

$$1a) \quad f(x) = x^3 + 2x^2 + x + 1$$

$$f(-1.5) = (-1.5)^3 + 2(-1.5)^2 + (-1.5) + 1 \\ = \frac{5}{8}$$

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

change of sign \therefore root between -1.5 and -2 .

$$b) \quad 0 = x^3 + 2x^2 + x + 1$$

~~$$-x - 1 = x(x^2 + 2x)$$~~

$$-x - 1 = x^3 + 2x^2$$

$$x^3 = -x - 1 - 2x^2$$

$$x = \frac{-x - 1 - 2}{x^2}$$

$$= - \left(\frac{x + 1 + 2}{x^2} \right)$$

$$c) \quad x_1 = - \left(\frac{-2 + 1}{(-2)^2} + 2 \right)$$

$$= -1.75$$

$$x_2 = -1.755102041 \quad (-1.755)$$

$$x_3 = -1.754867496 \quad (-1.755)$$

$$d) \quad f(-1.7545) = 1.22 \times 10^{-3}$$

$$f(-1.7555) = -2.00 \times 10^{-3}$$

change of sign $\therefore x = -1.755$ to 3dp

2/

$$f(x) = e^{x+2} + x - 10$$

$$0 = e^{x+2} + x - 10$$

$$10 - x = e^{x+2}$$

$$\ln(10 - x) = x + 2$$

$$\ln(10 - x) - 2 = x$$

$$x = \ln(10 - x) - 2$$

b/

$$x_1 = \ln(10 - (0.5)) - 2$$

$$= 0.251$$

$$x_2 = \ln(10 - 0.251) - 2$$

$$= 0.277$$

$$x_3 = 0.274$$

c/

$$f(0.2745) = -2.44 \times 10^{-3}$$

$$f(0.2755) = 8.28 \times 10^{-3}$$

change of sign $\therefore x = 0.275$ to 3dp.

3a/

$$y = (12 - x) \ln x$$

$$u = 12 - x \quad v = \ln x$$

$$\frac{du}{dx} = -1 \quad \frac{dv}{dx} = \frac{1}{x}$$

$$\frac{dy}{dx} = \frac{1}{x}(12 - x) - \ln x$$

$$= 12x^{-1} - 1 - \ln x$$

b/ stationary
max point where $\frac{dy}{dx} = 0$

$$\frac{12}{4.5} - 1 - \ln 4.5 = 0.16 \dots$$

$$\frac{12}{5} - 1 - \ln 5 = -0.52 \dots$$

change of sign \therefore P lies between 4.5 and 5.

c/

$$\frac{12}{x} - 1 - \ln x = 0$$

$$\frac{12}{x} = 1 + \ln x$$

$$\frac{12}{1 + \ln x} = x$$

d/

$$x_1 = \frac{12}{1 + \ln(4.75)}$$

$$= 4.691$$

$$x_2 = 4.714$$

$$x_3 = 4.705$$

4/

$$y = e^x$$

$$y = 5x - 1$$

$$e^x = 5x - 1$$

$$x = \ln(5x - 1)$$

b/

$$x_1 = \ln(5(2.5) - 1)$$

$$= 2.442$$

$$x_2 = \ln(5(\text{Ans}) - 1)$$

$$= 2.417$$

$$x_3 = \ln(5(\text{Ans}) - 1)$$

$$= 2.406$$