29/11 - Eve

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AMRITSAR COLLEGE OF ENGINEERING AND TECHNOLOGY, AMRITSAR
(AUTONOMUS COLLEGE)

No. ....
l No. of Questions: 09

Total No. of Pages: 02

B.Tech (CSE/IT):- 3rd Sem. (2016 Onward Batch)
Subject Name: Engineering Math - III
Subject Code: ACAM – 16302

: 3 hour.

Maximum Marks: 60

uction to Candidates:

Section - A is Compulsory.

Attempt any Four questions from Section - B.

Attempt any Two questions from Section - C.

Section – A

(2 marks each)

A periodic function of period 4 is defined as $f(x) = |x|, -2 < x < 2$. Find Euler's coefficients a_0 in its Fourier series expansion.

Can $f(x) = \tan x$ be expanded as a Fourier series in the interval $(-\pi, \pi)$

Find Laplace transform of $\mathrm{Sin}\sqrt{t}$.

Find Laplace transform of $e^{2t}\cos^3 2t$.

Solve $(D^3 - 6D^2D' + 11DD'^2 - 6D'^3)\,Z = 0$.

Form partial differential equation of $z = f\left(\frac{xy}{z}\right)$.

What are the properties of Normal distribution?

) If the mean of a Binomial distribution is 3 and the variance is 1.5, find the probability of obtaining at least 4 success.

Explain ERRORS in sampling.

Define Chi – Square test.

Section – B

(5 marks)

Q2) Obtain Fourier half – range cosine series of $\sin\left(\frac{\pi x}{\ell}\right)$ in the range $0 < x < \ell$.

Q3) Evaluate $\int_0^{\infty} e^{2t} \frac{\sin^2 t}{t} dt$.

Q4) Solve: $(D^2 + 2DD' + 2D'^2)z = 2\cos y - x \sin y$.

Q5) Solve the linear system of equations $2x + 2y + z = 12$, $3x + 2y + 2z = 8$, $5x + 10y - 8z = 10$ by Gauss – elimination method.

Q6) In a normal distribution, 7% of the items are under 35 and 12% are over 54. Find mean and standard deviation of the distribution.

Section – C

(10 marks each)

Q7) Obtain Fourier series of $f(x) = |\cos x|$ in the range $-\pi < x < \pi$.

Q8) Using Runge – Kutta method of fourth order, find y(0.2) and y(0.4) given that y(0) = 1. Take h = 0.2 for the equation $\frac{dy}{dx} = 3x + \frac{1}{2}y$.

Q9) The two random samples reveal the following data:

Sample no.	Size	Mean	Variance
I	16	440	40
II	25	460	42

Test whether the samples come from the same normal population.

ACAM – 16302

Engg. Maths III

Sec A

Q. $f(x) = \begin{cases} x, & 0 < x < 2 \\ -x, & -2 < x < 0 \end{cases}$

$a_0 = \frac{1}{2}\int_{-2}^{2} f(x)\,dx = \frac{1}{2}\left(\int_{-2}^{0} (-x)\,dx + \int_{0}^{2} (x)\,dx \right)$

$= \frac{1}{2}\left[\left[-\frac{x^2}{2}\right]_{-2}^{0} + \left(\frac{x^2}{2}\right)_0^2 \right] = \frac{1}{2}(2+2) = 2$

no fn. is divergent in $(-\pi, \pi)$

$\therefore$ fourier series is not expanded.

$\sin\sqrt{t} = \sqrt{t} - \frac{(\sqrt{t})^3}{\lfloor 3} + \frac{(\sqrt{t})^5}{\lfloor 5} + \ldots$

$= t^{1/2} - \frac{t^{3/2}}{\lfloor 3} + \frac{t^{5/2}}{\lfloor 5} + \ldots$

$L(\sin\sqrt{t}) = L\left[t^{1/2} - \frac{t^{3/2}}{\lfloor 3} + \frac{t^{5/2}}{\lfloor 5} + \ldots \right]$

$= \frac{\Gamma\left(\frac{3}{2}\right)}{s^{3/2}} - \frac{\Gamma(5/2)}{\lfloor 3\, s^{5/2}} + \frac{\Gamma\left(\frac{7}{2}\right)}{\lfloor 5\, s^{7/2}} + \ldots$

$= \frac{\frac{1}{2}\sqrt{\pi}}{s^{3/2}} - \frac{\frac{3}{2}\left(\frac{1}{2}\right)\sqrt{\pi}}{\lfloor 3\, s^{5/2}} + \frac{\frac{5}{2}\,\frac{3}{2}\,\frac{1}{2}\sqrt{\pi}}{\lfloor 5\, s^{7/2}} + \ldots$

$= \frac{\sqrt{\pi}}{2 s^{3/2}} e^{-1/4s}$

iv $\cos 3\theta = 4\cos^3\theta - 3\cos\theta$

$4\cos^3\theta = \frac{\cos 3\theta + 3\cos\theta}{4}$

$\cos^3 2t = \frac{1}{4}(\cos 6t + 3\cos 2t)$

$L(\cos^3 2t) = \frac{1}{4}\left[L(\cos 6t) + L(\cos 2t)\right]$

$= \frac{1}{4}\left(\frac{s}{s^2+36} + \frac{s}{s^2+4}\right)$

$\therefore L(e^{2t}\cos^3 2t) = \frac{1}{4}\left[\frac{s-2}{(s-2)^2+36} + \frac{s-2}{(s-2)^2+4}\right]$

v AE $m^3 - 6m^2 + 11m - 6 = 0$

$(m-1)(m^2-5m+6) = 0$

1	1	-6	11
		1	-5
	1	-5	6

$(m-1)(m^2-2m-3m+6) = 0$

$(m-1)\left[m(m-2)-3(m-2)\right] = 0$

$(m-1)(m-2)(m-3) = 0$

$m = 1, 2, 3$

$\therefore$ CF $y = f_1(y+x) + f_2(y+2x) + f_3(y+3x)$

vi $z = f\left(\frac{xy}{z}\right)$

$\frac{\partial z}{\partial x} = f'\left(\frac{xy}{z}\right)\frac{\partial}{\partial x}\left(\frac{xy}{z}\right)$

$= f'\left(\frac{xy}{z}\right) y\left[\frac{z\cdot 1 - x\frac{\partial z}{\partial x}}{z^2}\right]$

$p = \frac{y}{z^2} f'\left(\frac{xy}{z}\right)(z - xp)$

||ly $q = \frac{x}{z^2} f'\left(\frac{xy}{z}\right)(z - yq)$

Dividing $\frac{p}{q} = \frac{y}{x}\left(\frac{z-xp}{z-yq}\right)$

It is cts. Probability distribution. It can be used to approximate Binomial and Poisson distribution.

Total area under normal curve about x axis is 1. It has bell shaped graph.

It is unimodal

Mean, median and mode of the distribution coincide

It is symmetrical about its mean

$\mu = 3 = np$

$\sigma^2 = npq = 1.5$

Dividing $q = \frac{1.5}{3} = 0.5$

Also $p+q=1 \Rightarrow p+0.5=1 \Rightarrow p = 0.5$

$np = 3 \Rightarrow n(0.5) = 3 \Rightarrow n = 6$

atleast 4 success) $= P(X=0) + P(X=1) + P(X=2) + P(X=3) + P(X=4)$

$= {}^6C_0 (0.5)^6 (0.5)^0 + {}^6C_1 (0.5)^5 (0.5)^1 + {}^6C_2 (0.5)^4 (0.5)^2 + {}^6C_3 (0.5)^3 (0.5)^3 + {}^6C_4 (0.5)^2 (0.5)^4$

Type 1 error - rejection of null hypothesis Ho when it should be accepted

Type 2 error - acceptance of null hypothesis when it should have been rejected.

Chi square test measures the degree of discrepancy b/w observed frequencies and theoretical frequencies

Given $f(x) = \sin\frac{\pi x}{l}$, $0 < x < l$

The Fourier Half range Cosine Series is

$$f(x) = \frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos\frac{n\pi x}{l} \quad \text{— (1)}$$

$$a_0 = \frac{2}{l}\int_0^l f(x)\,dx = \frac{2}{l}\int_0^l \sin\frac{\pi x}{l}\,dx$$

$$= \frac{2}{l}\left[\frac{-\cos\frac{\pi x}{l}}{\frac{\pi}{l}}\right]_0^l = \frac{2}{\cancel{l}}\left[\frac{\cancel{l}}{\pi}\cdot\{-(-1)+1\}\right]$$

$$= \frac{2}{\pi}[1+1] = \frac{4}{\pi}$$

$$a_n = \frac{2}{l}\int_0^l f(x).\cos\frac{n\pi x}{l}\,dx = \frac{2}{l}\int_0^l \sin\frac{\pi x}{l}.\cos\frac{n\pi x}{l}\,dx$$

$$= \frac{1}{l}\int_0^l 2\cos\frac{n\pi x}{l}.\sin\frac{\pi x}{l}\,dx$$

$$= \frac{1}{l}\int_0^l \left[\sin(n+1)\frac{\pi x}{l} - \sin(n-1)\frac{\pi x}{l}\right]dx \quad \text{— *}$$

$$= \frac{1}{l}\left[-\frac{\cos(n+1)\frac{\pi x}{l}}{(n+1)\frac{\pi}{l}} + \frac{\cos(n-1)\frac{\pi x}{l}}{(n-1)\frac{\pi}{l}}\right]_0^l$$

$$= \frac{1}{\cancel{l}}.\frac{\cancel{l}}{\pi}\left[\left\{-\frac{(-1)^{n+1}}{n+1} + \frac{(-1)^{n-1}}{n-1}\right\} - \left\{-\frac{1}{n+1} + \frac{1}{n-1}\right\}\right], n \neq 1$$

$$= \frac{1}{\pi}\left[\frac{-(-1)^{n+1}}{n+1} + \frac{(-1)^{n-1}}{n-1} + \frac{1}{n+1} - \frac{1}{n-1}\right] \quad n \neq 1$$

Let when n is ~~Positive~~ even then $(n+1)$ & $(n-1)$ are odd so $(-1)^{odd} = -1$

$$a_n = \frac{1}{\pi}\left[\frac{1}{n+1} - \frac{1}{n-1} + \frac{1}{n+1} - \frac{1}{n-1}\right], n \neq 1$$

$$= \frac{1}{\pi}\left[\frac{2}{n+1} - \frac{2}{n-1}\right] = \frac{2}{\pi}\left[\frac{\cancel{n}-1-\cancel{n}-1}{(n+1)(n-1)}\right]$$

$$a_n = \frac{-4}{\pi(n^2-1)}$$

Case II when n is odd then $n+1$ & ... are even

$$\therefore (-1)^{even} = 1$$

$$\therefore a_n = \frac{1}{\pi}\left[\cancel{-\frac{1}{n+1}} + \cancel{\frac{1}{n-1}} + \cancel{\frac{1}{n+1}} - \cancel{\frac{1}{n-1}}\right] = $$

for $n=1$, from *

$$a_1 = \frac{1}{\pi}\int_0^{\pi}\left[\sin\left(\frac{2\pi x}{l}\right) - 0\right] dx$$

$$= \frac{1}{\pi}\left[-\frac{\cos\frac{2\pi x}{l}}{\frac{2\pi}{l}}\right]_0^l$$

$$= \frac{1}{\pi}\cdot\frac{l}{2\pi}\left[-1+1\right] = 0$$

$\therefore$ from (1) Fourier series is

$$f(x) = \frac{1}{2}\left(\frac{4}{\pi}\right) + a_1\cos\frac{\pi x}{l} + \left[a_2\cos\frac{2\pi x}{l} + a_3\cos\ldots\right.$$

$$= \frac{2}{\pi} + 0 + \left[\frac{-4}{\pi(2^2-1)}\cos\frac{2\pi x}{l} + 0 - \frac{4}{\pi\ldots}\right.$$

$$= \frac{2}{\pi} - \frac{4}{\pi}\left(\frac{\cos\frac{2\pi x}{l}}{2^2-1} + \frac{\cos\frac{4\pi x}{l}}{4^2-1} + \ldots\right.$$

(3)

$$\int_0^\infty e^{-2t}\frac{\sin^2 t}{t}dt = \int_0^\infty e^{-st}\frac{\sin^2 t}{t}dt \quad \text{where } s=2$$

$$= L\left\{\frac{\sin^2 t}{t}\right\} \quad \text{—— (1)}$$

Now $\sin^2 t = \frac{1-\cos 2t}{2}$

$$\therefore L(\sin^2 t) = \frac{1}{2}\left[L(1) - L(\cos 2t)\right]$$

$$= \frac{1}{2}\left[\frac{1}{s} - \frac{s}{s^2+4}\right]$$

$$\therefore L\left(\frac{\sin^2 t}{t}\right) = \int_s^\infty \frac{1}{2}\left(\frac{1}{s} - \frac{s}{s^2+4}\right)ds \quad (\because \text{of Divn Rule})$$

$$= \frac{1}{2}\left[\log s - \frac{1}{2}\log(s^2+4)\right]_s^\infty$$

$$= \frac{1}{4}\left[2\log s - \log(s^2+4)\right]_s^\infty$$

$$= \frac{1}{4}\left[\log\frac{s^2}{s^2+4}\right]_s^\infty = \frac{1}{4}\left[\log\frac{\cancel{s^2}}{\cancel{s^2}(1+\frac{4}{s^2})}\right]_s^\infty$$

$$= \frac{1}{4}\left[\log 1 - \log\frac{1}{1+\frac{4}{s^2}}\right] = \frac{1}{4}\left[0 - \log\frac{s^2}{s^2+4}\right]$$

$$\therefore L\left(\frac{\sin^2 t}{t}\right) = \frac{1}{4}\log\left(\frac{s^2+4}{s^2}\right)$$

$\therefore$ from (1)

$$\int_0^\infty e^{-2t}\frac{\sin^2 t}{t}dt = \frac{1}{4}\log\left(\frac{s^2+4}{s^2}\right) \quad \text{where } s=2$$

$$= \frac{1}{4}\log\left[\frac{4+4}{4}\right] = \frac{1}{4}\log[2]$$

Q: Given $(D^2+2DD'+2D'^2)z = 2\cos y - x\sin y$

For A.E, put $D = m$, $D' = 1$

$\therefore$ A.E is

$m^2 + 2m + 2 = 0$

$$m = \frac{-2 \pm \sqrt{4-8}}{2} = \frac{-2 \pm \sqrt{-4}}{2} = \frac{-2 \pm i2}{2}$$

Let $m = \alpha = -1+i$, $\beta = -1-i$

$\therefore$ C.F is

$$z_c = f_1(y+\alpha x) + f_2(y+\beta x)$$

$$P.I = \frac{1}{D^2+2DD'+2D'^2}(2\cos y - x\sin y)$$

$$= 2\frac{1}{D^2+2DD'+2D'^2}\cos(0x+y) - \frac{1}{D^2+2DD'+2D'^2}$$

$$= 2I_1 - I_2 \quad \text{——— (1)}$$

Now

$$I_1 = \frac{1}{D^2+2DD'+2D'^2}\cos(0x+y) = \frac{1}{0+0+2}\iint \cos$$

where $u = 0x+y$

$$= \frac{1}{2}\int \sin u\, du = -\frac{1}{2}\cos u = -\frac{1}{2}\cos(y)$$

$$I_2 = \frac{1}{D^2+2DD'+2D'^2}x\sin y = \frac{1}{(D-\alpha D')(D-\beta D')}x\sin y$$

$$= \frac{1}{(D-\alpha D')}\left[\frac{1}{(D-\beta D')}\cdot x\sin y\right]$$

$$= \frac{1}{(D-\alpha D')}\left[\int (y-\beta c)\sin y\, dy\right]$$

where x

$$= \frac{1}{(D-\alpha D')}\left[(y-\beta c)(-\cos y) - (1)(-\sin y)\right]$$

$$= \frac{1}{(D-\alpha D')}\left[-x\cos y + \sin y\right]$$

$P.I_2 = \int \{-(y-x_c)\cos y + \sin y\}\, dy$ where $x = y - x_c$ (B)

$= -\left[(y-x_c)\sin y - (1)(-\cos y)\right] + \cos y$

$= -\left[x\sin y + \cos y\right] + \cos y$

$= -x\sin y - \cancel{\cos y} + \cancel{\cos y} = -x\sin y$.

From (1)

$P.I = 2\left(-\frac{1}{2}\cos y\right) - \{-x\sin y\}$

$= -\cos y + \sin y$

$\therefore C.S = C.F + P.I$

The given sys is in matrix form are

$$\begin{bmatrix} 2 & 2 & 1 \\ 3 & 2 & 2 \\ 5 & 10 & -8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 12 \\ 8 \\ 10 \end{bmatrix}$$

ie $AX = B$

Consider Augmented matrix as

$$[A:B] = \left[\begin{array}{ccc:c} 2 & 2 & 1 & 12 \\ 3 & 2 & 2 & 8 \\ 5 & 10 & -8 & 10 \end{array}\right]$$

operating $R_2 \to R_2 - R_1$

$$\sim \left[\begin{array}{ccc:c} 2 & 2 & 1 & 12 \\ 1 & 0 & 1 & -4 \\ 5 & 10 & -8 & 10 \end{array}\right]$$

operating R_{12}

$$\sim \left[\begin{array}{ccc:c} 1 & 0 & 1 & -4 \\ 2 & 2 & 1 & 12 \\ 5 & 10 & -8 & 10 \end{array}\right]$$

operating $R_2 \to R_2 - 2R_1$
$R_3 \to R_3 - 5R_1$

$$\sim \left[\begin{array}{ccc:c} 1 & 0 & +1 & -4 \\ 0 & 2 & -1 & 20 \\ 0 & 10 & -13 & 30 \end{array}\right]$$

operating $R_3 \to R_3 - 5R_2$

$$\sim \left[\begin{array}{ccc:c} 1 & 0 & +1 & 4 \\ 0 & 2 & -1 & 20 \\ 0 & 0 & -8 & -70 \end{array}\right]$$

$\therefore$ In eq's method

$x + 0y + 1z = 4$ —— 1

$2y \cancel{+} 1z = 20$ —— 2

$\cancel{-} 8z = -70$ —— 3

$$z = \frac{\cancel{-}70}{\cancel{-}8} = \frac{+35}{4}$$

put in 2

$$2y - \frac{35}{4} = 20$$

$$2y = 20 + \frac{35}{4} = \frac{115}{4}$$

$$y = \frac{115}{8}$$

put in 1

$$x + \frac{35}{4} = 4$$

$$\Rightarrow x = -4 - \frac{35}{4} = \frac{-16 - 35}{4} = \frac{-51}{4}$$

$\therefore$ Sol is $x = \frac{-51}{4}$, $y = \frac{115}{8}$ & $z = \frac{35}{4}$

$$2\left(\frac{-51}{4}\right) + 2\left(\frac{115}{8}\right) + \frac{35}{4}$$

$$\frac{-102 + 115 + 35}{4} = \frac{48}{4} = 12$$

~~Area to left of $x = 35$ is~~ (7)

~~7% ie Area~~

let $\bar{x}$ & σ be the mean & S.D of the distribution

Since Area under $x = 35$ is 7%

ie Area to the left of $x = 35$ is 0.07

Let there $z = z_1$

$\therefore P(z_1 \le z \le 0) = 0.5 - 0.07 = .43$

$\therefore$ value of z Corresponding to are .43 is $z = -1.48$

Since Area over $x = 54$ is 12%.

ie Area to the right of $x = 54$ is .12

Let there $z = z_2$

$P(0 \le z \le z_2) = .5 - .12 = .38$

Value of z Corresponding to are .38

is $z = 1.18$

Now $z = \dfrac{x - \bar{x}}{\sigma}$

when $x = 35$, $z = -1.18$

$\therefore -1.18 = \dfrac{35 - \bar{x}}{\sigma}$

$\Rightarrow -1.18\sigma = 35 - \bar{x}$

$\Rightarrow \bar{x} - \dfrac{118}{100}\sigma = 35$

$\Rightarrow 100\bar{x} - 118\sigma = 350$ —— (1)

Again when $x = 54$, $z = 1.18$

$\therefore +1.18 = \dfrac{54 - \bar{x}}{\sigma}$

$\Rightarrow 1.18\sigma = 54 - \bar{x}$

$\Rightarrow x + \dfrac{118}{100}\sigma = 54$

$\Rightarrow 100x + 118\sigma = 5400$ —— (2)

Section C

$b_n = 0$

$$a_0 = \frac{2}{\pi}\int_0^{\pi} f(x)\,dx = \frac{2}{\pi}\int_0^{\pi} |\cos x|\,dx$$

$$= \frac{2}{\pi}\left[\int_0^{\pi/2} \cos x\,dx - \int_{\pi/2}^{\pi} \cos x\,dx\right]$$

$$= \frac{4}{\pi}$$

$$\frac{2}{\pi}\int_0^{\pi} f(x)\cos nx\,dx$$

$$= \frac{2}{\pi}\left[\int_0^{\pi/2} \cos x \cos nx\,dx - \int_{\pi/2}^{\pi} \cos nx \cos x\,dx\right]$$

$$\frac{1}{\pi}\left[\int_0^{\pi/2}\{\cos(n+1)x + \cos(n-1)x\}\,dx + \int_{\pi/2}^{\pi}\{\cos(n+1)x + \cos(n-1)x\}\,dx\right]$$

$$= \frac{2}{\pi}\left[\frac{\sin(n+1)\pi/2}{n+1} + \frac{\sin(n-1)\pi/2}{n-1}\right]$$

$$(n+1)\frac{\pi}{2} = 0 \;;\; n \text{ is odd}$$
$$= (-1)^{n/2};\; n \text{ is even}$$

$$(n-1)\frac{\pi}{2} = 0 \;;\; n \text{ is odd}$$
$$= -(-1)^{n/2};\; n \text{ is even}.$$

$$= \frac{-4(-1)^{n/2}}{\pi(n^2-1)} \;;\; n \neq 1$$

$$\frac{2}{\pi}\left[\int_0^{\pi/2} \cos^2 x\,dx - \int_{\pi/2}^{\pi} \cos^2 x\,dx\right]$$

$$= 0$$

$$f(x) = \frac{2}{\pi} + \sum_{n \text{ is even}} \frac{-4(-1)^{n/2}}{\pi(n^2-1)} \cos nx$$

$$= \frac{2}{\pi} + \frac{4}{\pi}\left[\frac{\cos 2x}{2^2-1} - \frac{\cos 4x}{4^2-1} + \frac{\cos 6x}{6^2-1} - \cdots\right]$$

(8) $h = 0.2, \quad x_0 = 0, \quad y_0 = 1$

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

(I) $k_1 = h f(x_0, y_0) = 0.2\left[3(0) + \frac{1}{2}\right] = 0.1$

$k_2 = h f\left(x_0 + \frac{h}{2}, y_0 + \frac{k_1}{2}\right) = 0.2 f(0.1, 1.05)$

$= 0.2\left[3(0.1) + \frac{1.05}{2}\right] = 0.165$

$k_3 = h f\left(x_0 + \frac{h}{2}, y_0 + \frac{k_2}{2}\right) = 0.2 f(0.1, 1.0825)$

$= 0.2\left[3(0.1) + \frac{1.0825}{2}\right] = 0.16825$

$k_4 = h f(x_0 + h, y_0 + k_3) = 0.2 f(0.2, 1.16825)$

$= 0.2\left[3(0.2) + \frac{1.16825}{2}\right] = 0.236825$

$k = \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4) = 0.1672$

$y_1 = y_0 + k \Rightarrow \boxed{y_1 = 1.1672}$ $\boxed{x_1 = 0.2}$

(II) $k_1 = h f(x_1, y_1) = 0.2 f(0.2, 1.1672)$

$= 0.2\left[3(0.2) + \frac{1.1672}{2}\right] = 0.23672$

$k_2 = h f\left(x_1 + \frac{h}{2}, y_1 + \frac{k_1}{2}\right) = 0.2 f(0.3, 1.28556)$

$= 0.2\left[3(0.3) + \frac{1.28556}{2}\right] = 0.308556$

$k_3 = h f\left(x_1 + \frac{h}{2}, y_1 + \frac{k_2}{2}\right) = 0.2 f(0.3, 1.321478)$

$= 0.2\left[3(0.3) + \frac{1.321478}{2}\right] = 0.312147$

$k_4 = h f(x_1 + h, y_1 + k_3) = 0.2 f(0.4, 1.4793478)$

$= 0.2 f\left(3(0.4) + \frac{1.493478}{2}\right) = 0.387934$

$k = 0.31101$

$y_2 = y_1 + k \Rightarrow \boxed{y_2 = 1.4782}$ $\boxed{x_2 = 0.4}$

F test $H_0: \sigma_1 = \sigma_2$

$n_1 = 16,\ n_2 = 25,\quad s_1^2 = 40,\quad s_2^2 = 42$

$$\frac{n_1}{n_1 - 1} s_1^2 = \frac{16}{15} \times 40 = \frac{128}{3}$$

$$\frac{n_2}{n_2 - 1} s_2^2 = \frac{25}{24} \times 42 = \frac{175}{4}$$

$$F = \frac{S_2^2}{S_1^2} = 1.02$$

$f_{0.05}$ at $(24, 15)$ d.f $= 2.23$

$CV < TV$ $\therefore$ H_0 is accepted.

t-test $H_0: \mu_1 = \mu_2$

$$S^2 = \frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2 - 2} = 43.3 \Rightarrow S = 6.58$$

$$t = \frac{\bar{x} - \bar{y}}{S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}} = -9.49 \Rightarrow |t| = 9.49$$

$t_{0.05}$ at 39 d.f. $= 1.96$

$CV > TV$ $\therefore$ H_0 is Rejected.

$\therefore$ Samples don't come from same population.