Benha University Faculty of Engineering – Shoubra Eng. Mathematics & Physics Department Second Year Civil		Final Term Exam Date: January 17, 2017 Course: Math. and Numer. Analy. Code: MPH 251 Duration: 3 hours
• The Exam consists of **Two pages** Answer **All** Questions		No. of questions: 3 Total Mark: 70

Question 1: **30**

1) ***Find* a root** to the equation: $x^2 + x - 2 = 0$,

in the interval $[\,0.8\,,\ 1.1\,]$, using:

(i) the fixed-point iteration method; the number of iterations n, is 5,

and initial point as, 0.8.

(ii) the inverse interpolation.

Which method is more accurate?

2) ***Use two different*** methods **to find the L.S.L.** that passes through the point $(1\,,\ 0.6)$, ***and fits*** the data: $(1, 1)$, $(2, 3)$, $(3, 2)$, $(4, 5)$, $(5, 8)$.

3) ***Solve*** the following **L.P.** problem graphically,

then check the solution using the simplex method:

$$\begin{aligned} \text{maximize}: \quad & f = 3x - y\,; \\ \text{subject to,} \quad & x + y \le 2\,, \\ & x - y \le 1\,; \qquad x \ge 0\,, \quad y \ge 0\,. \end{aligned}$$

Question 2: **15**

1) ***By using*** the Euler 's method, ***Find*** y_5, for *the* following differential equation:

$$y' = y^2 + x\,; \qquad y(2) = 1\,; \ x \in [\,2\,,\ 3.25\,]\,.$$

2) ***Solve*** the following liner system by using iterative method:

$10x + y + 2z = 44$ & $2x + 10y + z = 51$ & $x + 2y + 10z = 61$;

where the number of iterations n, is 3.

LOOK ANOTHER PAGE

Question 3:

25

1) ***Evaluate*** **the following integrals:**

$$\text{i}- \oint_C \left\{ \frac{\ell n\,(3+z)}{(z^2-3z)\cdot(z+1)} \right\} dz\,; \qquad C \text{ is } |z-1| = 3.$$

$$\text{ii}- \oint_C \left\{ \frac{e^{3z}}{(z^2+4)} \right\} dz\,; \qquad C \text{ is } |z+i| = 4.$$

2) **For the following data:**

x_i	1.00	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
$y_i = f(x_i)$	5.19	5.27	5.44	5.52	5.71	6.17	6.34	6.49	6.55

i- ***Find*** **the values:** $f^{\backslash}(1),\ f^{\backslash\backslash}(2.75),\ f^{\backslash\backslash}(1.00),\ f^{\backslash}(3)$.

ii- ***Evaluate*** **the following integral by Using *Two Rules:*** $\int_{1.00}^{2.50} f(x)\,dx$.

3) ***Show that*** **the function:** $v(x,y) = e^{-y}\cdot(\cos x) - 6x + 4y$ **, is harmonic,**

and find **the function** $f(z)$; **where** $f(z) = u + i\,v$ **, is analytic function.**

4) ***Put*** **the following complex numbers in another formula:**

i) $z_1 = \{\overline{(-2\sqrt{3},\ \sqrt{3})}\}^8.$

ii) $z_2 = (3\sqrt{2} + 3i)^{-1}\cdot(4e^{-i\pi/3}).$

iii) $z_3 = \{8e^{[5-i(25\pi/21)]}\}^{-7}.$

5) ***Find*** $W^{\backslash}$ **for the function:**

$$W = 2e^{-\sqrt{3z}} + (\sqrt[3]{z-8}) + \{\cos(e^{-2z^3})\} - 5^{\ell n\,8z}.$$

ENDED TEST QUESTIONS

Q1

(1)

اجابة السؤال الاول

(1) (i) $X(X+1)-2=0$, $X=g(X)=\frac{2}{X+1}$

$g'(X)=\frac{0-2}{(X+1)^2}$

$g'(.8)=-.617 < 1$

$g'(1.1)=\frac{0-2}{(1.1+1)^2}=-.454 < 1$

∴ it is. o.k

iteration	X_n	X_{n+1}
1	.8	1.111
2	1.111	0.947
3	0.947	1.027
4	1.027	0.987
5	0.987	1.007

at $n=1$, $X_2=\frac{2}{.8+1}=1.111$

at $n=2$, $X_3=\frac{2}{1.111+1}=.947$

at $n=3$, $X_4=\frac{2}{.947+1}=1.027$

at $n=4$, $X_5=\frac{2}{1.027+1}=0.987$

~~at n=5 , $X_6=\frac{2}{}$~~

(2)

at $n = 5$, $X_6 = \frac{2}{,987 + 1} = 1,007$

the root $X^* = 1,007$

ii) (,8 , −,56) , (,9 , −,29) , (1 , 0)

(1,1 , ,31) , Difference in h

$h_2 = +,29$, $h_1 = -,29 + ,56 = ,27$, $h_3 = ,31$

y	X	Δ_X	Δ^2_X	Δ^3_X
−,56	,8			
		$\frac{,9 - ,8}{-,29 + ,56} = ,370$		
−,29	,9		$\frac{,345 - ,37}{+,56} = -,045$	
		$\frac{1 - ,9}{+,29} = ,345$		$\frac{-,038 + ,045}{,31 + ,56} = ,008$
0	1			
		$\frac{1,1 - 1}{,31 - 0} = ,322$	$\frac{,322 - ,345}{,31 + ,29} = -,038$	
,31	1,1			

$F(y) = X = ,8 + ,37(y + ,56) - ,045(y + ,56)(y + ,29)$

$+ ,008(y + ,56)(y + ,29)(y)$

root $X^* = ,999$ at $y = 0$

$X = \simeq 1$

- the inverse interpolation is more

3

accurate than Fixed point which need alarge number of iterations to be correct.

اجابة السؤال الاول رقم ⓒ

ⓒ

First method:-

let line :- $y = aX + b$

$\frac{1}{n}\sum x$ $\frac{1}{n}\sum y$

$$\sum_{i=1}^{5} y = a \sum_{i=1}^{5} X + b \sum_{i=1}^{5} 1$$

$$\sum_{i=1}^{5} Xy = a \sum_{i=1}^{5} X^2 + b \sum_{i=1}^{5} X$$

(1,1) , (2,3) , (3,2) , (4,5) , (5,8)

n. poin	X	y	Xy	X^2
①	1	1	1	1
②	2	3	6	4
③	3	2	6	9
④	4	5	20	16
⑤	5	8	40	25
$\sum$	15	19	73	55

$19 = a(15) + b(5) \longrightarrow$ ①

$73 = a(55) + b(15) \longrightarrow$ ②

$\therefore a = 1,6 \quad , b = -1$

$\therefore$ the line is:- $y = 1,6\,X - 1$

Check the point $(1, ,6)$ achieve the line :- $\boxed{1,6 - 1 = ,6}$

Second method:-

the line passes through point $(\bar{X}, \bar{y})$, :- $\bar{X} = \frac{1}{n} \sum_{i=1}^{5} X = \frac{1}{5} * (15) = 3$

$\bar{y} = \frac{1}{n} \sum_{i=1}^{5} y = \frac{1}{5} (19) = 3,8$

line passes through $(3, 3,8)$ and $(1, ,6)$

$\therefore \frac{y - y_1}{X - X_1} = \frac{y_2 - y_1}{X_2 - X_1}$, $\frac{y - ,6}{X - 1} = \frac{3,8 - ,6}{3 - 1}$

$2 (y - ,6) = 3,2 \; (X - 1)$

$2y - 1,2 = 3,2X - 3,2$

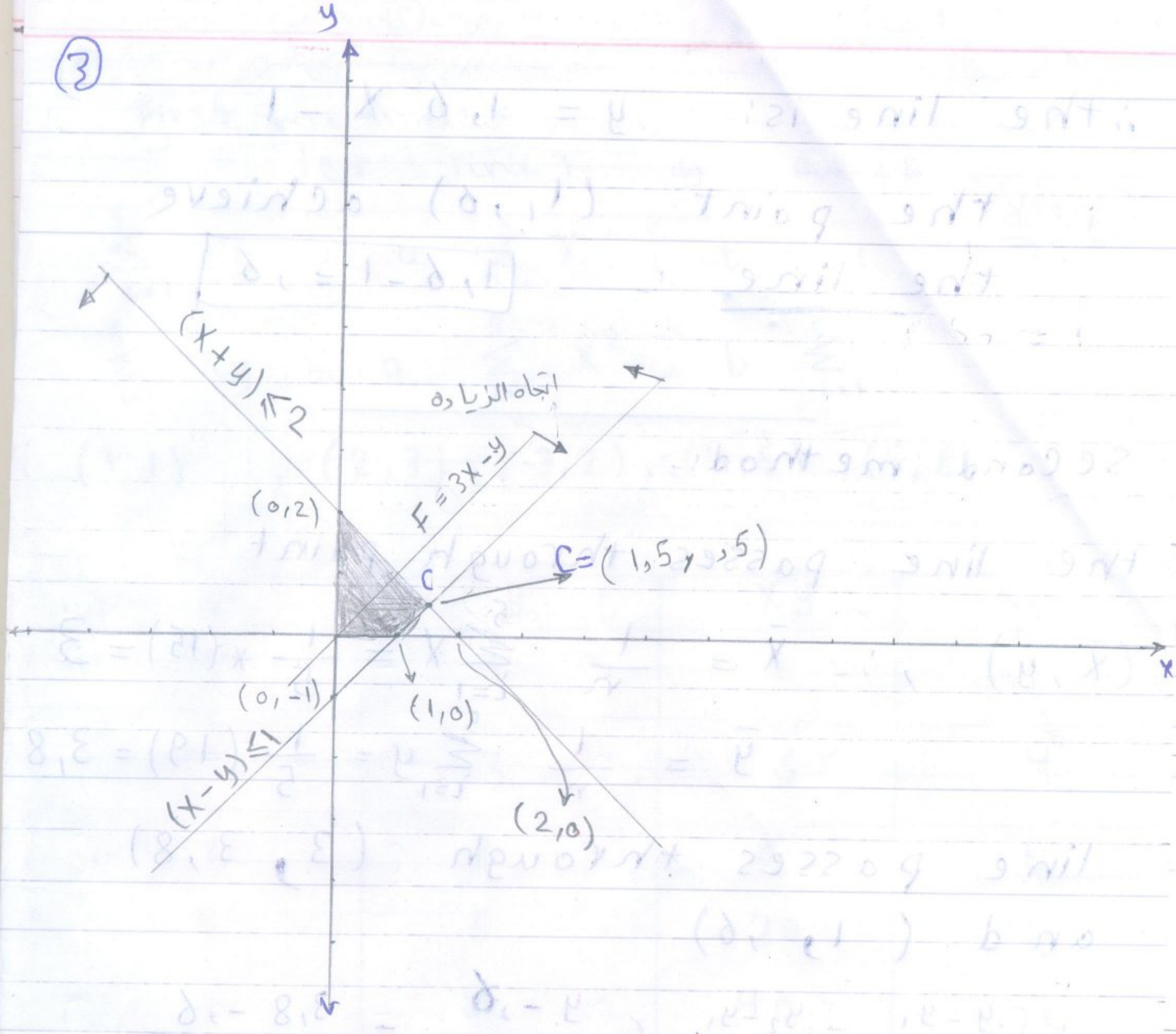
$\therefore 2y = 3,2\,X - 2 \quad \div 2$

$\therefore y = 1,6\,X - 1$

6

graphically

(3)



① $x + y = 2$, $y = 2 - x$
at $x = 0$, $y = 2$
at $x = 2$, $y = 0$
Subs. at $(0,0)$
$0 \leq 2$
o.k

$x - y = 1$, $y = x - 1$
at $x = 0$, $y = -1$
at $x = 1$, $y = 0$
substute at $(0,0)$
in $x - y \leq 1$
$0 \leq 1$ o.k

$x \geq 0$, $y \geq 0$

point of intersection

$x + \cancel{y} = 2$

$x - \cancel{y} = 1$ بالجمع

$2x = 3$, $x = 1,5$, $y = ,5$

~~maximize~~ $3x - y = 0$

at $x = 0$, $y = 0$

at $x = 1$, $y = 3$

maximize at the last point of interaction

point Corner	Value $F(x,y) = 3x - y$
(0,0)	0
(0,2)	-2
(1,5 , ,5)	4
(1, 0)	3

the maximum Value = 4

maximum Solution at $C = (1,5 , ,5)$

Check using simplex

$F = 3X - y \longrightarrow -3X + y$

$X + y \leqslant 2 \longrightarrow X + y + S_1 = 2$

$X - y \leqslant 1 \longrightarrow X - y + S_2 = 1$

$S_1, S_2 \longrightarrow$ slack

max $\longrightarrow$ No $\boxed{-ve}$ with simplex

pivet element

B.V	X	y	S_1	S_2	Solu
S_1	1	1	1	0	2
S_2	1	-1	0	1	1
F	-3	1	0	0	0
S_1	0	pivet eleme $\boxed{2}$	1	-1	1
X	1	-1	0	1	1
F	0	-2	0	3	3
y	0	1	1/2	-1/2	1/2
X	1	0	1/2	1/2	3/2
F	0	0	1	2	4

$\therefore$ the optimum value $= 4$

the maximum optimum Solution ~~(1.5, 1/2)~~

(1,5 , 1/2)

Q2 9

Question 2

1)

at $x_0 = 2$ $y_0 = 1$

at $x_1 = 2.25$

$y_1 = y_0 + h\, f(x_0, y_0) = 1 + 0.25(1^2 + 2) = 1.75$

at $x_2 = 2.5$

$y_2 = y_1 + h f(x_1, y_1) = 1.75 + 0.25(1.75^2 + 2.25)$

$= 3.078$

at $x_3 = 2.75$

$y_3 = y_2 + h f(x_2, y_2) = 3.078 + 0.25(3.078^2 + 2.5)$

$= 6.072$

at $x_4 = 3$

$y_4 = y_3 + h f(x_3, y_3) = 6.072 + 0.25(6.072^2 + 2.75)$

$= 15.977$

at $x_5 = 3.25$

$y_5 = y_4 + h f(x_4, y_4) = 15.977 + 0.2(15.977^2 + 3)$

$= 80.543$

Q2

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QUESTION2

1)

$y' = y^2 + x$ $\quad$ $\therefore h = 0.25$

$y_0 = 1 \quad x_0 = 2$

	(x)	(y) $\quad y_n = y_{n-1} + h f(y_{n-1}, x_{n-1})$
0	2	1
1	2.25	$y_1 = 1 + 0.25(1^2 + 2) = 1.75$
2	2.5	$y_2 = 1.75 + 0.25(1.75^2 + 2.25) = \frac{197}{64} \approx 3.078$
3	2.75	$y_3 = 3.078 + 0.25(3.078^2 + 2.5) = 6.072$
4	3	$y_4 = 6.072 + 0.25(6.072^2 + 2.75) = 15.977$
5	3.25	$y_5 = 15.977 + 0.25(15.977^2 + 3) = 80.543$

$y_1 = y_0 + h\, f(x_0, y_0)$ $\quad$ ملحوظة

$y_2 = y_1 + h\, f(x_1, y_1)$

$y_3 = y_2 + h\, f(x_2, y_2)$

$y_4 = y_3 + h\, f(x_3, y_3)$

$y_5 = y_4 + h\, f(x_4, y_4)$

حل اخر في الصفحة السابقة

Q 2

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2) $10x + y + 2z = 44$ & $2x + 10y + z = 51$ & $x + 2y + 10z = 61$

$10x + y + 2z = 44 \qquad x = \frac{-1}{10}y - \frac{1}{5}z + 4.4$

$2x + 10y + z = 51 \qquad y = \frac{-1}{5}x - \frac{1}{10}z + 5.1$

$x + 2y + 10z = 61 \qquad z = -\frac{1}{10}x - \frac{1}{5}y + 6.1$

Assume $x_0, y_0, z_0 = [0\ 0\ 0]^t$

$x_0 = 0 \qquad y_0 = 0 \qquad z_0 = 0$

$x_1 = \frac{-1}{10}(0) - \frac{1}{5}(0) + 4.4 = 4.4$
$y_2 = \frac{-1}{5}(4.4) - \frac{1}{10}(0) + 5.1 = 4.22$
$z_1 = -\frac{1}{10}(4.4) - \frac{1}{5}(4.22) + 6.1 = 4.816$

$x_1 = 4.4 \qquad y_2 = 4.22 \qquad z_1 = 4.816$

$x_2 = \frac{-1}{10}(4.22) - \frac{1}{5}(4.816) + 4.4 = 3.015$
$y_2 = \frac{-1}{5}(3.015) - \frac{1}{10}(4.816) + 5.1 = 4.015$
$z_2 = \frac{-1}{10}(3.015) - \frac{1}{5}(4.015) + 6.1 = 4.996$

$x_2 = 3.015 \qquad y_2 = 4.015 \qquad z_2 = 4.996$

$x_3 = \frac{-1}{10}(4.015) - \frac{1}{5}(4.996) + 4.4 = 3$
$y_3 = \frac{-1}{10}(3) - \frac{1}{10}(4.996) + 5.1 = 4$
$z_3 = \frac{-1}{10}(3) - \frac{1}{5}(4) + 6.1 = 5$
$\therefore x_3 = 3 \qquad y_3 = 4 \qquad z_3 = 5$

Q3

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Question 3

1) i- $\oint_c \frac{\ln(3+z)}{(z^2-3z)(z+1)}\,dz$ $\quad$ c is $|z-1|=3$

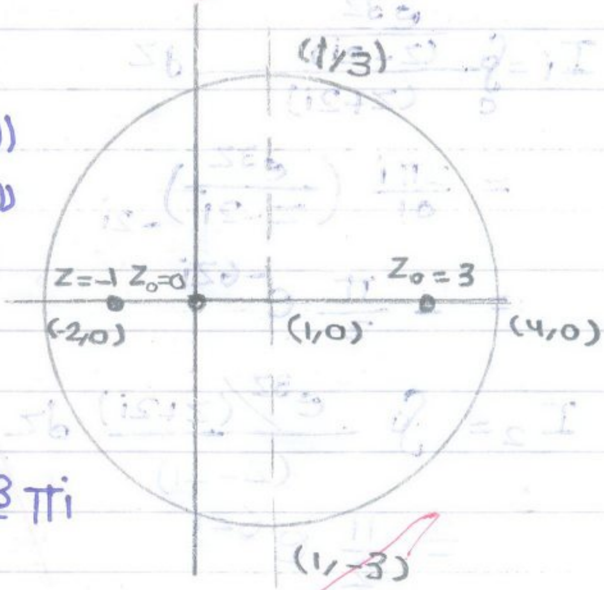
$= \oint_c \frac{\ln(3+z)}{z(z-3)(z+1)}\,dz$

$I = \frac{2\pi i}{(n-1)!} f^{(n-1)}(z_0)$

at $z = z_0 = 0 \in C$ ((inside))

at $z = z_0 = 3 \in C$ ((inside))

at $z = z_0 = -1 \in C$ ((inside



$I_1 = \oint_c \frac{\frac{\ln(3+z)}{(z-3)(z+1)}}{z}\,dz$

$= 2\pi i \left(\frac{\ln(3+z)}{(z-3)(z+1)}\right)_0 = -\frac{2\ln 3}{3}\pi i$

$I_2 = \oint_c \frac{\frac{\ln(3+z)}{z(z-3)}}{(z+1)}\,dz = 2\pi i \left(\frac{\ln(3+z)}{z(z-3)}\right)_{-1} = \frac{\ln(2)}{2}\pi i$

$I_3 = \oint_c \frac{\frac{\ln(3+z)}{z(z+1)}}{(z-3)}\,dz = 2\pi i \left(\frac{\ln(3+z)}{z(z+1)}\right)_3 = \frac{\ln 6}{6}\pi i$

$I = I_1 + I_2 + I_3 = \left(-\frac{2}{3}\ln(3) + \frac{1}{2}\ln(2) + \frac{1}{6}\ln(6)\right)\pi i$

$\approx \cancel{1.378}\,\pi i$ or $\left(-\frac{2}{3}\ln(3) + \frac{1}{2}\ln(2) + \frac{1}{6}\ln(6)\right)\pi i$

ii- $\oint_c \frac{e^{3z}}{z^2+4}\,dz = \oint_c \frac{e^{3z}}{(z+2i)(z-2i)}$

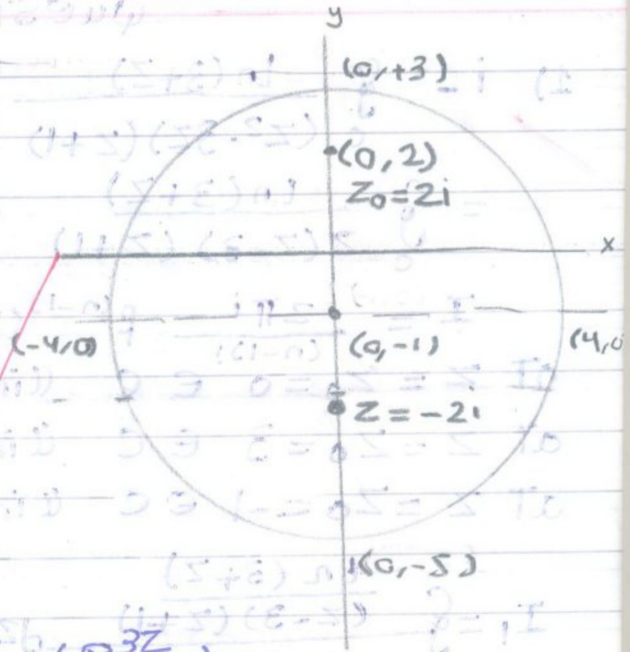
c is $|z+i|=4$

Q29

13

at $z = z_0 = 2i \in C$ ((inside))

at $z = z_0 = -2i \in C$ ((inside))



$$I_1 = \oint_c \frac{\frac{e^{3z}}{(z-2i)}}{(z+2i)}\,dz$$

$$= \frac{2\pi i}{0!}\left(\frac{e^{3z}}{z-2i}\right)_{-2i}$$

$$= -\frac{\pi}{2} e^{-6zi}$$

$$I_2 = \oint \frac{e^{3z}/(z+2i)}{(z-2i)}\,dz = \frac{2\pi i}{0!}\left(\frac{e^{3z}}{z+2i}\right)_{2i}$$

$$= \frac{\pi}{2} e^{6zi}$$

$$I = I_1 + I_2 = -\frac{\pi}{2} e^{-6zi} + \frac{\pi}{2} e^{6zi} = \pi\left(\frac{e^{6zi} - e^{-6zi}}{2}\right)$$

$$= \pi i \sin(6z)$$

Q3

14

$h = 0.25$

2) at $f'(1) = \frac{f(x+h)-f(x)}{h} = \frac{f(1.25)-f(1)}{h}$

الفروق الامامية لنقطة

$= \frac{5.27-5.19}{0.25} = 0.32$

$f'(1) = \frac{-3f(x)+4f(x+h)-f(x+2h)}{2h}$

الفروق الامامية لنقطتين

$= \frac{-3\times5.19+4\times5.27-5.44}{2\times0.25} = 0.14$

at $f''(2.75) = \frac{f(x+h)+f(x-h)-2f(x)}{h^2} = \frac{f(3)+f(2.5)+(-2f(2.75))}{h^2}$

الفروق المركزية

$= \frac{6.55+6.34-2\times6.49}{0.25^2} = -1.44$

at $f''(1) = \frac{2f(x)-5f(x+h)+4f(x+2h)-f(x+2h)}{h^2}$

الفروق الامامية لثلاث نقاط

$= \frac{2\times5.19-5\times5.27+4\times5.44-5.52}{(0.25)^2} = 6.72$

at $f'(3) = \frac{f(x)-f(x-h)}{h} = \frac{6.55-6.49}{0.25} = 0.24$

الفروق الخلفية لنقطة

$f'(3) = \frac{3f(x)-4f(x-h)+f(x-2h)}{2h}$

$= \frac{3\times6.55-4\times6.49+6.34}{2\times0.25} = 0.06$

Q3 (15)

ii) Trapizodal ...

$h = 0.25$

$$I = A_T = h\left[\frac{y_0+y_n}{2} + y_1 - \cdots y_{n-1}\right]$$

$$= 0.25\left[\frac{5.19+6.34}{2} + 5.27 + 5.44 + 5.52 + 5.71 + 6.17\right]$$

$$= 8.46875$$

Samson

$$I = A_S = \frac{h}{3}\left[y_0 + y_n + 4[\text{odd}] + 2[\text{even}]\right]$$

$$= \frac{0.25}{3}\left[5.19 + 6.34 + 4[5.27 + 5.52 + 6.34] + 2[5.44 + 5.71]\right]$$

$$= 8.5292$$

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3) $v = e^{-y}(\cos x) - 6x + 4y$

$v_x = -e^{-y}\sin x - 6$ $\qquad$ $v_y = -e^{-y}\cos x + 4$

$v_{xx} = -e^{-y}\cos x$ $\qquad$ $v_{yy} = e^{-y}\cos x$

$$v_{xx} + v_{yy} = -e^{-y}\cos x + e^{-y}\cos x = 0$$

$$v_x = -e^{-y}\sin x - 6 = -u_y$$

$u_y = e^{-y}\sin x + 6$ بالتكامل

$$\int u_y\,dy = \int (e^{-y}\sin x + 6)\,dy$$

$u = -e^{-y}\sin x + 6y + C(x)$ بالتفاضل بالنسبة x

$$u_x = -e^{-y}\cos x + C'(x)$$

Q3

(16)

$u_x = v_y = -e^{-y}\cos x + c'(x) = -e^{-y}\cos x + 4$

$c'(x) = 4$ بالتكامل

$\int c'(x)\,dx = \int 4\,dx$

$c(x) = 4x + c$

$\therefore u = -e^{-y}\sin x + 6y + 4x + c$

$f(x,y) = -e^{-y}\sin x + 6y + 4x + c + i(e^{-y}\cos x - 6x + 4y)$

$f(z)$ put $x = z \quad y = 0$

$f(z) = -e^{0}\sin z + 4z + c + i(\cos z - 6z)$

$\therefore f(z) = (\sin z + 4z + c) + i(\cos z - 6z)$

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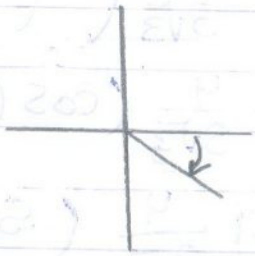
4)

i) $z_1 = (-2\sqrt{3}, \sqrt{3})^8 = (-2\sqrt{3} - i\sqrt{3})^8$

$r = \sqrt{(-2\sqrt{3})^2 + (-\sqrt{3})^2} = \sqrt{15}$



$\theta = \tan^{-1}\frac{+\sqrt{3}}{2\sqrt{3}} =$ π

$= 360 - \tan^{-1}\frac{1}{2} = 1.85\pi$

$z = (\sqrt{15})^8 \left(\cos\left(8(360 - \tan^{-1}\tfrac{1}{2})\right) + i\sin\left(8(360 - \tan^{-1}\tfrac{1}{2})\right)\right)$

او you can write

$z = (\sqrt{15})^8(\cos(14.8\pi) + i\sin(14.8\pi))$

Q3

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ii) $z_2 = (3\sqrt{2}+3i)^{-1} \cdot (4e^{-i\frac{\pi}{3}})$

$(3\sqrt{2}+3i)^{-1}$ $\quad r = 3\sqrt{3}$

$\theta = \tan^{-1}\left(\frac{3}{3\sqrt{2}}\right) = \tan^{-1}\frac{1}{\sqrt{2}}$

$= \frac{1}{3\sqrt{3}} e^{-i\tan^{-1}\frac{1}{\sqrt{2}}}$

$= \frac{1}{3\sqrt{3}}\left(\cos\left(\tan^{-1}\frac{1}{\sqrt{2}}\right) - i\sin\left(\tan^{-1}\frac{1}{\sqrt{2}}\right)\right)$

$4e^{-\frac{\pi}{3}i} = 4\left(\cos\left(\frac{\pi}{3}\right) - i\sin\left(\cancel{8}\cdot\frac{\pi}{3}\right)\right)$

$z_2 = \frac{4}{3\sqrt{3}}\left(\cos\left(\tan^{-1}\frac{1}{\sqrt{2}} + \frac{\pi}{3}\right) \cancel{\mp} \sin\left(\tan^{-1}\frac{1}{\sqrt{2}} + \frac{\pi}{3}\right)\right)$

$+ i\,\frac{4}{3\sqrt{3}}\left(-\left(\sin\left(\tan^{-1}\frac{1}{\sqrt{2}}\right)\cos\frac{\pi}{3} + \cos\left(\tan^{-1}\frac{1}{\sqrt{2}}\right)\sin\frac{\pi}{2}\right)\right)$

$= \frac{4}{3\sqrt{3}}\left(\cos\left(\tan^{-1}\frac{1}{\sqrt{2}} + \frac{\pi}{3}\right) - \sin\left(\tan^{-1}\frac{1}{\sqrt{2}} + \frac{\pi}{3}\right)\right)$

$- \cancel{*}i\,\frac{4}{3\sqrt{3}}\left(\sin\left(\tan^{-1}\frac{1}{\sqrt{2}} + \frac{\pi}{3}\right)\right)$

iii) $z_3 = \left(8e^5 e^{i\frac{25\pi}{21}}\right)^{-7} = (8e^5)^{-7} e^{-\frac{25}{3}\pi}$

$= \frac{1}{(8e^5)^7}\left(\cos\frac{25}{3}\pi \cancel{+} i\sin\frac{25}{3}\pi\right)$

$= \frac{1}{(8e^5)^7}\left(\cos\frac{25}{3}\pi - i\sin\frac{25}{3}\pi\right)$

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5) $w = 2e^{-\sqrt{3z}} + (\sqrt[3]{z^{-8}}) + \cos(e^{-2z^3}) - 5^{\ln 8z}$

$2e^{-\sqrt{3z}} \xrightarrow{D} 2e^{-\sqrt{3z}} \cdot -\frac{3}{2\sqrt{3z}} = -\frac{3e^{-\sqrt{3z}}}{\sqrt{3z}}$

$\sqrt[3]{z^{-8}} = z^{-\frac{8}{3}} \xrightarrow{D} -\frac{8}{3} z^{-\frac{11}{3}}$

$\cos(e^{-2z^3}) \xrightarrow{D} -\sin(e^{-2z^3}) \cdot e^{-2z^3} \cdot (-6z^2)$

$= e^{-2z^3} \cdot 6z^2 \cdot \sin(e^{-2z^3})$

$-5^{\ln 8z} \xrightarrow{D} -5^{\ln 8z} \cdot \ln 5 \cdot \frac{8}{8z}$

$\therefore w' = -\frac{3e^{-\sqrt{3z}}}{\sqrt{3z}} - \frac{8}{3} z^{-\frac{11}{3}} + e^{-2z^3} \cdot 6z^2 \cdot \sin(e^{-2z^3})$

$\cancel{-5L} - 5^{\ln 8z} \cdot \ln 5 \cdot \cancel{\frac{8}{8z}} \frac{1}{z}$

$w' = -\frac{3e^{-\sqrt{3z}}}{\sqrt{3z}} - \frac{8}{3} z^{-\frac{11}{3}} + \sin(e^{-2z^3}) \cdot e^{-2z^3} \cdot 6z^2$

$-5^{\ln(8z)} \cdot \ln 5 \cdot \frac{1}{z}$

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