

### (a) Simple Heun without Corrector

```
SUB Heun (x, y, h, ynew)
  CALL Derivs (x, y, dy1dx)
  ye = y + dy1dx * h
  CALL Derivs(x + h, ye, dy2dx)
  Slope = (dy1dx + dy2dx)/2
  ynew = y + Slope * h
  x = x + h
END SUB
```

### (b) Midpoint Method

```
SUB Midpoint (x, y, h, ynew)
  CALL Derivs(x, y, dydx)
  ym = y + dydx * h/2
  CALL Derivs (x + h/2, ym, dymdx)
  ynew = y + dymdx * h
  x = x + h
END SUB
```

### (c) Heun with Corrector

```
SUB HeunIter (x, y, h, ynew)
  es = 0.01
  maxit = 20
  CALL Derivs(x, y, dy1dx)
  ye = y + dy1dx * h
  iter = 0
  DO
    yeold = ye
    CALL Derivs(x + h, ye, dy2dx)
    slope = (dy1dx + dy2dx)/2
    ye = y + slope * h
    iter = iter + 1
    ea =  $\left| \frac{ye - yeold}{ye} \right| 100\%$ 
    IF (ea ≤ es OR iter > maxit) EXIT
  END DO
  ynew = ye
  x = x + h
END SUB
```