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

$$s := 4$$

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

$$t := n \to t_0 + n\,h$$

```
> 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);
```

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

```
> 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;
```

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

```
>
```