2.6 EULER'S METHOD

ACTUAL SOL'N

$y = x + \frac{2}{x}$

$y(2) = 2 + \frac{2}{2} = 3$

eg. $\frac{dy}{dx} = 2 - \frac{y}{x}$, $y(1) = 3$

ESTIMATE $y(2)$

$y + \left(2 - \frac{y}{x}\right)h$

LET $h = 0.1$ $(= \Delta x)$

$\boxed{y(1.1)} \approx y(1) + y'(1)\underbrace{(1.1-1)}_{=h} = 3 + \left(2 - \frac{3}{1}\right)(0.1) = 2.9$

$\boxed{y(1.2)} \approx y(1.1) + y'(1.1)(0.1) \approx 2.9 + \left(2 - \frac{2.9}{1.1}\right)(0.1) = 2.8\overline{36}$

$\boxed{y(1.3)} \approx y(1.2) + y'(1.2)(0.1) \approx 2.8\overline{36} + \left(2 - \frac{2.8\overline{36}}{1.2}\right)(0.1)$

$= 2.8$

IN TI-84: 1 ▶ X : 3 ▶ Y : 0.1 ▶ H

Y + (2 − Y/X)H ▶ Y : X + H ▶ X : Y

$y(2) \approx 2.947368421$

GIVEN $\frac{dy}{dx} = f(x,y)$, $y(x_0) = y_0$ WITH $\Delta x = h$

NO PROGRAM EULER'S METHOD

IN TI-84: X_0 ▶ X : Y_0 ▶ Y : Δx ▶ H

Y + (f(X,Y))H ▶ Y : X + H ▶ X : Y

ENTER
ENTER...

2.2 SEPARABLE 1ST ORDER ODE

CAN BE WRITTEN IN FORM $\frac{dy}{dx} = g(x)p(y)$.

TO SOLVE: $\int \frac{1}{p(y)}\,dy = \int g(x)\,dx$

$$P(y) = G(x) + C$$

IF POSSIBLE, SOLVE EXPLICITLY FOR y

IS $y^2 + y' = \frac{y+1}{xy}$ SEPARABLE? PROBABLY NOT

$$y' = \frac{y+1}{xy} - y^2$$

$$= \frac{y+1-xy^3}{xy}$$

$$(xy^2+3y^2)\,dy - 2x\,dx = 0, \quad y(-2)=2$$

$$(xy^2+3y^2)\frac{dy}{dx} - 2x = 0$$

$$\frac{dy}{dx} = \frac{2x}{xy^2+3y^2} = \frac{2x}{y^2(x+3)} = \underbrace{\frac{2x}{x+3}}_{g(x)} \cdot \underbrace{\frac{1}{y^2}}_{p(y)}$$

$$\begin{array}{r|l} & \;2 \\ \hline x+3 & \;2x \\ & -2x+6 \\ \hline & \;-6 \end{array}$$

$$2 - \frac{6}{x+3}$$

$$\int y^2\,dy = \int \frac{2x}{x+3}\,dx$$

$$\frac{1}{3}y^3 = \int \left(2 - \frac{6}{x+3}\right)dx$$

$$\frac{1}{3}y^3 = 2x - 6\ln|x+3| + C$$

$$y =$$