\right)\left(-(Ek+Ep)^{2} + (k1+p1)^{2} + (k2+p2)^{2} + (k3+p3)^{2} + m_{\phi r}^{2}\right)}$$