Assignment B

Problem 1: Numerical Derivatives

1. a) Derive Simpson rule formula for second order approximation by showing how it is obtained by extrapolating the differences to the desired order.

2. a) Derive Newton forward difference formula by showing how it is obtained by extrapolating the differences to the desired order.

3. a) Derive Newton backward difference formula by showing how it is obtained by extrapolating the differences to the desired order.

4. a) Derive Newton central difference formula by showing how it is obtained by extrapolating the differences to the desired order.

5. a) Derive Simpson rule formula for fourth order approximation by showing how it is obtained by extrapolating the differences to the desired order.

6. a) Derive Newton forward difference formula by showing how it is obtained by extrapolating the differences to the desired order.


Problem 2: Error in Numerical Derivatives

1. a) Prove the error bound for the forward difference formula by showing how it is obtained by extrapolating the differences to the desired order.

2. a) Prove the error bound for the backward difference formula by showing how it is obtained by extrapolating the differences to the desired order.

3. a) Prove the error bound for the central difference formula by showing how it is obtained by extrapolating the differences to the desired order.

4. a) Prove the error bound for the Simpson rule formula by showing how it is obtained by extrapolating the differences to the desired order.

5. a) Prove the error bound for the fourth order approximation formula by showing how it is obtained by extrapolating the differences to the desired order.


Problem 3: Computation of the rocket velocity and acceleration

1. a) Derive the formula for the velocity of the rocket at any time t using the given information.

2. b) Derive the formula for the acceleration of the rocket at any time t using the given information.

3. c) Derive the formula for the position of the rocket at any time t using the given information.


Problem 4: Newton's Law of Cooling

4. a) Derive the formula for the temperature of the object at any time t using the given information.

5. b) Derive the formula for the rate of change of temperature at any time t using the given information.

6. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 5: Newton's Law of Cooling: Curve Fitting

5. a) Derive the formula for the temperature of the object at any time t using the given information.

6. b) Derive the formula for the rate of change of temperature at any time t using the given information.

7. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 6: Newton's Law of Cooling

6. a) Derive the formula for the temperature of the object at any time t using the given information.

7. b) Derive the formula for the rate of change of temperature at any time t using the given information.

8. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 7: Newton's Law of Cooling

7. a) Derive the formula for the temperature of the object at any time t using the given information.

8. b) Derive the formula for the rate of change of temperature at any time t using the given information.

9. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 8: Newton's Law of Cooling

8. a) Derive the formula for the temperature of the object at any time t using the given information.

9. b) Derive the formula for the rate of change of temperature at any time t using the given information.

10. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 9: Newton's Law of Cooling

9. a) Derive the formula for the temperature of the object at any time t using the given information.

10. b) Derive the formula for the rate of change of temperature at any time t using the given information.

11. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 10: Newton's Law of Cooling

10. a) Derive the formula for the temperature of the object at any time t using the given information.

11. b) Derive the formula for the rate of change of temperature at any time t using the given information.

12. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 11: Newton's Law of Cooling

11. a) Derive the formula for the temperature of the object at any time t using the given information.

12. b) Derive the formula for the rate of change of temperature at any time t using the given information.

13. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 12: Newton's Law of Cooling

12. a) Derive the formula for the temperature of the object at any time t using the given information.

13. b) Derive the formula for the rate of change of temperature at any time t using the given information.

14. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 13: Newton's Law of Cooling

13. a) Derive the formula for the temperature of the object at any time t using the given information.

14. b) Derive the formula for the rate of change of temperature at any time t using the given information.

15. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.


Problem 14: Newton's Law of Cooling

14. a) Derive the formula for the temperature of the object at any time t using the given information.

15. b) Derive the formula for the rate of change of temperature at any time t using the given information.

16. c) Derive the formula for the time it takes for the object to reach a certain temperature using the given information.