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# University of Swaziland



**Re-sit Examination – July 2019**

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## **BSc Env. Health I**

**Title of Paper** : Calculus for Health Sciences

**Course Number** : EHS102

**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.
5. Begin each question on a new page.

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

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**Section A**  
**Answer ALL Questions in this section**

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**A.1 a. Evaluate**

i.  $\lim_{x \rightarrow 0} \frac{4x - x^2}{5x^2 - 2x}$  [5 marks]

ii.  $\lim_{x \rightarrow \infty} \frac{3x^2 + 7}{2x^2 + 5x}$  [5 marks]

b. Use the limit definition to find  $f'(x)$  if

$$f(x) = x^2 + 2. \quad [10 \text{ marks}]$$

c. Find  $y'$  if

i.  $y = 10x^4 - 6x\sqrt{x} - \frac{7}{x^2}$  [4 marks]

ii.  $y = \pi^2 - 2e^{-3x} + \sin 3x - \ln 4x$  [4 marks]

iii.  $y = (2x - 1)e^{2x}$  [5 marks]

iv.  $y = \frac{4 + 3x^2}{1 - 2x^2}$  [5 marks]

d. Integrate

i.  $\int_4^{16} \left(4x^3 - \frac{7}{\sqrt{x}} + 9\right) dx$  [6 marks]

ii.  $\int_{\frac{1}{2}}^3 \left(9e^{-3x} - \frac{7}{x} - \frac{10}{x^3}\right) dx$  (correct to 2 d.p.) [6 marks]

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## Section B

### Answer ANY 2 Questions in this section

**B.2** a. Consider the function

$$y = (x^2 - 2)^4 + e^{1-x} + 2.$$

- i. Find  $y'$  [4 marks]  
 ii. Find the equation of the tangent of  $y$  at  $x = 1$ . [5 marks]

b. Find 2 numbers  $x$  and  $y$  whose sum is 1200 such that

$$F = xy^3$$

is the largest. [8 marks]

c. A bullet is fired vertically upwards from the top of a building 50m high. Its height (in metres) is given by

$$h(t) = 50 + 245t - 4.9t^2,$$

where  $t$  is the number of seconds after the shot.

- i. Find the greatest height reached by the bullet. [4 marks]  
 ii. Find the speed at which it hits the ground. [4 marks]

**B.3** a. Find the indicated derivative

i.  $y = 16\sqrt{x} - \frac{3}{x}$ ,  $y'''$  [5 marks]

ii.  $y = \frac{\sin x}{\cos x}$ ,  $y'$  [5 marks]

b. Consider the function

$$f(x) = 10 + 12x - x^3.$$

- i. Find the stationary points of  $f(x)$  and determine the nature of each [8 marks]  
 ii. Find the inflexion point and  $y$ -intercept [3 marks]  
 iii. Make a sketch of the graph of  $y = f(x)$ . [4 marks]

**B.4 a. Integrate**

i.  $\int 120x(x^2 - 3)^9 dx$  [5 marks]

ii.  $\int \frac{3x^4 - 2x^2 + 7}{x^2} dx$  [5 marks]

iii.  $\int 4xe^{-2x} dx$  [5 marks]

b. Find the area of the region bounded by the parabola  $y = 27 - 3x^2$  and the  $x$ -axis. [10 marks]

**B.5 a. Evaluate**

i.  $\int [10x^{\frac{2}{3}} - 3 \cos(0.1x)] dx$  [5 marks]

ii.  $\int \frac{10x dx}{(x-1)(x+4)}$  [10 marks]

b. After the launch of a new product on 01 January 2018, the rate sales (in thousands per month) is given by

$$S'(t) = \frac{12}{1 + 0.2t},$$

where  $t$  is the number of months after 01 January 2018. Find

i. the total number of sales in the first year [5 marks]

ii. the total number of sales in the second year [5 marks]

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END OF EXAMINATION

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