



MTH603



Question # 1 of 20

SOLVED BY: WAQAR HUSSAIN

When we apply Simpson's $3/8$ rule, the number of intervals n must be

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Even
☐	Odd
☐	Multiple of 3
☐	Multiple of 8

REMEMBER:

In **Simpson's $1/3$ rule**, the number of intervals n must be **even**.

But In **Simpson's $3/8$ rule**, the number of intervals n must be **multiple of 3**.





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Question # 1 of 20

SOLVED BY: WAQAR HUSSAIN

When we apply Simpson's 3/8 rule, the number of intervals n must be

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Even	
☐	Odd	
☒	Multiple of 3	
☐	Multiple of 8	

(Conceptual Question)

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Question # 2 of 20

SOLVED BY: WAQAR HUSSAIN

To apply Simpson's 3/8 rule, the number of intervals in the following must be

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	10	REMEMBER: In Simpson's 3/8 rule, the number of intervals n must be multiple of 3 . In Given options 12 is the multiple of 3 .	
☐	11		
☐	12		
☐	13		



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Question # 2 of 20

SOLVED BY: WAQAR HUSSAIN

To apply Simpson's 3/8 rule, the number of intervals in the following must be

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|----|---|
| ☐ | 10 |  |
| ☐ | 11 |  |
| ☒ | 12 |  |
| ☐ | 13 |  |

(Conceptual Question)

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Question # 3 of 20

SOLVED BY: WAQAR HUSSAIN

Adam Moulton PC method is derived by employing

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐

Newton's backward difference interpolation formula

☐

Adam-Moulton Method

It is another predictor-corrector method, where we use the fact that the solution to the given initial value problem is known at past four equally spaced points

☐

$$y_{n+1} - y_n = \int_{t_n}^{t_{n+1}} f(t, y) dt$$

☐

To carry out integration, we proceed as follows. We employ *Newton's backward interpolation formula*, so that





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Question # 3 of 20

SOLVED BY: WAQAR HUSSAIN

Adam Moulton PC method is derived by employing

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|---|--|
| ☒ | Newton's backward difference interpolation formula
(Lecture No.40, Pg.222) | |
| ☐ | Newton's forward difference interpolation formula | |
| ☐ | Newton's divided difference interpolation formula | |
| ☐ | None of the given choices | |

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Question # 4 of 20

SOLVED BY: WAQAR HUSSAIN

To apply Simpson's $1/3$ rule, the number of intervals in the following must be

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	2
☐	3
☐	5
☐	7

REMEMBER:

In **Simpson's $1/3$** rule, the number of intervals n must be **Even**.

In Given options **2** is the **Even value**.





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Question # 4 of 20

SOLVED BY: WAQAR HUSSAIN

To apply Simpson's $1/3$ rule, the number of intervals in the following must be

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☒	2	(Conceptual Question)	
☐	3		
☐	5		
☐	7		

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Question # 5 of 20

SOLVED BY: WAQAR HUSSAIN

Simpson's rule is a numerical method that approximates the value of a definite integral by using polynomials

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Linear
☐	Cubic
☐	Quadratic
☐	None of the given choi

REMEMBER:

Simpson's Rule is a numerical method that approximates the value of a definite integral by using **quadratic functions**. This method is named after the English mathematician **Thomas Simpson (1710-1761)**.





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Question # 5 of 20

SOLVED BY: WAQAR HUSSAIN

Simpson's rule is a numerical method that approximates the value of a definite integral by using polynomials

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Linear	
☐	Cubic	
☒	Quadratic	
☐	None of the given choices	

(Conceptual Question)

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Question # 6 of 20

SOLVED BY: WAQAR HUSSAIN

We can improve the accuracy of trapezoidal and Simpson's rules using

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Richardson's extrapolation method	
☐	Simpson's 1/3 rule	
☐	Simpson's 3/8 rule	
☐	None of the given choices	

REMEMBER:

Using the concept of **Richardson Extrapolation**, very higher order integration can be achieved using only a series of values from **Trapezoidal Rule**.

The main ingredient for MATLAB's basic numerical integration function **quad** is Richardson extrapolation of the basic **Simpson rule**.



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Question # 6 of 20

SOLVED BY: WAQAR HUSSAIN

We can improve the accuracy of trapezoidal and Simpson's rules using

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Richardson's extrapolation method	
☐	Simpson's 1/3 rule	
☐	Simpson's 3/8 rule	
☐	None of the given choices	

REMEMBER:

Using the concept of **Richardson Extrapolation**, very higher order integration can be achieved using only a series of values from **Trapezoidal Rule**.

The main ingredient for MATLAB's basic numerical integration function **quad** is Richardson extrapolation of the basic **Simpson rule**.



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Question # 6 of 20

SOLVED BY: WAQAR HUSSAIN

We can improve the accuracy of trapezoidal and Simpson's rules using

Select the correct option

PRESENTED BY: TALEEMI MARKAZ



Richardson's extrapolation method

(Conceptual Question)



Simpson's 1/3 rule



Simpson's 3/8 rule



None of the given choices



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Question # 7 of 20

SOLVED BY: WAQAR HUSSAIN

In fourth order Runge-Kutta method, k_4 is given by

The fourth-order Runge-Kutta method is described as

$$y_{n+1} = y_n + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4) \quad (1)$$

Where

$$k_1 = hf(t_n, y_n)$$

$$k_2 = hf\left(t_n + \frac{h}{2}, y_n + \frac{k_1}{2}\right)$$

$$k_3 = hf\left(t_n + \frac{h}{2}, y_n + \frac{k_2}{2}\right)$$

$$k_4 = hf(t_n + h, y_n + k_3)$$

In this problem

$$f(t, y) = t + y, \quad h = 0.1, \quad t_0 = 0, \quad y_0 = 1.$$

Select the correct answer

☐

k_4

☐

k_4

☐

k_4

☐

No

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Question # 7 of 20

SOLVED BY: WAQAR HUSSAIN

In fourth order Runge-Kutta method, k_4 is given by

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|----------------------------------|---|
| ☐ | $k_4 = hf(x_n + 2h, y_n + 2k_3)$ |  |
| ☐ | $k_4 = hf(x_n - h, y_n - k_3)$ |  |
| ☒ | $k_4 = hf(x_n + h, y_n + k_3)$ |  |
| ☐ | None of the given choices |  |

(Lecture No.38 Pg.207)

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Question # 8 of 20

SOLVED BY: WAQAR HUSSAIN

The truncation error in Adam's predictor formula is

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐

Equation simplifies to

$$y_{n+1} = y_n + \frac{h}{24}(55f_n - 59f_{n-1} + 37f_{n-2} - 9f_{n-3}) + \frac{251}{720}h\nabla^4 f_n$$

☐

Alternatively, it can be written as

$$y_{n+1} = y_n + \frac{h}{24}[55y'_n - 59y'_{n-1} + 37y'_{n-2} - 9y'_{n-3}] + \frac{251}{720}h\nabla^4 y'$$

☐

This is known as Adam's predictor formula.

☐

The truncation error is $(251/720)h\nabla^4 y'_n$.





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Question # 8 of 20

SOLVED BY: WAQAR HUSSAIN

The truncation error in Adam's predictor formula is

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | | |
|----------------------------------|---------------------------------------|------------------------|--|
| ☒ | $\frac{251}{720} h \nabla^4 y_n'$ | (Lecture No.40 Pg.223) | |
| ☐ | $\frac{251}{720} h \nabla^4 y_{n+1}'$ | | |
| ☐ | $\frac{19}{720} h \nabla^4 y_{n+1}'$ | | |
| ☐ | $\frac{19}{720} h \nabla^4 y_n'$ | | |

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Question # 9 of 20

SOLVED BY: WAQAR HUSSAIN

In fourth order Runge-Kutta method, k_1 is given by

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐

k_1

The fourth-order Runge-Kutta method is described as

☐

k_1

Where

$$y_{n+1} = y_n + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4) \quad (1)$$

☐

k_1

$$k_1 = hf(t_n, y_n)$$

$$k_2 = hf\left(t_n + \frac{h}{2}, y_n + \frac{k_1}{2}\right)$$

$$k_3 = hf\left(t_n + \frac{h}{2}, y_n + \frac{k_2}{2}\right)$$

$$k_4 = hf(t_n + h, y_n + k_3)$$

☐

No





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Question # 9 of 20

SOLVED BY: WAQAR HUSSAIN

In fourth order Runge-Kutta method, k_1 is given by

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | | |
|----------------------------------|---------------------------|------------------------|--|
| ☒ | $k_1 = hf(x_n, y_n)$ | (Lecture No.38 Pg.207) | |
| ☐ | $k_1 = 2hf(x_n, y_n)$ | | |
| ☐ | $k_1 = 3hf(x_n, y_n)$ | | |
| ☐ | None of the given choices | | |

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Question # 10 of 20

SOLVED BY: WAQAR HUSSAIN

The global error in Simpson's 3/8 rule is of

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

This formula is called composite Simpson's 1/3 rule. The error term E , which is also called global error, is given by

$$E = -\frac{N}{90} h^5 y^{(iv)}(\xi) = -\frac{x_{2N} - x_0}{180} h^4 y^{(iv)}(\xi)$$

for some ξ in $[x_0, x_{2N}]$. Thus, in Simpson's 1/3 rule, the global error is of $O(h^4)$.

Similarly in deriving composite Simpson's 3/8 rule, we divide the interval of integration into n sub-intervals, where n is divisible by 3, and applying the integration formula

It may be noted that the global error in Simpson's 1/3 and 3/8 rules are of the same order.



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Question # 10 of 20

SOLVED BY: WAQAR HUSSAIN

The global error in Simpson's 3/8 rule is of

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|---------------------------|---|
| ☐ | $o(h^2)$ |  |
| ☐ | $o(h^3)$ |  |
| ☒ | $o(h^4)$ |  |
| ☐ | None of the given choices |  |

(Lecture No.32 Pg.179)

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Question # 11 of 20

SOLVED BY: WAQAR HUSSAIN

Rate of change of any quantity with respect to another can be modeled by

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|-----------------------|--|---|
| ☐ | <p>~~An ordinary differential equation~~</p> <p>Theories concerning electrical networks, bending of beams, stability of aircraft, etc., are modeled by differential equations.</p> <p>To be more precise, the rate of change of any quantity with respect to another can be modeled by an ODE ordinary differential equation</p> <p>Closed form solutions may not be possible to obtain, for every modeled problem, while numerical methods exist, to solve them using computers.</p> |  |
| ☐ | <p>A polynomial equation</p> |  |
| ☐ | <p>None of the given choices</p> |  |



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Question # 11 of 20

SOLVED BY: WAQAR HUSSAIN

Rate of change of any quantity with respect to another can be modeled by

Select the correct option

PRESENTED BY: TALEEMI MARKAZ



An ordinary differential equation

(Lecture No.35 Pg.191)



A partial differential equation



A polynomial equation



None of the given choices



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Question # 12 of 20

SOLVED BY: WAQAR HUSSAIN

While deriving Simpson's 3/8 rule, we approximate $f(x)$ in the form _____

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	$ax + b$	
☐	$ax^3 + bx^2 + cx + d$	
☐	$ax^2 + bx + c$	
☐	$ax^4 + bx^3 + cx^2 + d$	

REMEMBER:

Simpson's Rule is a numerical method that approximates the value of a definite integral by using **quadratic functions**. This method is named after the English mathematician **Thomas Simpson (1710-1761)**.



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Question # 12 of 20

SOLVED BY: WAQAR HUSSAIN

While deriving Simpson's 3/8 rule, we approximate $f(x)$ in the form _____

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|-------------------------------|---|
| ☐ | $ax + b$ |  |
| ☐ | $ax^3 + bx^2 + cx + d$ |  |
| ☒ | $ax^2 + bx + c$ |  |
| ☐ | $ax^4 + bx^3 + cx^2 + dx + e$ |  |

(Conceptual Question)

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Question # 13 of 20

SOLVED BY: WAQAR HUSSAIN

While deriving Trapezoidal rule, we approximate $f(x)$ in the form _____

Select the correct option

PRESENTED BY: TALEEMI MARKAZ



$$ax + b$$

(Conceptual Question)



$$ax^3 + bx^2 + cx + d$$



$$ax^2 + bx + c$$



$$ax^4 + bx^3 + cx^2 + dx + e$$



7:31 / 11:30

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Question # 14 of 20

SOLVED BY: WAQAR HUSSAIN

Let I denotes the closed interval spanned by $x_0, x_1, x_2, x_3, x_4, x_5, x_6, x_7, \bar{x}$. Then $F(x)$ vanishes _____ times in the interval I .

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	6	REMEMBER: There are 7 terms given The $F(x)$ vanishes $n + 2$ times in the interval I , so $n + 2$ $= 7 + 2$ $= 9$	
☐	9		
☐	7		
☐	8		



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Question # 14 of 20

SOLVED BY: WAQAR HUSSAIN

Let I denotes the closed interval spanned by $x_0, x_1, x_2, x_3, x_4, x_5, x_6, x_7, \bar{x}$. Then $F(x)$ vanishes _____ times in the interval I .

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	6	
☒	9	
☐	7	
☐	8	

(Lecture No.26 Pg.147)

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Question # 15 of 20

SOLVED BY: WAQAR HUSSAIN

The magnitude of truncation error in Milne's predictor formula is

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

In general, Milne's predictor-corrector pair can be written as

$$\left. \begin{aligned} P: y_{n+1} &= y_{n-3} + \frac{4h}{3}(2y'_{n-2} - y'_{n-1} + 2y'_n) \\ C: y_{n+1} &= y_{n-1} + \frac{h}{3}(y'_{n-1} + 4y'_n + y'_{n+1}) \end{aligned} \right\}$$

From these equations, we observe that the magnitude of the truncation error in corrector formula is $1/90h\Delta^4 y'_0$ while the truncation error in predictor formula is

$$28/90h\Delta^4 y'_0$$

Thus: TE in, c-formula is less than the TE in p-formula.

$$\frac{28}{90}h\Delta^4 y'_0$$



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Question # 15 of 20

SOLVED BY: WAQAR HUSSAIN

The magnitude of truncation error in Milne's predictor formula is

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|---------------------------------|---|
| ☐ | $\frac{1}{90} h \Delta^4 y_o'$ |  |
| ☐ | $\frac{1}{90} h \Delta^3 y_o'$ |  |
| ☐ | $\frac{28}{90} h \Delta^3 y_o'$ |  |
| ☒ | $\frac{28}{90} h \Delta^4 y_o'$ |  |

(Lecture No.39 Pg.216)

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Question # 16 of 20

SOLVED BY: WAQAR HUSSAIN

$y_{n+1} = y_n + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$ is known as:

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

This well-known fourth-order R-K method is described in the following steps.

$$y_{n+1} = y_n + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$$



Taylor's formula



Euler's formula



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Question # 16 of 20

SOLVED BY: WAQAR HUSSAIN

$y_{n+1} = y_n + \frac{1}{6}(K_1 + 2K_2 + 2K_3 + K_4)$ is known as:

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	Simpson's formula	
☒	Runge-Kutta's formula	
☐	Taylor's formula	
☐	Euler's formula	

(Lecture No.37 Pg.204)

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Question # 17 of 20

SOLVED BY: WAQAR HUSSAIN

Lagrange's interpolation formula is used when the values of the independent variable are

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

LAGRANGE'S INTERPOLATION FORMULA

Newton's interpolation formulae developed earlier can be used only when the values of the independent variable x are equally spaced. Also the differences of y must ultimately become small.

If the values of the independent variable are not given at equidistant intervals, then we have the basic formula associated with the name of Lagrange which will be derived now.

☐ None of the above



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Question # 17 of 20

SOLVED BY: WAQAR HUSSAIN

Lagrange's interpolation formula is used when the values of the independent variable are

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☒	Equally spaced	(Lecture No.23 Pg.135)	
☐	Not equally spaced		
☐	Constant		
☐	None of the above		

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Question # 19 of 20

SOLVED BY: WAQAR HUSSAIN

Shift operator is defined as

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	$Ef(x) =$	Shift operator, E $E f(x) = f(x+h)$	
☐	$Ef(x) =$	$E^n f(x) = f(x+nh)$ $E^n y_x = y_{x+nh}$	
☐	$Ef(x) =$	The inverse operator E^{-1} is defined as $E^{-1} f(x) = f(x-h)$	
☐	$Ef(x) = f(x+h)$		



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Question # 19 of 20

SOLVED BY: WAQAR HUSSAIN

Shift operator is defined as

Select the correct option

PRESENTED BY: TALEEMI MARKAZ



$$Ef(x) = f(x - h)$$



$$Ef(x) = -f(x - h)$$



$$Ef(x) = -f(x + h)$$



$$Ef(x) = f(x + h)$$

(Lecture No.45 Pg.267)



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Question # 20 of 20

SOLVED BY: WAQAR HUSSAIN

From the following table of values:
Estimate of $y'(3)$ will be done using
the formula of differential operator
in terms of

x	1.3	1.5	1.7	1.9	2.1	2.3
y	2.9648	2.6599	2.3333	1.9922	1.6442	1.2969

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

Example

Given the table of values, estimate, $y''(1.3)$

x	1.3	1.5	1.7	1.9	2.1	2.3
y	2.9648	2.6599	2.3333	1.9922	1.6442	1.2969

Solution Since $x = 1.3$ appear at beginning of the table, it is appropriate to use formulae based on forward differences to find the derivatives. The difference table for the given data is depicted below:



None of the given choices





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Question # 20 of 20

SOLVED BY: WAQAR HUSSAIN

From the following table of values:
Estimate of $y'(3)$ will be done using
the formula of differential operator
in terms of

x	1.3	1.5	1.7	1.9	2.1	2.3
y	2.9648	2.6599	2.3333	1.9922	1.6442	1.2969

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|------------------------------|---|
| ☐ | Backward difference operator |  |
| ☐ | Central difference operator |  |
| ☒ | Forward difference operator |  |
| ☐ | None of the given choices |  |

(Lecture No.28 Pg.160)

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1



MTH603 FINALTERM Quiz



Question # 1 of 20

SOLVED BY: **WAQAR HUSSAIN**

The idea of Richardson's extrapolation is to combine two computed values of derivative of y using the same method but with _____ different step sizes.

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐	Two	(LECTURE No.30, Pg.169) The idea of Richardson's extrapolation is to combine two computed values of $y'(x)$ using the same method but with two different step sizes usually h and $h/2$ to yield a higher order method.	
☐	Four		
☐	Three		
☐	None		

2



MTH603 FINALTERM Quiz



Question # 2 of 20

SOLVED BY: **WAQAR HUSSAIN**

We prefer _____ over the Lagrange's interpolating method for economy of computation.

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | | |
|----------------------------------|-------------------------------------|---|
| ☐ | Newton's backward difference method |  |
| ☐ | Newton's forward difference method |  |
| ☒ | Newton's divided difference method |  |
| ☐ | None of the given choices |  |

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MTH603 FINALTERM Quiz



Question # 3 of 20

SOLVED BY: WAQAR HUSSAIN

What will be the value of ' a ' in the given divide difference table?

x	y	1stD. D	2ndD. D
3	0.4		
6	0.9	0.1667	
9	1.7	0.2667	a

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐ 0
☐ 0
☐ 0
☐ 0

(LECTURE No.24, Pg.139 Conceptual)

x	y	1stD. D	2ndD. D
3	0.4		
6	0.9	0.1667	
9	1.7	0.2667	$a = \frac{0.2667 - 0.1667}{9 - 3} = 0.0333$



3



MTH603 FINALTERM Quiz



Question # 3 of 20

SOLVED BY: WAQAR HUSSAIN

What will be the value of ' a ' in the given divide difference table?

x	y	1stD. D	2ndD. D
3	0.4		
6	0.9	0.1667	
9	1.7	0.2667	a

Select the correct option

PRESENTED BY:

TALEEMI MARKAZ

☐	0.0211	
☐	0.0167	
☒	0.0349	
☐	0.0254	

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4



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Question # 4 of 20

SOLVED BY: **WAQAR HUSSAIN**

For the given data points (x_0, y_0) , (x_1, y_1) , (x_2, y_2) , and (x_3, y_3) the zero-order divide difference will be given as

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐	$y[x_0]$	(LECTURE No.24, Pg.139) DIVIDED DIFFERENCES The divided differences of orders 0, 1, 2, ..., n are now defined recursively as: $y[x_0] = y(x_0) = y_0$ is the zero-th order divided difference	
☐	$y[y_0]$		
☐	$y[x_0]$		
☐	$y[y_0]$		

4



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Question # 4 of 20

SOLVED BY: **WAQAR HUSSAIN**

For the given data points (x_0, y_0) , (x_1, y_1) , (x_2, y_2) , and (x_3, y_3) the zero-order divide difference will be given as

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | | |
|----------------------------------|---------------|---|
| ☐ | $y[x_0, x_1]$ |  |
| ☐ | $y[y_0, y_1]$ |  |
| ☒ | $y[x_0]$ |  |
| ☐ | $y[y_0]$ |  |

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5



MTH603 FINALTERM Quiz



Question # 5 of 20

SOLVED BY: **WAQAR HUSSAIN**

For the given data points $(1, -3)$, $(2, 0)$, and $(3, 15)$, the zero-order divide difference will be

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | |
|-----------------------|----|
| ☐ | -3 |
| ☐ | -2 |
| ☐ | 0 |
| ☐ | -1 |

(LECTURE No.24, Pg.139)

The zero-order divide difference will be

$$y[x_0] = y(x_0) = y_0$$

So in the given points $(1, -3)$, $(2, 0)$ and $(3, 15)$

$$y_0 = -3$$



6



MTH603 FINALTERM Quiz



Question # 6 of 20

SOLVED BY: **WAQAR HUSSAIN**

Differential operator in terms of forward difference operator is given by

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐	$D = \frac{1}{h}$	(LECTURE NO.27, Pg.152) Remember the Differential operator, D is known to represents the property $\left. \begin{aligned} Df(x) &= \frac{d}{dx}f(x) = f'(x) \\ D^2f(x) &= \frac{d^2}{dx^2}f(x) = f''(x) \end{aligned} \right\}$ This would mean that in terms of Δ : $D = \frac{1}{h} \left(\Delta - \frac{\Delta^2}{2} + \frac{\Delta^3}{3} - \frac{\Delta^4}{4} + \frac{\Delta^5}{5} - \dots \right)$
☐	$D = \frac{1}{h}$	
☐	$D = \frac{1}{h}$	
☐	$D = \frac{1}{h}$	



6



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Question # 6 of 20

SOLVED BY: WAQAR HUSSAIN

Differential operator in terms of forward difference operator is given by

Select the correct option

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MARKAZ

- | | | |
|----------------------------------|---|---|
| ☐ | $D = \frac{1}{h} \left(\Delta - \frac{\Delta^2}{2!} + \frac{\Delta^3}{3!} - \frac{\Delta^4}{4!} + \frac{\Delta^5}{5!} - \dots \right)$ |  |
| ☐ | $D = \frac{1}{h} \left(\Delta + \frac{\Delta^2}{2} + \frac{\Delta^3}{3} + \frac{\Delta^4}{4} + \frac{\Delta^5}{5} + \dots \right)$ |  |
| ☒ | $D = \frac{1}{h} \left(\Delta - \frac{\Delta^2}{2} + \frac{\Delta^3}{3} - \frac{\Delta^4}{4} + \frac{\Delta^5}{5} - \dots \right)$ |  |
| ☐ | $D = \frac{1}{h} \left(\Delta + \frac{\Delta^2}{2!} + \frac{\Delta^3}{3!} + \frac{\Delta^4}{4!} + \frac{\Delta^5}{5!} + \dots \right)$ |  |

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7



MTH603 FINALTERM Quiz



Question # 7 of 20

SOLVED BY: WAQAR HUSSAIN

Let

$$f(x, y) = 2x^3 + 6y^3 + 9xy$$

For $x = 0, 1, 2, 3, 4$ and $y = 0, 1, 2, 3, 4$. Then computing the value of $f(2.5, 3.5)$ is an example of _____.

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐

ir

☐

ir

☐

ir

☐

ir

(LECTURE No.26, Pg.148)

Let

$$f(x, y) = 2x^3 + 6y^3 + 9xy$$

For $x = 0, 1, 2, 3, 4$ and $y = 0, 1, 2, 3, 4$. Then computing the value of $f(2.5, 3.5)$ is an example of **interpolation in two dimensions**.



7



MTH603 FINALTERM Quiz



Question # 7 of 20

SOLVED BY: **WAQAR HUSSAIN**

Let

$$f(x, y) = 2x^3 + 6y^3 + 9xy$$

For $x = 0, 1, 2, 3, 4$ and $y = 0, 1, 2, 3, 4$. Then computing the value of $f(2.5, 3.5)$ is an example of _____.

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | | |
|----------------------------------|-----------------------------------|--|
| ☐ | interpolation in four dimensions | |
| ☐ | interpolation in three dimensions | |
| ☒ | interpolation in two dimensions | |
| ☐ | interpolation in one dimensions | |

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5:06 / 14:40



8



MTH603 FINALTERM Quiz



Question # 8 of 20

SOLVED BY: **WAQAR HUSSAIN**

For the given data points (2,5), (4,7), and (6,9), the zero-order divide difference will be

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | |
|-----------------------|---|
| ☐ | 0 |
| ☐ | 1 |
| ☐ | 5 |
| ☐ | 2 |

(LECTURE No.24, Pg.139)

The zero-order divide difference will be

$$y[x_0] = y(x_0) = y_0$$

So in the given points (2,5), (4,7) and (6,9)

$$y_0 = 5$$



9



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Question # 9 of 20

SOLVED BY: **WAQAR HUSSAIN** $\delta =$ _____

Select the correct option

PRESENTED BY:

TALEEMI MARKAZ

- ☐ $\frac{1}{E^2}$
- ☐ $\frac{1}{E^2}$
- ☐ $E^{1/2}$
- ☐ None

(LECTURE No.27, Pg.154)

Using central difference operator δ and following the definitions of differential operator D , central difference operator δ and the shift operator E , we have

$$\delta = E^{1/2} - E^{-1/2} = e^{\frac{hD}{2}} - e^{-\frac{hD}{2}} = 2\sinh \frac{hD}{2}$$

9



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Question # 9 of 20

SOLVED BY: WAQAR HUSSAIN

$$\delta = \underline{\hspace{2cm}}$$

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- | | | |
|----------------------------------|--------------------------------------|---|
| ☒ | $E^{\frac{1}{2}} - E^{-\frac{1}{2}}$ |  |
| ☐ | $E^{\frac{1}{2}} + E^{-\frac{1}{2}}$ |  |
| ☐ | $\frac{E^{1/2} + E^{-1/2}}{2}$ |  |
| ☐ | None |  |

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10



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Question # 10 of 20

SOLVED BY: WAQAR HUSSAIN

Given the following data $x: 0 \ 1 \ 2 \ 4$ $y: 1 \ 1 \ 2 \ 6$ value of 1st order divided difference $f[2, 4]$ is

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐	1
☐	0
☐	2
☐	-2

(LECTURE NO.24, Pg.140)

x	y	1st D. D
0	1	
1	1	$\frac{1-1}{1-0} = 0$
2	2	$\frac{2-1}{2-1} = 1$
4	6	$\frac{6-2}{4-2} = 2$

11



MTH603 FINALTERM Quiz



Question # 11 of 20

SOLVED BY: **WAQAR HUSSAIN**

For the given data points (x_0, y_0) , (x_1, y_1) , (x_2, y_2) , and (x_3, y_3) the second-order divide difference will be given as

Select the correct option

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- ☐ $y[x_0,$
- ☐ $y[x_0,$
- ☐ $y[x_0]$
- ☐ $y[x_0,$

(LECTURE No.24, Pg.139)

x	$y(x)$	1 st order	2 nd order	3 rd order
x_0	y_0	$y[x_1, x_0]$		
x_1	y_1	$y[x_2, x_1]$		
x_4	y_2	$y[x_3, x_2]$	$y[x_0, x_1, x_2]$	$y[x_0, x_1, x_2, x_3]$



11

MTH603 FINALTERM Quiz

**Question # 11 of 20****SOLVED BY: WAQAR HUSSAIN**

For the given data points (x_0, y_0) , (x_1, y_1) , (x_2, y_2) , and (x_3, y_3) the second-order divide difference will be given as

Select the correct option**PRESENTED BY: TALEEMI MARKAZ**

- | | | |
|----------------------------------|-------------------------|--|
| ☒ | $y[x_0, x_1, x_2]$ | |
| ☐ | $y[x_0, x_1]$ | |
| ☐ | $y[x_0]$ | |
| ☐ | $y[x_0, x_1, x_2, x_3]$ | |

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12



MTH603 FINALTERM Quiz



Question # 12 of 20

SOLVED BY: WAQAR HUSSAIN

What will be the value of first order divided difference $f[1, 5]$ for the following $x: 0 \ 1 \ 5 \ y: 2 \ 1 \ 5$

Select the correct option

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- ☐ 1
- ☐ 0
- ☐ 2
- ☐ 3

(LECTURE NO.24, Pg.140)

x	y	$Ist D. D$
0	2	
1	1	$\frac{1-2}{1-0} = -1$
5	5	$\frac{5-1}{5-1} = 1$



12



MTH603 FINALTERM Quiz



Question # 12 of 20

SOLVED BY: **WAQAR HUSSAIN**

What will be the value of first order divided difference $f[1, 5]$ for the following $x: 0 \ 1 \ 5 \ y: 2 \ 1 \ 5$

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☒	1	
☐	0	
☐	2	
☐	3	

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13



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Question # 13 of 20

SOLVED BY: **WAQAR HUSSAIN**

Three-point formula for the second derivative is defined as

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐	$y(x_i+h)$	(LECTURE No.28, Pg.162) The given equation constitute three-point formulae for computing the second derivative. $y''_i = \frac{y(x_i - h) - 2y(x_i) + y(x_i + h)}{h^2}$
☐	$y(x_i+h)$	
☐	$y(x_i+h)$	
☐	$y(x_i+h)$	

13

MTH603 FINALTERM Quiz

**Question # 13 of 20****SOLVED BY: WAQAR HUSSAIN**

Three-point formula for the second derivative is defined as

Select the correct option**PRESENTED BY: TALEEMI MARKAZ**

- | | | |
|----------------------------------|-------------------------------------|---|
| ☐ | $y(x_i+h) - 2y(x_i) + y(x_i-h)/2h$ |  |
| ☐ | $y(x_i+h) + 2y(x_i) + y(x_i-h)/h^2$ |  |
| ☒ | $y(x_i+h) - 2y(x_i) + y(x_i-h)/h^2$ |  |
| ☐ | $y(x_i+h) - 2y(x_i) - y(x_i-h)/h^2$ |  |

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14



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Question # 14 of 20

SOLVED BY: **WAQAR HUSSAIN**

Two-point formula for the first derivative is defined as

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐	$y(x_i+h)$	(LECTURE NO.28, Pg.161) The given equation constitute two-point formulae for computing the first derivative. $y'_i = \frac{y(x_i + h) - y(x_i - h)}{2h}$	
☐	$y(x_i+h)$		
☐	$y(x_i+h)$		
☐	$y(x_i+h)$		

14



MTH603 FINALTERM Quiz



Question # 14 of 20

SOLVED BY: **WAQAR HUSSAIN**

Two-point formula for the first derivative is defined as

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | | |
|----------------------------------|-------------------------|--|
| ☐ | $y(x_i+h)+y(x_i-h)/h^2$ | |
| ☒ | $y(x_i+h)-y(x_i-h)/2h$ | |
| ☐ | $y(x_i+h)+y(x_i-h)/2h$ | |
| ☐ | $y(x_i+h)-y(x_i-h)/h^2$ | |

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15



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Question # 15 of 20

SOLVED BY: WAQAR HUSSAIN

Given the following data $x: 0 \ 1 \ 4 \ 8$ $y: 1 \ 1 \ 8 \ 16$ value of 1st order divided difference $f[4, 8]$ is

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

- ☐ 4
- ☐ 6
- ☐ 8
- ☐ 2

(LECTURE NO.24, Pg.140)

x	y	1st D.D
0	1	
1	1	$\frac{1-1}{1-0} = 0$
4	8	$\frac{8-1}{4-1} = 2.33$
8	16	$\frac{16-8}{8-4} = 2$

16



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Question # 16 of 20

SOLVED BY: **WAQAR HUSSAIN**

Richardson extrapolation method is used to improve the rate of convergence of a _____.

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐

Se

(LECTURE No.30, Pg.169 Conceptual)

☐

Se

Richardson's extrapolation is a natural way to improve the order of accuracy of a numerical solution that involves the use of a discretization size h [15], and can be seen as a **sequence** acceleration method to improve the rate of convergence.

☐☐

17



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Question # 17 of 20

SOLVED BY: WAQAR HUSSAIN

What will be the value of ' a ' in the given divide difference table?

x	y	1stD.D	2ndD.D	3rdD.D
1	0.4	0.25	0.0375	-0.0104
3	0.9	0.4	a	
5	1.7	0.3		
7	2.3			

Select the correct option

PRESENTED BY: TALEEMI MARKAZ

☐ -0.0104
☐ -0.025
☐ -0.0375
☐ -0.0408

(LECTURE No.24, Pg.140 Conceptual)

x	y	1stD.D	2ndD.D	3rdD.D
1	0.4			
3	0.9	0.25		
5	1.7	0.4	0.0375	
7	2.3	0.3	$a = \frac{0.3 - 0.4}{7 - 3} = -0.025$	-0.0104



17



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Question # 17 of 20

SOLVED BY: WAQAR HUSSAIN

What will be the value of ' a ' in the given divide difference table?

x	y	1stD.D	2ndD.D	3rdD.D
1	0.4	0.25	0.0375	-0.0104
3	0.9	0.4	a	
5	1.7	0.3		
7	2.3			

Select the correct option

PRESENTED BY:

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☐	-0.0012	
☐	-0.0109	
☐	-0.0343	
☒	-0.025	

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18



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FINALTERM Quiz



Question # 18 of 20

SOLVED BY: **WAQAR HUSSAIN**

If any three points are given, the formula for Lagrange's interpolation polynomial will be

PRESENTED BY: **TALEEMI MARKAZ**

Select the correct option

☐

y =

☐

y =

☐

y =

☐

y =

(LECTURE No.23, Pg.137)

If any three points are given, the formula for Lagrange's interpolation polynomial will be

$$y = f(x) = \frac{(x - x_1)(x - x_2)}{(x_0 - x_1)(x_0 - x_2)} y_0 + \frac{(x - x_0)(x - x_2)}{(x_1 - x_0)(x_1 - x_2)} y_1 + \frac{(x - x_0)(x - x_1)}{(x_2 - x_0)(x_2 - x_1)} y_2$$



18



MTH603 FINALTERM Quiz



Question # 18 of 20

SOLVED BY: **WAQAR HUSSAIN**

If any three points are given, the formula for Lagrange's interpolation polynomial will be

PRESENTED BY:

Select the correct option

BY: **TALEEMI MARKAZ**

- | | | |
|----------------------------------|--|---|
| ☒ | $y = f(x) = \frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)} y_0 + \frac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)} y_1 + \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)} y_2$ |  |
| ☐ | $y = f(x) = \frac{(x-x_1)(x-x_2)}{(x_1-x_0)(x_1-x_2)} y_0 + \frac{(x-x_0)(x-x_2)}{(x_0-x_1)(x_0-x_2)} y_1 + \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)} y_2$ |  |
| ☐ | $y = f(x) = \frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)} y_2 + \frac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)} y_1 + \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)} y_0$ |  |
| ☐ | $y = f(x) = \frac{(x_0-x_1)(x_0-x_2)}{(x-x_1)(x-x_2)} y_0 + \frac{(x_1-x_0)(x_1-x_2)}{(x-x_0)(x-x_2)} y_1 + \frac{(x_2-x_0)(x_2-x_1)}{(x-x_0)(x-x_1)} y_2$ |  |

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19



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Question # 19 of 20

SOLVED BY: **WAQAR HUSSAIN**

Newton's divided difference interpolation is used when the values of the independent variable are

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

- | | | |
|----------------------------------|--------------------|--|
| ☐ | Constant | |
| ☐ | Not equally spaced | |
| ☒ | Equally spaced | |
| ☐ | None | |

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20



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Question # 20 of 20

SOLVED BY: **WAQAR HUSSAIN**

_____ difference is a symmetric function of its arguments.

Select the correct option

PRESENTED BY: **TALEEMI MARKAZ**

☐	Backward	(LECTURE No.24, Pg.139) We can easily verify that the divided difference is a symmetric function of its arguments. That is, $y[x_1, x_0] = y[x_0, x_1] = \frac{y_0}{x_0 - x_1} + \frac{y_1}{x_1 - x_0}$
☐	Forward	
☐	Divided	
☐	None	