In[1]:=
```
Simplify[
 D[InterpolatingPolynomial[Table[{x_i + k h/2, f[x_(i + k/2)]}, {k, -3, 3, 2}], z], {z, 1}] /.
  z → x_i]
Simplify[D[InterpolatingPolynomial[Table[{x_i + k h/2, f[x_(i + k/2)]}, {k, -5, 5, 2}], z],
   {z, 2}] /. z → x_i]
```

Out[1]= $\frac{f[x_{-\frac{3}{2}+i}] - 27 f[x_{-\frac{1}{2}+i}] + 27 f[x_{\frac{1}{2}+i}] - f[x_{\frac{3}{2}+i}]}{24 h}$

Out[2]= $-\frac{5 f[x_{-\frac{5}{2}+i}] - 39 f[x_{-\frac{3}{2}+i}] + 34 f[x_{-\frac{1}{2}+i}] + 34 f[x_{\frac{1}{2}+i}] - 39 f[x_{\frac{3}{2}+i}] + 5 f[x_{\frac{5}{2}+i}]}{48 h^2}$

In[3]:=
```
UFDWeights[m_, n_, s_] :=
 CoefficientList[Normal[Series[x^s Log[x]^m, {x, 1, n}] / h^m], x]
```

In[4]:=
```
UFDWeights[1, 3, 3 / 2]
```

Out[4]= $\left\{\frac{1}{24 h}, -\frac{9}{8 h}, \frac{9}{8 h}, -\frac{1}{24 h}\right\}$

In[5]:=
```
UFDWeights[2, 5, 5 / 2]
```

Out[5]= $\left\{-\frac{5}{48 h^2}, \frac{13}{16 h^2}, -\frac{17}{24 h^2}, -\frac{17}{24 h^2}, \frac{13}{16 h^2}, -\frac{5}{48 h^2}\right\}$

In[6]:=
```
StaggerdDiff[m_, n_] :=
 Simplify[D[InterpolatingPolynomial[Table[{x_i + k h/2, f[x_(i + k/2)]}, {k, -n, n, 2}], z],
   {z, m}] /. z → x_i]
```

In[7]:=
```
StaggerdDiff[1, 1]
```

Out[7]= $\frac{-f[x_{-\frac{1}{2}+i}] + f[x_{\frac{1}{2}+i}]}{h}$

In[8]:=
```
StaggerdDiff[1, 3]
```

Out[8]= $\frac{f[x_{-\frac{3}{2}+i}] - 27 f[x_{-\frac{1}{2}+i}] + 27 f[x_{\frac{1}{2}+i}] - f[x_{\frac{3}{2}+i}]}{24 h}$

In[10]:=
```
StaggerdDiff[2, 3]
```

Out[10]= $\frac{f[x_{-\frac{3}{2}+i}] - f[x_{-\frac{1}{2}+i}] - f[x_{\frac{1}{2}+i}] + f[x_{\frac{3}{2}+i}]}{2 h^2}$

In[16]:=
```
StaggerdDiff[2, 5]
```

Out[16]= $-\frac{5 f[x_{-\frac{5}{2}+i}] - 39 f[x_{-\frac{3}{2}+i}] + 34 f[x_{-\frac{1}{2}+i}] + 34 f[x_{\frac{1}{2}+i}] - 39 f[x_{\frac{3}{2}+i}] + 5 f[x_{\frac{5}{2}+i}]}{48 h^2}$

In[17]:=
```
StaggerdDiff[3, 3]
```

Out[17]= $\frac{-f[x_{-\frac{3}{2}+i}] + 3 f[x_{-\frac{1}{2}+i}] - 3 f[x_{\frac{1}{2}+i}] + f[x_{\frac{3}{2}+i}]}{h^3}$

In[18]:= **StaggerdDiff[3, 5]**

$$\text{Out[18]}= \frac{f\left[x_{-\frac{5}{2}+i}\right]-13\,f\left[x_{-\frac{3}{2}+i}\right]+34\,f\left[x_{-\frac{1}{2}+i}\right]-34\,f\left[x_{\frac{1}{2}+i}\right]+13\,f\left[x_{\frac{3}{2}+i}\right]-f\left[x_{\frac{5}{2}+i}\right]}{8\,h^3}$$

In[20]:= **StaggerdDiff[4, 5]**

$$\text{Out[20]}= \frac{f\left[x_{-\frac{5}{2}+i}\right]-3\,f\left[x_{-\frac{3}{2}+i}\right]+2\,f\left[x_{-\frac{1}{2}+i}\right]+2\,f\left[x_{\frac{1}{2}+i}\right]-3\,f\left[x_{\frac{3}{2}+i}\right]+f\left[x_{\frac{5}{2}+i}\right]}{2\,h^4}$$

In[21]:= **StaggerdDiff[4, 7]**

$$\text{Out[21]}= \frac{1}{48\,h^4}\left(-7\,f\left[x_{-\frac{7}{2}+i}\right]+59\,f\left[x_{-\frac{5}{2}+i}\right]-135\,f\left[x_{-\frac{3}{2}+i}\right]+ 83\,f\left[x_{-\frac{1}{2}+i}\right]+83\,f\left[x_{\frac{1}{2}+i}\right]-135\,f\left[x_{\frac{3}{2}+i}\right]+59\,f\left[x_{\frac{5}{2}+i}\right]-7\,f\left[x_{\frac{7}{2}+i}\right]\right)$$