MA 101 (Mathematics I)
Marking scheme of Quiz - 2

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1. (a) For getting correct answer (FALSE) with proper justification : 2 marks (no partial marks)
   The steps $\lim_{n\to\infty}(x_n + y_n) = 0$ and/or $\lim_{n\to\infty}(x_n^3 + y_n^3) \neq 0$ should be justified except possibly in trivial cases.

   (b) For getting correct answer (FALSE) with proper justification : 2 marks
   First method: For correct approach and getting a convergent subsequence of $(\sin n)$ by using Bolzano-Weierstrass theorem : 1 mark
   Second method: For correct approach and concluding that f is bounded on $[-1, 1]$ by applying the appropriate result of continuity : 1 mark
   (For just writing that $(\sin n)$ is bounded and $(\frac{n\pi}{2})$ is unbounded and f is continuous will have no mark.)

2. For showing $x_n \geq \sqrt{3}$ for all $n \in \mathbb{N}$: 1 mark (simply calculating first few terms and comparing their values won't do)
   For showing (x_n) is decreasing : 1 mark (same comment as above applies here as well)
   (The fact that $x_n \geq \sqrt{3}$ for all $n \in \mathbb{N}$ is used in proving that (x_n) is decreasing. Hence for just showing $x_n > 0$ for all $n \in \mathbb{N}$ and concluding that (x_n) is bounded below will have no mark unless the decreasing nature of (x_n) is also independently shown.)
   If an attempt (although it is not fully correct) is made to show (not for just mentioning) that $x_n \geq \sqrt{3}$ for all $n \in \mathbb{N}$ and then this fact is used for showing that (x_n) is decreasing, then 1 mark will be given.

3. For choosing the correct sequence (y_n) and applying limit comparison test (*i.e.* calculating $\lim_{n\to\infty}\frac{x_n}{y_n}$) : 1 mark
   For concluding the correct values (in the form of 'iff' or mentioning both convergence and divergence) of p (after the correct application of limit comparison test) : 1 mark
   (For obtaining only a partial set of values of p for which convergence takes place, no mark will be given. Thus, in particular, just for obtaining some values of p by applying comparison test instead of limit comparison test will get no mark.)

4. For getting correct conclusion (limit does not exist) with proper justification : 2 marks
   In order to get the non-existence of limit, if correct approach is followed with minor mistake in case of one sequence only, then 1 mark will be given.
   (However, no mark will be given for assuming non-existence of some limits and/or for breaking the terms without giving proper justification.)

The notations/terminologies used here refer to those given in the model solutions.