MAT092: Remedial Course in Mathematics Assessment

December 24, 2025

Total - 20 Marks

.

(**You have to answer 1 question from each part**)

Name:

ID:

Section:

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1. **(Trigonometric transformations and sketching)**

   (a) Sketch the graph of

   $$y = 1 + 2\cos\left(3x - \frac{\pi}{2}\right)$$

   for

   $$0 \leq x \leq \frac{2\pi}{3}.$$

   On your sketch, clearly indicate:

   - the amplitude,
   - the period,
   - the phase shift,
   - the vertical shift,
   - at least one maximum and one minimum point.

   (b) Using your sketch, state the **maximum and minimum values** of the function and the corresponding values of x in the given interval.

2. **(Modulus function and graphical solution)**

   (a) On the same set of axes, sketch the graphs of

   $$y = |\sin x| \quad \text{and} \quad y = \cos x$$

for

$$0 \leq x < 2\pi.$$

Clearly mark all points of intersection.

(b) Hence, solve the equation

$$|\sin x| = \cos x$$

for $0 \leq x < 2\pi$.

Briefly explain how the graph helps in determining the solutions.

3. **(Polar form and De Moivre's theorem)**

(a) Write the complex number

$$z = -1 + i\sqrt{3}$$

in the polar form

$$z = r(\cos\theta + i\sin\theta),$$

where θ is the principal argument.

(b) Hence, compute

$$z^4$$

and express your final answer in the form $a + bi$.

4. **(Roots of a complex number and geometry)**

(a) Find all fourth roots of

$$z = 16i.$$

Write the roots:

- in polar/exponent form,
- and in rectangular form.

(b) Sketch the roots on the Argand plane and briefly describe the geometric symmetry they exhibit.

In remembrance of Sharif Osman Bin Hadi, whose courage and sacrifice will shape our nation.