Quiz 5 for Mathematics 224
Introductory Analysis II - Spring 2001
Material Covered: Sections B.3, B.4 of workbook and text
For: Friday, 29th March

This is a 15 minute quiz, worth 5% and marked out of 5 points. The total possible points awarded for each question is given in square brackets at the beginning of each question. Anything that can fit on one side of an $8\frac{1}{2}$ by 11 inch piece of paper may be used as a reference during this quiz. A calculator may also be used. No other aids are permitted.

Name (please print): _____ . **ID Number:** _____.
last first

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1. Consider $\frac{dy}{dx} = y + 2xy$.

(a) [1 point] The slopes of this differential equation are positive when
(*circle none, one or more!*)
$\boldsymbol{y < 0,\ 1 + 2x < 0}$ / $\boldsymbol{y > 0,\ 1 + 2x < 0}$ / $\boldsymbol{y < 0,\ 1 + 2x > 0}$ /
$\boldsymbol{y = 0,\ 1 + 2x = 0}$ / $\boldsymbol{y > 0,\ 1 + 2x > 0}$

(b) [1 point] The second derivative is $\frac{dy^2}{d^2x} =$

(i) $\boldsymbol{3y^2\frac{dy}{dx} - 4y\frac{dy}{dx} - 3\frac{dy}{dx}}$
(ii) $\boldsymbol{3y + 4xy + 4x^2y}$
(iii) $\boldsymbol{\frac{1}{3}x^3 - \frac{1}{2}x^2 + 5x + C}$
(iv) $\boldsymbol{\frac{dy}{dx}(3y^2 - 4y - 3)}$
(v) $\boldsymbol{(y - 3)(y - 1)(y + 2)(3y^2 - 4y - 3)}$

2. [3 points] Use Euler's method to complete the following table which is used to approximate the value of $y(1.5)$ where $y' = 2x^3 - 2y$ and $y(1) = 3$.

n	$x_n = x_0 + n \times dx$	$y_n = y_{n-1} + (2x_{n-1}^3 - 2y_{n-1})dx$
1	$x_1 = 1.1$	$y_1 = 2.6$
2	$x_2 = 1.2$	$y_2 = 2.3462$
3	$x_3 = 1.3$	$y_3 = ?$
4	$x_4 = 1.4$	$y_4 = ?$
5	$x_5 = 1.5$	$y_5 = ?$

1. Consider $\frac{dy}{dx} = y + 2xy$.

(a) (i) $y < 0,\ 1 + 2x < 0$, (v) $y > 0,\ 1 + 2x > 0$
positive slope when $\frac{dy}{dx} = y + 2xy = y(1 + 2x) > 0$

(b) (ii) $3y + 4xy + 4x^2y$
$\frac{dy^2}{d^2x} = \frac{dy}{dx} + 2y(1) + 2x\frac{dy}{dx} = \frac{dy}{dx}(1+2x) + 2y = (y+2xy)(1+2x) + 2y = 3y + 4xy + 4x^2y$

2. Use Euler's method to complete the following table which is used to approximate the value of $y(1.5)$ where $y' = 2x^3 - 2y$ and $y(1) = 3$.

n	$x_n = x_0 + n \times dx$	$y_n = y_{n-1} + (2x_{n-1}^3 - 2y_{n-1})dx$
1	$x_1 = 1.1$	$y_1 = 2.6$
2	$x_2 = 1.2$	$y_2 = 2.3462$
3	$x_3 = 1.3$	$y_3 = 2.2226$
4	$x_4 = 1.4$	$y_4 = 2.2174$
5	$x_5 = 1.5$	$y_5 = 2.3228$

- Set the calculator to difference equation (or "sequence graphing") mode by MODE, then arrowing down four and over four, to SEQ (ENTER).
- Continue to set the calculator to difference question mode by typing 2nd FORMAT, then arrowing over two, to uv (ENTER).
- Adjust the window dimensions for proper viewing,
  WINDOW 0, 5, 1, 1, 0.5, 2, 1, 2, 5, 1,
- To input the difference equations, type
  Y=
  nMin $= 0$,
  u(n) $= 1 + 0.1n$,
  u(nMin) $= \{1\}$,
  v(n) $=$ v$(n-1) + 0.1(2$u$(n-1)^3 - 2$v$(n-1))$,
  v(nMin) $= \{3\}$
  Notice that n is the "X,T,θ,n" button, that "u" is the "2nd 7" button and "v" is the "2nd 8" button on your calculator.