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a)

(i) continuous

(ii) $\frac{dx}{dt} = -2x$

(iii) $F(x) = -2x$

(iv) $-2x = 0$

$\Rightarrow x = 0$ is an eq. pt.

(v) $F'(0) = -2 < 0$, so it is stable.

b) (i) discrete

(ii) $x(n) = \frac{1}{2} x(n-1)$

(iii) $f(x) = \frac{1}{2}x$

(iv) $x = \frac{1}{2}x$

$\Rightarrow x = 0$ is a fixed pt.

(v) $f'(0) = \frac{1}{2} < 1$, so it is stable.

c) i) discrete

ii) $x(n) = 2x(n-1) \cdot (1 - x(n-1))$

(iii) $f(x) = 2x(1-x)$

(iv) $x = 2x(1-x)$

$x = 0$

$1 = 2(1-x)$

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

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

so fixed pts are $x = 0, \frac{1}{2}$

(v) $f(x) = 2x - 2x^2$

$f'(x) = 2 - 4x$

$f'(0) = 2 > 1$, so $x = 0$ is <u>not</u> stable

$f'(\frac{1}{2}) = 2 - 2 = 0 < 1$, so $x = \frac{1}{2}$ is stable

d) (i) continuous

(ii) $\frac{dx}{dt} = 2x(1-x)$

(iii) $F(x) = 2x(1-x)$

(iv) $2x(1-x) = 0$

$\Rightarrow x = 0, 1$ are the eq. pts

(v) $F(x) = 2x - 2x^2$

$F'(x) = 2 - 4x$

$F'(0) = 2 > 0$, so 0 is not stable

$F'(1) = 2 - 4 = -2 < 0$, so 1 is stable