Composite rules

Quad 3

Closed Newton Cotes rule: $Q_{NC}(m) = (b-a) \sum_{k=1}^{m} w_k f(x_k)$

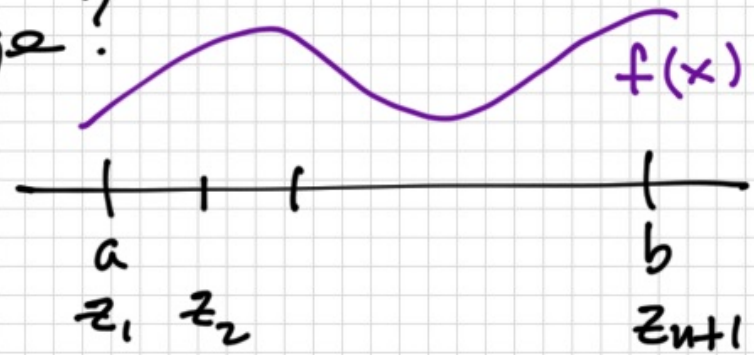
```
function w = ClosedNewtonCotesWeights(m)
%HELP TEXT
  switch m
      case 2
          w = transpose([1/2 1/2])
      case 3
          w = transpose([1/6 4/6 1/6])
      otherwise
          error = 'M>3 NOT CODED'
end
```

```
function numI = ClosedQNC(fname, a, b, m)
% HELP TEXT
  w = ClosedNewtonCotesWeights(m);
  x = linspace(a,b,m)';
  f = fname(x);
  numI = (b-a)(w'*f);
```

$$\left| \int_a^b f(x)\,dx - Q_{NC(m)} \right| \le |c_m| M_{d+1} \left(\frac{b-a}{m-1} \right)^{d+2}$$

where $d = m-1$ (~~odd~~ even m) or $d = m$ (~~even~~ odd m)

What if $b-a$ is large?



ClosedQNC(f,a,b,n)

may be inaccurate

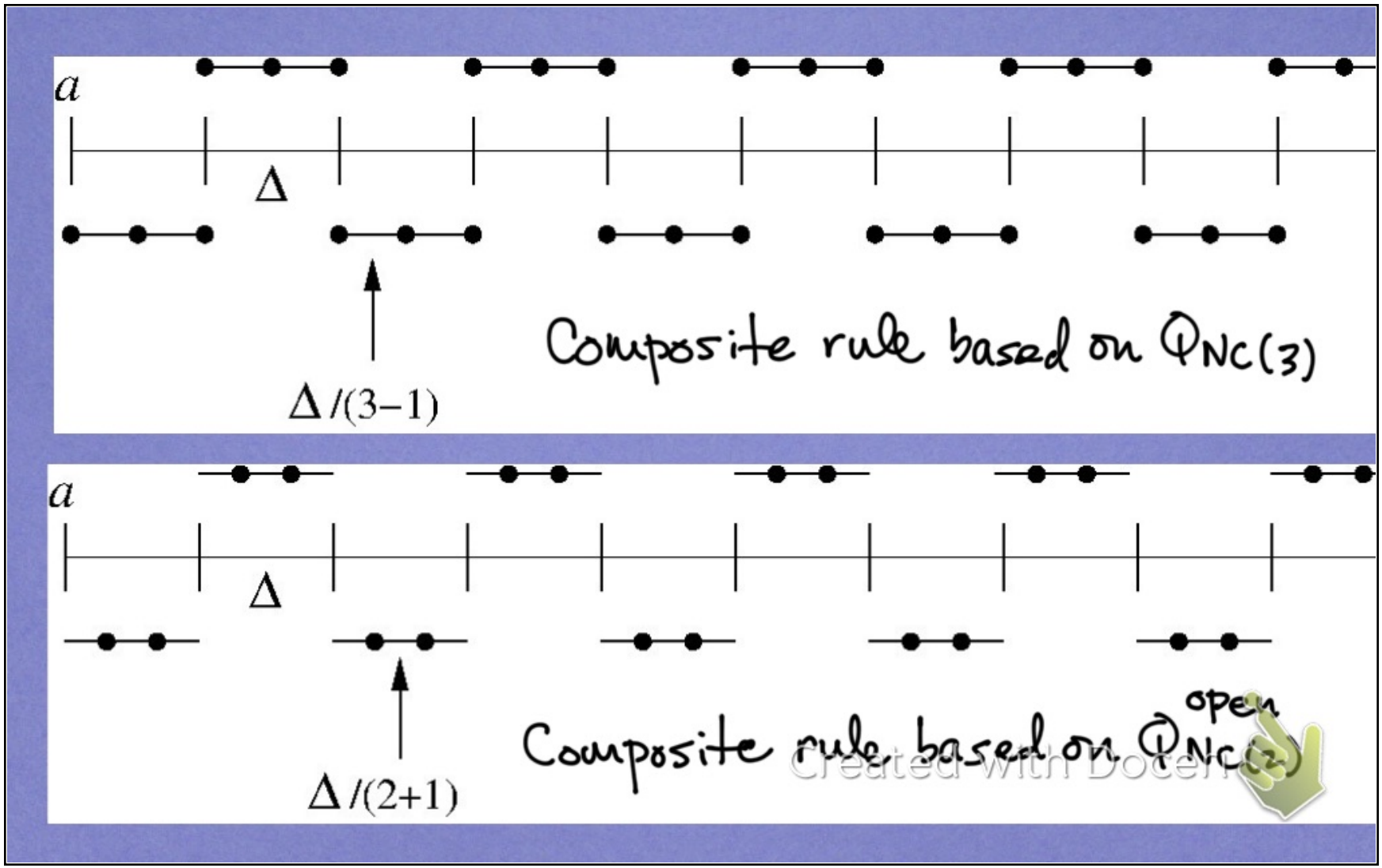
Introduce $z_i = a+(i-1)\Delta \quad i=1,2,\dots,n+1$

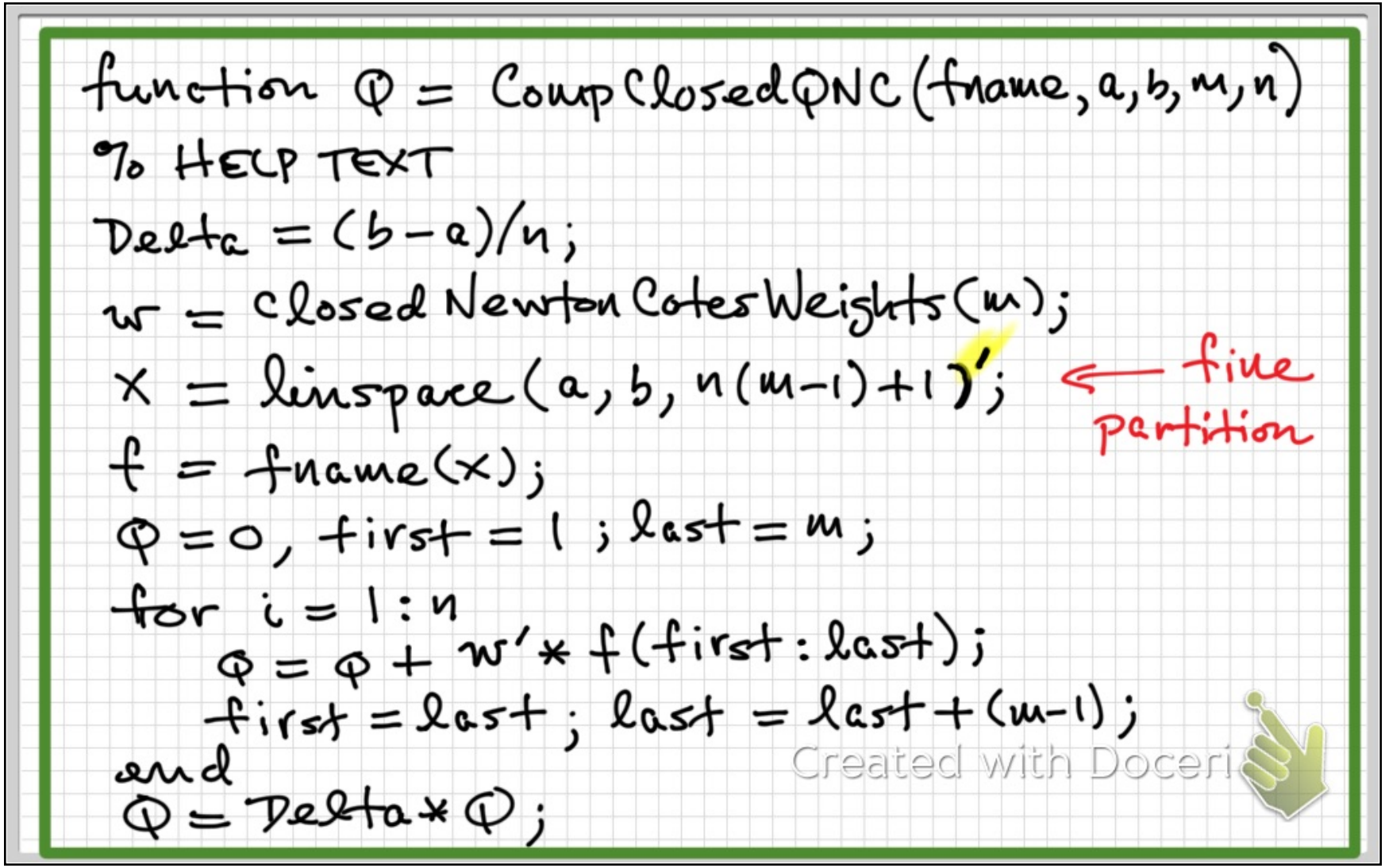
$\Delta = (b-a)/n$

$$\int_a^b f(x)\,dx = \sum_{i=1}^{n} \int_{z_i}^{z_{i+1}} f(x)\,dx$$

```
Q = 0 ; Δ = (b-a)/n ;
for i = 1 to n
    Q = Q + ClosedQNC(f, a+(i-1)Δ, a+iΔ, n)
end
```

z_i z_{i+1}




function Q = CompClosedQNC(fname,a,b,m,n)
% HELP TEXT
Delta = (b-a)/n;
w = closedNewtonCotesWeights(m);
x = linspace(a,b,n(m-1)+1)';
f = fname(x);
Q=0, first = 1 ; last = m;
for i = 1:n
Q = Q + w'*f(first:last);
first = last ; last = last+(m-1);
end
Q = Delta*Q;
fine partition
Created with Doceri