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Universiti Tun Hussein Onn Malaysia

**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
SEMESTER I  
SESSION 2018/2019**

**COURSE NAME** : **ENGINEERING MATHEMATICS I**  
**COURSE CODE** : **BDA 14003**  
**PROGRAMME CODE** : **BDD**  
**EXAMINATION DATE** : **DECEMBER 2018 / JANUARY 2019**  
**DURATION** : **3 HOURS**  
**INSTRUCTION** : **ANSWER FIVE (5) QUESTIONS ONLY**

DR. SHARIFAH ADILIA BINTI SYED ABU BAKAR  
Jabatan Pendidikan dan Penyelidikan  
Fakulti Kejuruteraan, Kimia dan Teknologi  
Universiti Tun Hussein Onn Malaysia  
54000 Shah Alam, Selangor Darul Ehsan, Malaysia

**THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES**

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**TERBUKA**

Q1 (a) Find the domain and range of  $h(x) = \frac{3}{\sqrt{16-x^2}}$  (5 marks)

(b) Solve the  $\lim_{x \rightarrow \infty}$  for the function of  $f(x) = \frac{2-x}{\sqrt{7+6x^2}}$  (5 marks)

(c) Given the function  $h = \begin{cases} 6z & z \leq -4 \\ 1-9z & z > -4 \end{cases}$ , evaluate the following limits, if they exists:

(i)  $\lim_{z \rightarrow 7} h(z)$  (4 marks)

(ii)  $\lim_{z \rightarrow -4} h(z)$  (6 marks)

Q2 (a) Differentiate  $(6x^3 + 3x + 1)^{10}$  using the Chain Rule. (5 marks)

(b) Solve the derivative of  $7y^2 + \sin(3x) = 12-y^4$ . (5 marks)

(c) A person is standing 350 feet away from a model rocket that is fired straight up into the air at a rate of 15 ft/sec. At what rate is the distance between the person and the rocket increasing 20 seconds after liftoff? (10 marks)

Q3 (a) Show  $\frac{d}{d\theta}(\tan^3 \theta) = 3 \tan^4 \theta + 3 \sec^2 \theta - 3$ . Then, solve  $\int_0^{\frac{\pi}{4}} \tan^4 \theta d\theta$ . (5 marks)

(b) Evaluate the integrals  $\int_0^1 4x^3 \ln(x^2 + 1) dx$  by using appropriate integration methods. (7 marks)

(c) Prove  $\int_0^1 \frac{36-8x-2x^2}{(4-3x)(1+x)^2} dx = 3 + \frac{14}{3} \ln 2$  (8 marks)

- Q4** (a) Find the arc length of the graph of  $y = \frac{x^3}{6} + \frac{1}{2x}$  on the interval  $[\frac{1}{2}, 2]$  (6 marks)
- (b) Evaluate the area of the region between the graphs of  $f(x) = 3x^3 - x^2 - 10x$  and  $g(x) = -x^2 + 2x$  (6 marks)
- (c) Determine the volume of the solid obtained by rotating the region bounded by  $y = 7 - x^2$ ,  $x = -2$ ,  $x = 2$  and the x-axis about the x-axis. (8 marks)

- Q5** (a) Solve the function of  $(f \circ g)(x)$  and  $(g \circ f)(x)$  with its domain of  $f(x) = \frac{3}{x-2}$  and  $g(x) = \frac{4}{x+1}$  (5 marks)
- (b) Evaluate the value of  $c$  if  $f(x)$  is continuous at every  $x$ ,  
 $f = \begin{cases} x^2 - 2 & x < 2 \\ 4cx & x \geq 2 \end{cases}$  (5 marks)
- (c) Find  $\frac{dy}{dx}$  if  $y^2 = x^2 + \sin xy$  (5 marks)
- (d) Use L'Hospital's Rule to evaluate the limit of  $\lim_{x \rightarrow 1} \frac{x^3 + x^2 - 2x}{x-1}$  (5 marks)

- Q6** (a) Solve the integral  $\int_0^{\frac{1}{2}} \frac{4x^2}{\sqrt{1-x^2}} dx$  by using trigonometric substitutions. Show the answer in form of surd. (5 marks)
- (b) Evaluate the integral  $\int_0^{\frac{\pi}{6}} e^{-x} \sin 3x dx$  (5 marks)
- (c) A spherical tank of radius 8 feet is half full of oil that weighs 50 pounds per cubic foot. Find the work required to pump oil out through a hole in the top of the tank. (10 marks)

**-END OF QUESTION-**