

1809801 Mathematics Exam

by Kieran Williams

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HNC Electrical and Electronic Engineering

SGEE5001 Further Engineering

Mathematics

Mathematics Exam

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1809801

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1809801 Mathematics Exam

Section A

a)	x	f	xf	$f(x - \bar{x})^2$
	3	3	9	28.09
	4	17	68	72.141
	5	29	145	32.584
	6	46	276	0.166
	7	33	231	29.159
	8	18	144	67.745
	9	4	36	34.574
		$\Sigma = 150$	$\Sigma = 909$	$\Sigma = 264.459$

$$\bar{x} = \frac{909}{150} = 6.06$$

$$\sigma = \sqrt{\frac{264.459}{150}} = 1.33$$

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b) (i)

$$Z = \frac{x - \mu}{\sigma} \quad \begin{array}{l} \mu = 245 \\ \sigma = 40 \\ x = 200 \end{array}$$

$$Z = \frac{(200 - 245)}{40}$$

$$= -1.125 \stackrel{3/3}{=} -0.3643 \quad \times$$

As it's greater than 245

$$\begin{aligned} Z &= 0.5 + 0.3643 \\ &= 0.8643 \quad \times \end{aligned}$$

(ii) Larger than X therefore:

$$0.5 + 0.1 = 0.6 \quad \times$$

z value of 3.0902

$$3.0902 = \frac{x - 245}{40} \quad x = (3.0902 \times 40) - 245$$

$$x = \del{121.392} 121.392 \quad x$$

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Section B

1) $\frac{dy}{dt} + 4y = 10$ given $y(0) = 3$

$$(s\bar{y} - y_0) + 4\bar{y} = \frac{10}{s} \quad 3$$

Since $y_0 = 3$

$$s\bar{y} - 3 + 4\bar{y} = \frac{10}{s} \quad 2$$

$$\bar{y}(s+4) = \frac{13}{s} \quad x$$

$$\bar{y} = \frac{13}{(s)(s+4)}$$

$$\frac{13}{(s)(s+4)} = \frac{A}{(s)} + \frac{B}{(s+4)}$$

$$13 = A(s+4) + B(s) \quad 1$$

Put s as 0

$$13 = A(4) + B(0)$$

$$13 = 4A$$

$$A = 3.25 \quad 1$$

Put s as -4

$$13 = A(0) + B(-4)$$

$$13 = -4B$$

$$B = -3.25 \quad 1$$

therefore :

$$y(t) = 3.25(1 - e^{-4t}) + 3$$

$$\mathcal{L}^{-1} \left\{ \frac{3.25}{(s)} - \frac{3.25}{(s+4)} \right\}$$

$$= 3.25 - 3.25e^{-4t}$$

2

t

o

t

$$2) R = 30 \quad L = 0.6 \quad E = 30 \quad I(0) = 0$$

$$\text{Since } E = RI + L \frac{dI}{dt}$$

$$30 = 30I + 0.6 \frac{dI}{dt}$$

$$\div 0.6$$

$$50 = 50I + \frac{dI}{dt}$$

$$P = 50 \quad Q = 50$$

$$\int P dt = \int 50 dt = 50t$$

$$\text{Therefore, integrating factor} = e^{50t}$$

$$Ie^{50t} = \int e^{50t} 50 dt$$

$$Ie^{50t} = \int 50e^{50t} dt$$

General solution :

$$Ie^{50t} = e^{50t} + C$$

When $I = 0$ $t = 0$

$$(0)e^{50(0)} = e^{50(0)} + C$$

$$0 = 1 + C$$

$$C = -1$$

$$50t \quad 50t$$

$$Ie^{-} = e^{-} - 1$$

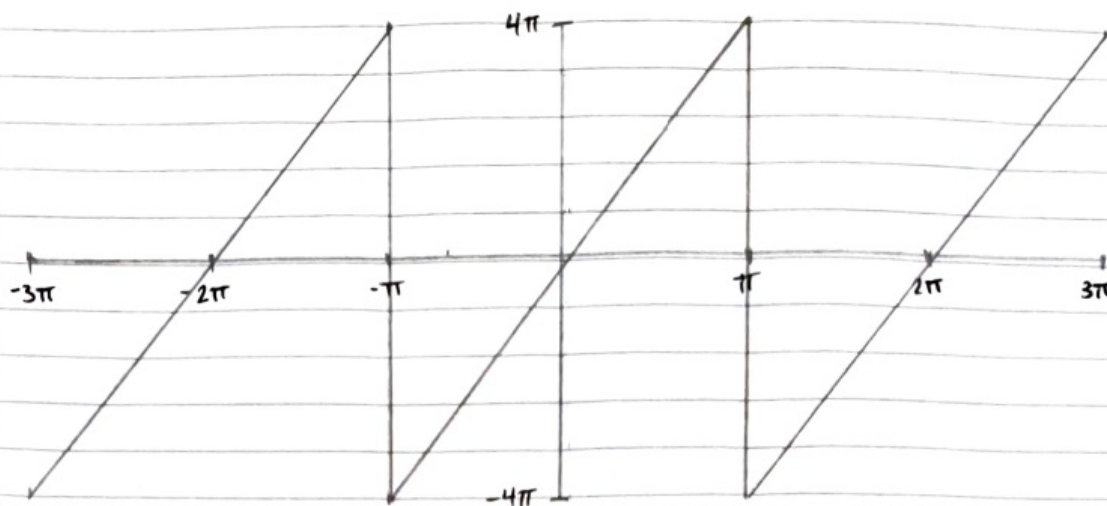
$$I = \frac{e^{50t}}{e^{50t}} - \frac{1}{e^{50t}}$$

$$I = 1 - e^{-50t}$$

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3) $f(x) = 4x$ when $-\pi < x < \pi$

and $f(x+2\pi) = f(x)$



If $x = -\pi$

$4x = 4(-\pi)$

$x = -\pi$

If $x = \pi$

$4x = 4(\pi)$

$x = \pi$

odd function so therefore

$a_0 = 0$ $a_n = 0$

$$b_n = \frac{2}{\pi} \int_0^{\pi} 4x \sin nx \, dx$$

Integration by Parts:

let $u = 4x$

let $\frac{dv}{dx} = \sin nx$

$\frac{du}{dx} = 4$

$v = -\frac{1}{n} \cos nx$

$$\int 4x \sin nx \, dx = (4x)\left(-\frac{1}{n} \cos nx\right) - \int \left(-\frac{1}{n} \cos nx\right)(4) \, dx$$

$$= -\frac{4x}{n} \cos nx + \int \frac{4}{n} \cos nx \, dx$$

$$= -\frac{4x}{n} \cos nx + \frac{4}{n^2} \sin nx$$

Therefore:

$$b_n = \frac{2}{\pi} \left[-\frac{4x}{n} \cos nx + \frac{4}{n^2} \sin nx \right]_0^{\pi}$$

$$b_n = \frac{2}{\pi} \left[-\frac{4(\pi)}{n} \cos(n\pi) + \frac{4}{n^2} \sin(n\pi) \right] - \left[-\frac{4(0)}{n} \cos(n0) + \frac{4}{n^2} \sin(n0) \right]$$

Since $\sin 0 = 0$ and $\sin(n\pi) = 0$

$$b_n = -\frac{8\pi}{\pi n} \cos(n\pi)$$

$$= -\frac{8}{n} \cos(n\pi)$$

~~$$A_2 = \frac{1}{2} b_1 + \frac{1}{2} b_2 + \frac{1}{2} b_3 + \frac{1}{2} b_4$$~~

$$n=1 \quad b_1 = \frac{-8}{1} \cos(\pi) = \frac{8}{(1)}$$

$$n=2 \quad b_2 = \frac{-8}{2} \cos(2\pi) = \frac{-8}{(2)}$$

$$n=3 \quad b_3 = \frac{-8}{3} \cos(3\pi) = \frac{8}{3}$$

$$n=4 \quad b_4 = \frac{-8}{4} \cos(4\pi) = \frac{-8}{(4)}$$

$$f(x) = \frac{1}{2} a_0 + \sum_{n=1}^{\infty} [a_n \cos nx + b_n \sin nx]$$

~~$$f(x) = \frac{1}{2} a_0 + \frac{1}{2} b_1 \sin x + \frac{1}{2} b_2 \sin 2x + \frac{1}{2} b_3 \sin 3x + \frac{1}{2} b_4 \sin 4x$$~~

$$f(x) = \frac{8}{1} \sin x - \frac{8}{2} \sin 2x + \frac{8}{3} \sin 3x - \frac{8}{4} \sin 4x.$$

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GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

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