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UNIVERSITY OF RUHUNA - FACULTY OF ALLIED HEALTH SCIENCES

DEPARTMENT OF PHARMACY

FIRST BPHARM PART I EXAMINATION - NOVEMBER 2020

PH1152 : MATHEMATICS - SEQ

TIME: TWO HOURS

INSTRUCTIONS

- There are **four** questions in this paper.
- Answer all questions.
- No paper should be removed from the examination hall.
- Do not use any correction fluid.

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1. a) Find the following limits:

(i) $\lim_{x \to 3} \frac{x^2 - 9}{x^2 - 3x}$ **[10]**

(ii) $\lim_{x \to 0} \frac{(x+5)^3 - 125}{x}$ **[10]**

(iii) $\lim_{x \to 1} \frac{x^3 - 1}{x^2 - 1}$ **[10]**

b) Differentiate the function $y = -x^2 + 3x$ with respect to x using the **first principles**. **[25]**

c) The Maxwell Boltzmann Distribution is a probability distribution, which has the form $f(v) = \lambda v^2 e^{-\mu v^2}$; where λ and μ are constants, of finding particles at certain speed v in three dimensional space.

Show that the rate of change of $f(v)$ with respect to v is $2\lambda v e^{-\mu v^2}(1 - \mu v^2)$. **[20]**

d) Compute the first derivative of the function $y = \sqrt{u^2 + 2}$, where $u = \cot x$, with respect to x. **[25]**

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2. a) Find the equation of the tangent line to the curve $y = (x+2)(2x+1)^2$ at $x = -1$. **[35]**

b) The cubic curve $y = ax^3 + bx^2 + cx + d$, where a, b, c and d are constants, has a stationary point at (1,0) and touches the line $y = -9x + 5$ at (0,5).

(i) Show that $a = 1, b = 3, c = -9$ and $d = 5$. **[40]**

(ii) Find the other stationary point of this function. **[10]**

(iii) Classify the above stationary points as maxima or minima using the second derivative $\frac{d^2y}{dx^2}$. **[15]**

Continued.

3. (a) Let $f(x,y) = \frac{y^2}{x^2} \ln x$. Verify that

$$\frac{\partial^2 f(x,y)}{\partial x \partial y} = \frac{\partial^2 f(x,y)}{\partial y \partial x}.$$

[30]

(b) Let $g(x,y) = e^{2x^3+3y^3}$.

(i) Find the partial derivatives $\frac{\partial g(x,y)}{\partial x}$ and $\frac{\partial g(x,y)}{\partial y}$. [20]

(ii) Find the total differential of g at the point $(1,1)$. [20]

(c) Show that the function $f(x,y) = 9x^3y + 8x^2y^2 - 6xy^3$ is homogeneous of degree 4 and satisfies the Euler's theorem. [30]

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4. (a) Using the method of integration by parts, show that

$$\int x \sin x \, dx = -x \cos x + \sin x + C;$$

where C is the constant of integration. [30]

Use the method of integration by parts and the above result to show that

$$\int_0^{2\pi} x^2 \cos x \, dx = 4\pi.$$

[20]

(b) Find the constants A, B and C such that

$$\frac{1}{x(3x-1)^2} = \frac{A}{x} + \frac{B}{3x-1} + \frac{C}{(3x-1)^2}.$$

Hence, evaluate [15]

$$\int \frac{1}{x(3x-1)^2} dx.$$

[15]

(c) Test the differential equation

$$(2xy + y^3 \cos x)\, dx + (x^2 + 3y^2 \sin x)\, dy = 0$$

for exactness. If it is exact, then find its solution. [20]
