P6-Numerical Methods

The questions is from the review exercise of the Heinemann modular book for AS and Alevel Pure mathematics 6.

113) Given that y satisfies the differential equation

$$\frac{d^2y}{d^2x} + 20\frac{dy}{dx} - y^2 = x$$

use the approximations

$$\left[\frac{dy}{dx}\right]_0 \approx \frac{y_1 - y_{-1}}{2h}, \text{ and } \left(\frac{d^2y}{dx^2}\right)_0 \approx \frac{y_1 - 2y_0 + y_{-1}}{h^2}$$

to find the value of y at x = 0.3, given also that y = 1 at x = 0 and y=2 at x = 0.1. Give your final answer to 3 decimal places.