NCUK
THE NORTHERN CONSORTIUM

Semester 2 Examination

Further Mathematics : Differential Equations

Examination Session
May 2012

Time Allowed
1 hour

INSTRUCTIONS TO STUDENTS

- **Write your Student Number clearly on the Answer Booklet Provided**

1 **This exam is worth 5% of the overall marks for the course.**
2 **The time allowed for this exam is 1 hour.**
3 **This paper contains 4 sections.**
4 **Answer 2 questions from section A, 2 questions from section B, 2 questions from section C and 1 question from section D.**
5 **Apart from question A1, give all answers in the from y = f(x).**
6 **Show full workings.**
6 **The total number of marks for the exam is 50.**
7 **The marks for each question are indicated in square brackets.**
8 **Only approved calculators may be used.**
9 **No written material is allowed in the examination room.**
10 **No mobile phones are allowed in the examination room.**

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Section A

Answer 2 Questions

A1 Solve $(x^2+4)\cos y\dfrac{dy}{dx}=1$, given that when $x=\dfrac{\pi}{2}$, $y=0$. Leave your answer in implicit form. [6]

A2 Solve $\dfrac{dy}{dx}+4y=8x+6$, given that when $x=0$, $\dfrac{dy}{dx}=-6$. [6]

A3 Solve $x\dfrac{dy}{dx}+y=x\cos x$. [6]

Section B

Answer 2 Questions

B1 Solve $6\dfrac{d^2y}{dx^2}-13\dfrac{dy}{dx}+6y=0$. [5]

B2 Solve $\dfrac{d^2y}{dx^2}+2\dfrac{dy}{dx}+26y=0$. [5]

B3 Solve $9\dfrac{d^2y}{dx^2}-24\dfrac{dy}{dx}+16y=0$. [5]

Section C

Answer 2 Questions

C1 Solve $\dfrac{d^2y}{dx^2}-6\dfrac{dy}{dx}+8y=8e^{4x}$. [8]

C2 Solve $\dfrac{d^2y}{dx^2}+4y=12\cos 2x$. [8]

C3 Solve $\dfrac{d^2y}{dx^2}+\dfrac{dy}{dx}-6y=-6x^2-2x+3$. [8]

Section D

Answer 1 Question

D1 Solve $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}-8y=-24x+10$, given that when $x=0$, $y=15$ and $\dfrac{dy}{dx}$ remains finite for large x. [12]

D2 Solve $\dfrac{d^2y}{dx^2}+3\dfrac{dy}{dx}+2y=5\sin 3x+\cos 3x$, given that when $x=0$, $y=4$ and $\dfrac{dy}{dx}=0$. [12]