University of Swaziland

Re-sit Examination – July 2017

BSc in Environmental Sciences I

Title of Paper : Algebra for Health Sciences
Course Number : EHS101
Time Allowed : Two (2) hours

Instructions:

1. This paper consists of 2 sections.
2. Answer ALL questions in Section A.
3. Answer ANY 2 questions in Section B.
4. Show all your working.

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

Section A

Answer ALL Questions in this section

A.1 a. Find the value of the sum

i. $\sum_{n=-5}^{75}(5-8n)$ [5 marks]

ii. $\sum_{n=0}^{\infty}75\left(\frac{4}{9}\right)^n$ [5 marks]

b. Find the first 3 terms of the binomial expansion of

$$\left(x+\frac{2}{x^2}\right)^{15}.$$ [8 marks]

c. Evaluate the complex number

i. $3i(3+5i)-5i(3i-5)$ [4 marks]

ii. $\dfrac{i+2}{2i-1}$ [4 marks]

and leave your answer in the form $a+ib$.

d. Find the equation of the straight line from $(0,-5)$ to $(5,0)$. [6 marks]

e. Solve for x (express non-exact answers correct to 2 d.p.)

i. $5^{x+1}=7439$ [5 marks]

ii. $\log_2\left(\dfrac{7x}{2x+15}\right)=0$ [5 marks]

f. Given the vectors $\boldsymbol{A}=2\hat{\boldsymbol{i}}-6\hat{\boldsymbol{k}}$ and $\boldsymbol{B}=9\hat{\boldsymbol{i}}+3\hat{\boldsymbol{j}}+2\hat{\boldsymbol{k}}$, compute

i. $\boldsymbol{A}\cdot\boldsymbol{B}$ [2 marks]

ii. $\boldsymbol{A}\times\boldsymbol{B}$ [6 marks]

Section B

Answer ANY 2 Questions in this section

B.1 a. Consider the vectors $\boldsymbol{A} = 2\hat{\boldsymbol{i}} - 6\hat{\boldsymbol{k}}$ and $\boldsymbol{B} = 9\hat{\boldsymbol{i}} + 3\hat{\boldsymbol{j}} + 2\hat{\boldsymbol{k}}$. Find the angle made by the vectors (correct to 1 d.p.). [8 marks]

b. Use Cramer's rule to solve

$$\begin{aligned} 2x + y - 3z &= -6 \\ x + 2y + 2z &= 0 \\ 5x + 2y &= 10 \end{aligned}$$ [17 marks]

B.2 a. Consider the triangle with vertices $A(3, 8)$, $B(4, -7)$ and $C(-8, -9)$. Find

i. the perimeter of the triangle [6 marks]

ii. the interior angle $\hat{A}$ [4 marks]

iii. the area of the triangle [6 marks]

b. A circle is centred at $C(-9, 12)$. If the x-axis is a tangent of the circle, find

i. the equation of the circle in *general form* [5 marks]

ii. the perimeter and area of the circle [2,2 marks]

B.3 a. In the binomial expansion of

$$\left(x - \frac{1}{x^2}\right)^{21}$$

find

i. the 19th term [4 marks]

ii. the term that does not involve x [7 marks]

b. Consider the polynomial

$$P(x) = 4x^3 + 12x^2 - x - 3.$$

i. Determine the remainder when $P(x)$ is divided by

$x - 1$ [2 marks]

$x + 3$ [2 marks]

$x - 4$ [2 marks]

ii. Hence, or otherwise, factorise $P(x)$ and determine its roots. [8 marks]

B.4 a. Solve for x (expressing non-exact aswers correct to 2 d.p.)

i. $7 \cdot e^{3x+1} = 750$ [7 marks]

ii. $\log_2 x + \log_2(x - 2) = 3$ [7 marks]

b. On 01 January 2017, a photocopying machine was bought for E230,000. If it depreciates at 11% per annum, such that its value is given by

$$V(t) = 230000e^{-0.11t},$$

where t is the number of years after 01 January 2016, find

i. its value on 01 July 2022 [3 marks]

ii. the date corresponding to the half-life of the machine. [8 marks]