

eg.
$$X_2 = X_1 - \frac{f(X_1)}{f'(X_1)}$$

$$f(x) = 1 - 3x - x^3$$

$$f'(x) = -3 - 3x^2$$

$$X_1 = 0$$

$$f(0) = 1 - 3(0) - (0)^3 = 1$$

$$f'(0) = -3 - 3(0)^2 = -3$$

$$X_2 = 0 - \frac{1}{-3} = +\frac{1}{3} \checkmark$$

$$X_3 = ?$$

$$X_2 = \frac{1}{3}$$

$$f(X_2) = 1 - 3\left(\frac{1}{3}\right) - \left(\frac{1}{3}\right)^3$$

$$= 1 - 1 - \frac{1}{27} = -\frac{1}{27}$$

$$f'\left(\frac{1}{3}\right) = -3 - 3\left(\frac{1}{3}\right)^2$$

$$= -3 - \frac{1}{3} = -\frac{10}{3}$$

$$X_3 = \frac{1}{3} - \frac{\left(-\frac{1}{27}\right)}{\left(-\frac{10}{3}\right)} = \frac{29}{90} \checkmark$$

HW

Q1 $f(x) = x^3 - 4$

find root where $x_1 = 1$.
(ie. find x_2 and x_3)

$$X_2 = X_1 - \frac{f(X_1)}{f'(X_1)}$$

$$f'(x) = 3x^2$$

$$x_1 = 1$$

$$f(x_1) = f(1) = (1)^3 - 4 = -3$$

$$f'(x_1) = f'(1) = 3(1)^2 = 3$$

$$x_2 = 2$$

$$f(x_2) = (2)^3 - 4 = 4$$

$$f'(x_2) = 3(2)^2 = 12$$

$$X_2 = 1 - \frac{-3}{3} = 2$$

$$X_3 = 2 - \frac{4}{12} = 2\frac{2}{3}$$

$$Q2$$

$$f(x) = x^3 - 3x^2 + 3x - 3$$

$$x_2 = x_1 - \frac{f(x_1)}{f'(x_1)}$$

find root where $x_1 = 2$
(ie. find x_2 and x_3)

$$f'(x) = 3x^2 - 6x + 3$$

$$x_1 = 2$$

$$f(x_1) = f(2) = (2)^3 - 3(2)^2 + 3(2) - 3 = -1$$

$$f'(x_1) = f'(2) = 3(2)^2 - 6(2) + 3 = 3$$

$$x_2 = 2 - \frac{-1}{3} = 2\frac{1}{3}$$

$$x_2 = 2\frac{1}{3} = \frac{7}{3}$$

$$f(x_2) = \left(\frac{7}{3}\right)^3 - 3\left(\frac{7}{3}\right) + 3\left(\frac{7}{3}\right) - 3 = 0.37$$

$$f'(x_2) = 3\left(\frac{7}{3}\right)^2 - 6\left(\frac{7}{3}\right) + 3 = 5.33$$

$$x_3 = 2.33 - \frac{0.37}{5.33} = 2.26$$

kj