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Started on Wednesday, 24 November 2021, 9:45 PM

State Finished

Completed on Thursday, 25 November 2021, 12:05 PM

**Time taken** 14 hours 20 mins

**Grade 12.00** out of 12.00 (100%)

Question 1

Correct

Mark 1.00 out of 1.00

When using the formulas shown during this course to estimate values for derivatives, we want the error to be as small as possible.

For this reason, for accuracy, a formula with an error of  $O(h^2)$  is better  $\checkmark$  than a formula with an error of O(h).

Your answer is correct.

The correct answer is:

When using the formulas shown during this course to estimate values for derivatives, we want the error to be as [small] as possible. For this reason, for accuracy, a formula with an error of  $O(h^2)$  is [better] than a formula with an error of O(h).

Question 2

Correct

Mark 1.00 out of 1.00

What is the formula for the centered estimate of the first derivative of f that has an  $O(h^4)$  error term?

Select one:

a.

$$f'(x_i) = \frac{-f(x_{i+2}) + 8f(x_{i+1}) - 8f(x_{i-1}) + f(x_{i-2})}{12h}$$

b.

$$f'(x_i) = \frac{-f(x_{i+2}) + 8f(x_{i+1}) - 8f(x_{i-1}) + f(x_{i-2})}{h^2}$$

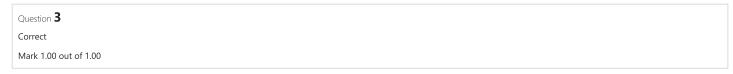
O c.

$$f'(x_i) = rac{-f(x_{i+2}) + 6f(x_{i+1}) - 6f(x_{i-1}) + f(x_{i-2})}{12h}$$

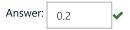
d.

$$f'(x_i) = \frac{f(x_{i+1}) - f(x_{i-1})}{2h}$$

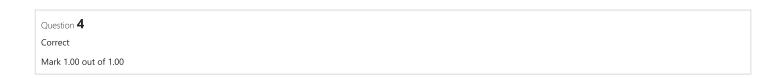
The correct answer is:  $f'(x_i) = \frac{-f(x_{i+2}) + 8f(x_{i+1}) - 8f(x_{i-1}) + f(x_{i-2})}{12h}$ \$



Suppose we have a function (f) and that (f(0) = 3.7) (f(0.5) = 3.8). Use the lower accuracy centered difference formula to estimate the first derivative of (f) at (x=0.25) Give your answer to 1 decimal place.



The correct answer is: 0.2



What is the formula for calculating the terms (R(n,k)) for (k > 0) using the Romberg method?

Select one:

- a.  $R(n,k) = \frac{kR(n,k-1) R(n-1,k-1)}{k-1}$
- $\bullet$  b. \$\$ R(n,k) = \frac{4^kR(n,k-1) R(n-1,k-1)}{4^k-1} \$\$
- o.  $R(n,k) = \frac{R(n,k-1) + R(n-1,k-1)}{2}$ \$
- od.  $R(n,k) = \frac{4R(n,k-1) R(n-1,k-1)}{3}$

The correct answer is:  $\ R(n,k) = \frac{4^kR(n,k-1) - R(n-1,k-1)}{4^k-1}$ 

Question **5**Correct
Mark 1.00 out of 1.00

Suppose we have a function (f(1) = 5.7) (f(1.25) = 8) (f(1.5) = 2.5) (f(1.75) = 5.5) (f(2) = 7.1).

Use the higher accuracy centered difference formula to estimate the second derivative of (f) at (x=1.5) Give your answer to 1 decimal place.



The correct answer is: 170.9

Question **6** Correct Mark 1.00 out of 1.00 What is the high accuracy formula for the backward estimate of the second derivative? Select one: a.  $f''(x_i) = \frac{-f(x_{i+2}) + 4f(x_{i+1})-3f(x_i)}{2h}$ \$  $b. $$f''(x_i) = \frac{f(x_i) - f(x_{i-1}) + f(x_{i-2}) - f(x_{i-3})}{h^2} $$$ o c.  $f''(x_i) = \frac{2f(x_i) - 5f(x_{i-1}) + 4f(x_{i-2}) - f(x_{i-3})}{h^2}$ od.  $f(x_i) = \frac{2f(x_i) - 5f(x_{i-1}) + 4f(x_{i-2}) - f(x_{i-3})}{2h}$ The correct answer is:  $f''(x_i) = \frac{2f(x_i) - 5f(x_{i-1}) + 4f(x_{i-2}) - f(x_{i-3})}{h^2}$ Question 7Correct Mark 1.00 out of 1.00 Under what circumstances can we use Richardson extrapolation to get better estimates? Select one: a. When we have a formula for estimating a value that has an error term that can be expressed using a power series Ob. When the function can be modelled by a freely converging continuous Romberg power series o. When the Taylor series is differentiable d. When our values are Romberg integrable The correct answer is: When we have a formula for estimating a value that has an error term that can be expressed using a power series Question  ${\bf 8}$ Correct Mark 1.00 out of 1.00 What is the formula for the order (h) forward estimate of the derivative of (f) at  $(x_i)$  with step size (h). Select one: a.  $f'(x_i) = \frac{f(x_{i})-f(x_{i-1})}{h}$ \$ • b.  $f'(x_i) = \frac{f(x_{i+1})-f(x_i)}{h} $$ o.  $f'(x_i) = \frac{f(x_{i+1})-f(x_i)}{h^2}$ od.  $f'(x_i) = \frac{f(x_{i+1})-2f(x_{i+1}+f(x_i))}{h^2}$ 

The correct answer is:  $f'(x_i) = \frac{f(x_{i+1})-f(x_i)}{h}$ 

11/25/21, 12:08 PM Homework 14: Attempt review Question **9** Correct Mark 1.00 out of 1.00 Suppose we use the composite trapezoid rule to estimate the value of an integral. Suppose we do two estimates, one using  $(h_0 = 0.5)$  and another using  $(h_1 = 0.25)$ . Suppose the first estimate produces  $(I_0 = 38.9)$  and the second estimate produces  $(I_1 = 52.3)$ Combine these estimates into a better one using the Romberg method. Give your answer to 2 decimal places. Answer: 56.76 The correct answer is: 56.77 Question 10 Correct Mark 1.00 out of 1.00 Given a function  $\{f(x)\}\$  what is the name for the series  $\{f(a) + f'(a)(x-a) + \frac{f''(a)}{2}(x-a)^2 + \frac{f''(a)}{3}(3)\{a\}\{x-a)^3 + ... ?\}$ Select one: a. The Newton series b. The Taylor series o. The Simpson series d. The Euler series

The correct answer is: The Taylor series

Ouestion 11 Correct

Mark 1.00 out of 1.00

Suppose we have a function (f()) and that (f(0) = 2.7) (f(0.5) = 10.2) (f(1) = 14) Use the lower accuracy forward difference formula to estimate the second derivative of (f) at (x=0) Give your answer to 1 decimal place.

Answer: -14.79

The correct answer is: -14.8

Question 12	
Correct	
Mark 1.00 out of 1.00	
The Romberg estimates $(R(n,1))$ for $(n \neq 0)$ are equivalent to which integral estimate with $(2^n)$ segments?	
Select one:	
a. Richardson extrapolation	
<ul><li>b. Composite Simpson's 1/3 rule</li></ul>	~
○ c. Simpson's 3/8 rule	
Od. The composite trapezoid rule	
The correct answer is: Composite Simpson's 1/3 rule	
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