



MASENO UNIVERSITY
UNIVERSITY EXAMINATIONS 2016/2017

**FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE
CERTIFICATE IN BRIDGING MATHEMATICS**

CITY CAMPUS

SMA 005: TRIGONOMETRY

Date: 25th November 2016

Time: 9.00 – 12.00 noon

INSTRUCTIONS:

- Answer question ONE and any other TWO questions.
- Show all the necessary workings
- Start each question on a new page.
- Electronic scientific calculators may be used.
- Observe further instructions on the answer booklet.

QUESTION ONE (COMPULSORY) (30mks)

- (a) (i) Convert to decimal degree notation, round to two decimal places
 $49^{\circ}38'46''$. [2mks]
- (ii) Convert to degrees, minutes, and seconds, round to the nearest
second 67.84° . [2mks]

- (b) (i) Find $\sin \theta$, given $\cos \theta = -\frac{4}{5}$ and that $\tan \theta$ is positive. [3mks]

- (ii) Solve for θ in the following trigonometric equation
 $\sin \theta = \cos(2\theta - 30)^{\circ}$ for $0 \leq \theta \leq 360^{\circ}$ [4mks]

- (c) Use a right angled triangle to show that

$$\sin^2 \theta + \cos^2 \theta = 1$$

- , where θ is one of the acute angles. [4mks]

- (d) Find all angles between 0° and 360° which satisfy the equation
 $2 \cos^2 \theta - \sin \theta - 1 = 0$ [5mks]

- (e) Verify that the following equation is an identity

$$\tan^2 x(1 + \cot^2 x) = \frac{1}{1 - \sin^2 x}$$

[5mks]

- (f) Three angles $x = (3p + 25)^{\circ}$, $y = (2p - 20)^{\circ}$ and $z = (2p + 35)^{\circ}$ are on
a straight line, find

- (i) the value of p [2mks]

- (ii) the value of x, y and z [1mks]

- (g) As a hot-air balloon began to rise, the ground crew drove 1.2 m to an observation station. The initial observation from the station estimated the angle between the ground and the line of sight to the balloon to be 30° . Approximately how high was the balloon at that point? (We are assuming that the wind velocity was low and that the balloon rose vertically for the first few minutes.) [2mks]

QUESTION TWO (20mks)

- (a) Find all the unknown angles of triangle ABC in which the length of AC is 11 cm, the length of BC is 9 cm and angle A is 0.673 radians. [6mks]
- (b) Find the height of a tree if the angle of elevation of its top changes from 20° to 40° as the observer advances 75 ft toward its base. [5mks]
- (c) A circle has a radius of 4 cm. Find the length of the arc cut off (subtended) by a central angle of 240° . [3mks]
- (d) The average daily income, R of a tourist shop for any month of the year (in hundreds of dollars) is given by the function

$$R(t) = 18 + 12 \sin \frac{\pi}{6}t$$

where t is the number of months since 1st January

- (i) Find the average daily income expected in the month commencing 1st July
- (ii) In what month(s) of the year would you expect the daily revenue to be \$2400? [6mks]

QUESTION THREE (20mks)

- (a) Simplify the expression $\sin^2 x + \sin^2 x \tan^2 x$ [4mks]
- (b) Express the following angle in terms of the trigonometric ratios of acute angles. $\cos(460)^\circ$ [3mks]
- (c) Simplify the expression

$$\frac{\sqrt{5}}{\sqrt{5}+2} - \frac{\sqrt{5}}{\sqrt{5}-2}$$

leaving your answer in the form $a + b\sqrt{c}$ where a, b and c are integers. (5mks)

- (d) A reversed curve on a railroad track consists of two circular arcs. The central angle of one is 20° with radius 2500 feet and the central angle of the other is 25° with radius 3000 feet. Find the total length of the two arcs. [3mks]
- (e) Solve $\cos^2 x + \cos x = \sin^2 x$ for $0^\circ \leq x \leq 180^\circ$ [5mks]

QUESTION FOUR (20mks)

- (a) Prove that $\sin^2 x + 3 \cos^2 x = 3 - 2 \sin^2 x$ [4mks]
- (b) A T.V antenna is on top of a tall building. A surveyor standing 53.5m away measured the angle of elevation to the top of the building as 64° . She then measured the angle of elevation to the top of the antenna as 71° . What is the height of the T.V antenna to the nearest tenth of a meter? [3mks]

(c) Verify the identity

$$\frac{\sec^2 \theta - 1}{\sec^2 \theta} = \sin^2 \theta$$

[5mks]

(d) State the period, amplitude and phase angle of the curve

$$y = 3 \sin(4x - 10^\circ)$$

[3mks]

(e) Solve for x in the equation

$$3 \cos^2 x + \sin x + 1 = 0 \text{ given } 0^\circ \leq x \leq 360^\circ.$$

[5mks]

QUESTION FIVE (20mks)

(a) X is an angle in third quadrant and $\sin x = \frac{-1}{3}$. Find $\cos x$. [5mks]

(b) Prove that $\frac{\sec w \sin w}{\tan w + \cot w} = \sin^2 w$ [4mks]

(c) Find all solutions of $x^2 - 1 - \sin x = 0$ in the domain $0^\circ \leq x \leq 2\pi$
[11mks]