Seat No.

College of Industrial Technology

King Mongkut's University of Technology North Bangkok

Final Examination of Semester 1 **Year: 2017**

Subject: 394171 Mathematics I **Section: 15-18**

Date 28 November 2017 **Time 13:00-16:00**

Name _____ **ID**_____**Class**_____

Instructions

1. The examination has 11 pages (including this page) and a total score of 100 points.
2. Write all your solutions and answers on this examination sheet.
3. This is a closed book examination.
4. You are not allowed to leave the examination room during the first 1 hour after the beginning of the examination.
5. You are not allowed to open the exam papers or start to answer before the proctor's permission.
6. You are not allowed to use the restroom during the exam except in case of an emergency.
7. No documents are allowed to be taken out of the examination room.
8. Calculators are not allowed in the examination.
9. Electronic communication devices are **NOT** allowed in the examination room.

Cheating In the exam is considered an extremely serious offence which will result in expulsion from the University

Question 1 1.1 Find the inverse function of $f(x) = \frac{x}{1-x}$. (5 marks)

1.2 Find the value of $\frac{f(-1)+f^{-1}(1)}{f^{-1}\left(\frac{-1}{2}\right)}$. (5 marks)

Question 2 2.1 Given $a \in R$ and two functions $f(x) = 5x+a$ and $g(x) = \frac{x}{x+2}$, if $(g \circ f)(a) = 0$, find the value of $a^3 - 2a^2 + a + 1$. (5 marks)

2. 2 Compute the value of $(f^{-1} \circ g^{-1})(a)$. (5 marks)

Question 3 3.1 Find the value of the expression

$$\left(\sin^2\frac{13\pi}{6}+\cos^2\frac{5\pi}{6}\right)+\left(\sec^2\frac{2\pi}{3}-\tan^2\frac{5\pi}{3}\right)+\left(\operatorname{cosec}^2\frac{3\pi}{4}-\cot^2\frac{7\pi}{4}\right).$$ (5 marks)

3.2 Given the trigonometric equation $\tan\frac{5\pi}{4}-\sin^2\frac{2\pi}{3}=x\cos\frac{7\pi}{4}\sin\frac{3\pi}{4}\tan\frac{4\pi}{3}$. Find the value of x. (5 marks)

Question 4 4.1 Evaluate the expression $\dfrac{\sin(-420^\circ)\cot 210^\circ + \sqrt{3}\cot(-390^\circ)}{\cos(-840^\circ)}$.

(5 marks)

4.2 Use the value of the trigonometric function, $4\tan\theta = 7$, where $\theta \in \left[\pi, \dfrac{3\pi}{2}\right]$ to evaluate the indicated function $\dfrac{3\sin\theta - 2\cos\theta}{\sin\theta + \cos\theta}$. (5 marks)

Question 5 5.1 Find the value of x from the simplify expression

$$\sec\theta \cos ec(90^\circ - \theta) - x^2 \cot(90^\circ - \theta) = 1. \qquad \text{(5 marks)}$$

5.2 Use trigonometric identities to transform the left hand side of the equation into the right hand side:

$$\sqrt{1 + \cot^2\theta} \cdot \sqrt{\csc^2\theta \tan^2\theta - 1} \cdot \sqrt{1 - \sin^2\theta} = 1. \qquad \text{(5 marks)}$$

Question 6 6.1 Evaluate the expression $\cos 20^\circ \cos 70^\circ - \sin 20^\circ \sin 70^\circ$. (5 marks)

6.2 If $A \in Q_2$ and $B \in Q_3$ where $24 \tan A + 7 = 0$ and $3 - 4 \tan B = 0$, find the value of $\cos(A + B)$. (5 marks)

Question 7 7.1 Given $A+B=225$, find the value of $\frac{\tan A \tan B}{(1-\tan A)(1-\tan B)}$. (5 marks)

7.2 Evaluate the value of $\cos 70^\circ \cos 50^\circ \cos 10^\circ$. (10 marks)

Question 8 8.1 Determine the exact value of $\arcsin\left(\cos^2\frac{\pi}{12}-\sin^2\frac{5\pi}{12}\right)$. (5 marks)

8.2 Use some inverse trigonometric properties to evaluate the exact value of

$\sin(\arctan 2+\arctan 3)$. (5 marks)

Question 9 9.1 Solve the trigonometric equation

$$\cos x = \sqrt{3} - \sqrt{3}\sin x, \qquad x \in [0, 4\pi].$$ (5 marks)

9.2 Give the trigonometric equation and find the solutions in term of an inverse trigonometric function. (5 marks)

$$\cos(2\arccos(1-x)) = x^2$$

Question 10 Two fire-spotting towers are 7 kilometers apart on an east–west line. From Tower A a fire is seen on a bearing of 310° (clockwise from the north). From Tower B the same fire is spotted on a bearing of 020° (clockwise from the north). Which tower how far is that tower from the fire? ($\sin 20^\circ = 0.342$) (10 marks)

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