```
> restart;
> # Find Adams-Bashforth method of order s
> s:=4;
```

$$s := 4$$

```
> t:=n->t_0+n*h;
```

$$t := n \rightarrow t\_0 + n\,h$$

```
> L:=k->product((tau-t(n-j))/(t(n-k)-t(n-j)),j=0..k-1)
      *product((tau-t(n-j))/(t(n-k)-t(n-j)),j=k+1..s-1);
```

$$L := k \rightarrow \left(\prod_{j=0}^{k-1} \frac{\tau - t(n-j)}{t(n-k) - t(n-j)}\right) \left(\prod_{j=k+1}^{s-1} \frac{\tau - t(n-j)}{t(n-k) - t(n-j)}\right)$$

```
> p:=0:
  for i from 0 to s-1
  do
      p:=p+simplify(L(i))*f[n-i];
  od:
  p:=collect(p,tau);
```

$$p := \left(\frac{f_n}{6\,h^3} - \frac{f_{n-1}}{2\,h^3} + \frac{f_{n-2}}{2\,h^3} - \frac{f_{n-3}}{6\,h^3}\right)\tau^3 + \left(-\frac{(3\,t\_0 + 3\,n\,h - 6\,h)\,f_n}{6\,h^3} + \frac{(3\,t\_0 + 3\,n\,h - 5\,h)\,f_{n-1}}{2\,h^3} - \frac{(3\,t\_0 + 3\,n\,h - 4\,h)\,f_{n-2}}{2\,h^3} + \frac{(3\,t\_0 + 3\,n\,h - 3\,h)\,f_{n-3}}{6\,h^3}\right)\tau^2 + \left(-\frac{(-(t\_0 + n\,h - h)\,(t\_0 + n\,h - 2\,h) + (-2\,t\_0 - 2\,n\,h + 3\,h)\,(t\_0 + n\,h - 3\,h))\,f_n}{6\,h^3} + \frac{(-(t\_0 + n\,h)\,(t\_0 + n\,h - 2\,h) + (-2\,t\_0 - 2\,n\,h + 2\,h)\,(t\_0 + n\,h - 3\,h))\,f_{n-1}}{2\,h^3} - \frac{(-(t\_0 + n\,h)\,(t\_0 + n\,h - h) + (-2\,t\_0 - 2\,n\,h + h)\,(t\_0 + n\,h - 3\,h))\,f_{n-2}}{2\,h^3} + \frac{(-(t\_0 + n\,h)\,(t\_0 + n\,h - h) + (-2\,t\_0 - 2\,n\,h + h)\,(t\_0 + n\,h - 2\,h))\,f_{n-3}}{6\,h^3}\right)\tau - \frac{(t\_0 + n\,h - h)\,(t\_0 + n\,h - 2\,h)\,(t\_0 + n\,h - 3\,h)\,f_n}{6\,h^3}$$

$$+\frac{(t\_0+n\,h)\,(t\_0+n\,h-2\,h)\,(t\_0+n\,h-3\,h)\,f_{n-1}}{2\,h^3}$$

$$-\frac{(t\_0+n\,h)\,(t\_0+n\,h-h)\,(t\_0+n\,h-3\,h)\,f_{n-2}}{2\,h^3}$$

$$+\frac{(t\_0+n\,h)\,(t\_0+n\,h-h)\,(t\_0+n\,h-2\,h)\,f_{n-3}}{6\,h^3}$$

```
> AB:=simplify(int(p,tau=t(n)..t(n+1)));
```

$$AB := \frac{1}{24}\,h\,(55\,f_n-59\,f_{n-1}+37\,f_{n-2}-9\,f_{n-3})$$

```
> y[n+1]=y[n]+AB;
```

$$y_{n+1}=y_n+\frac{1}{24}\,h\,(55\,f_n-59\,f_{n-1}+37\,f_{n-2}-9\,f_{n-3})$$

```
>
```