

College of Industrial Technology  
King Mongkut's University of Technology North Bangkok

Seat No.

Final Examination of Semester 1

Year: 2016

Subject: 394171 Mathematics I

Section: 15-16

Date 29 November 2016

Time 13:00-16:00

Name \_\_\_\_\_ ID \_\_\_\_\_ Class \_\_\_\_\_

Instructions

1. Cheating in the exam is considered an extremely serious offence which will result in expulsion from the University.
2. No documents are allowed to be taken out of the examination room.
3. Textbooks and dictionaries are not allowed.
4. Calculators are not allowed.
5. Electronic communication devices are NOT allowed in the examination room.
6. This examination has 9 pages (including this page), 12 questions and a total score of 120 marks.
7. Write all your answers in this examination sheet.

You are not allowed to leave the exam room during the first  
two hours after the beginning of the exam.

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You are not allowed to use the restroom during the exam  
except in case of an emergency.

## Question 1

- 1.1 Use the value of the trigonometric function,  $\cos \theta = \frac{5}{13}$ ,  $0 \leq \theta \leq \frac{\pi}{2}$ , to evaluate the indicated function  $\tan(\theta - \pi) \sec\left(\frac{3}{2}\pi - \theta\right)$ . (5 marks)

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- 1.2 If  $\tan 65^\circ = x$ , then find the value of  $\frac{\tan 155^\circ + \cot 115^\circ}{\cot 245^\circ + \tan 335^\circ}$  in terms of the variable  $x$ . (5 marks)

Question 2 2.1 Simplify the expression  $\sqrt{\frac{1-\cos x}{1+\cos x}}$ . (5 marks)

2.2 Use trigonometric identities to transform the left hand side of the equation into the right hand side:  $\frac{\sin^2 x}{1-\cos x} - \frac{\cos^2 x}{1+\sin x} = \sin x + \cos x$  (5 marks)

Question 3 Use a unit trigonometric circle to evaluate the expression (10 marks)

$$\cot^2 \frac{5\pi}{6} - \sin^2 \frac{7\pi}{3} - \cos 13\pi + \tan \frac{7\pi}{4} - \sec^4 \frac{3\pi}{4} - \sin^3 4\pi.$$

Question 4 Evaluate the value of  $\frac{1}{8} \sin 70^\circ \sin 50^\circ \sin 10^\circ$  (10 marks)

Question 5 5.1 Determine the exact value of

$$\arccos\left(\frac{1}{2}\right) - \operatorname{arccot}\left(\frac{1}{\sqrt{3}}\right) + \operatorname{arccsc}\left(\frac{\sqrt{3}}{2}\right) \quad (5 \text{ marks})$$

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

$$\sin\left(\arccos\frac{4}{5} + \arcsin\frac{1}{\sqrt{10}}\right) \quad (5 \text{ marks})$$

Question 6 6.1 Solve the trigonometric equation (5 marks)

$$\cos^2 x + \sin 2x + \sin^2 x = \tan 3\pi$$

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

$$\sec^2 x - 2 \tan x = 4$$

**Question 7** Find the value of  $x$  that satisfies the inverse trigonometric equation  
(10 marks)

$$\arctan\left(\frac{x+1}{x+2}\right) + \arctan\frac{x-1}{x+1} = \frac{\pi}{4}$$

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**Question 8.** Evaluate the exact value of

$$\sec\left[\frac{1}{2}\left(\arcsin\frac{3}{5} + \arccos\frac{3}{5}\right)\right] + \operatorname{cosec}\left[\frac{1}{2}\left(\arcsin\frac{4}{5} + \arccos\frac{4}{5}\right)\right] \quad (10 \text{ marks})$$

**Question 9** Two men are 400 feet apart on opposite sides of a flag pole . If the angles on elevation from two men to the top of the tree are  $20^\circ$  and  $15^\circ$  respectively. How tall of the flag pole? ( $\cot 20^\circ = 2.748$  and  $\cot 15^\circ = 3.732$ ) (10 marks)

**Question 10** Find the inverse function of  $f(x) = \frac{x}{1+|x|}$ . (10 marks)



Question 11 Given  $a \neq 0$  and two function  $f(x) = ax - 3$  and  $g(x) = x^3$ , if  $(f^{-1} \circ g^{-1})(1) = 4$ , then find the value of  $(g \circ f)(a)$ . (10 marks)

Question 12 Given three functions  $f(x) = \frac{x-1}{x+2}$ ,  $g(x) = 4 - (x-2)^2$  and  $h(x) = \frac{1}{x(x-4)}$ . Find the function  $\left(\frac{g \cdot h}{f}\right)(x)$  and the domain  $D_{\frac{f+g}{h}}$ . (10 marks)