MAT1320D Calculus 1 **Midterm 01**

Professor: José Malagón-López 7 February

NAME: _____

STUDENT NUMBER: _____

- No calculators or other electronic aids allowed.
- No notes, books or other papers allowed.
- Answer all questions in the space provided. You must justify your answers and explain your reasoning.
- There are 8 pages. In all there are 7 questions worth a total of 70 marks.

1. Find the derivative of the following functions:

[3] a) $y = 3\sqrt{x} - \dfrac{4}{x^3} + e^2$.

[3] b) $y = e^x \sin(x)$.

[3] c) $y = \dfrac{\tan(x)}{\sqrt[5]{x}}$.

[4] d) $y = \cos(x)x^2e^x$.

2. An object is launched directly upward from a platform. If the height of the object with respect to the ground, in feet, after t seconds that it was launched is given by

$$h(t) = -2t^2 + 8t + 10.$$

[4] a) Find the formulas that describe the velocity and acceleration of the object at time t.

[2] b) Find the height and velocity of the object after 2 seconds. Give units.

[4] c) What is the speed of the object at the moment that hits the ground? Give the units.

[8] 3. Find an equation of the tangent line to $f(t) = \pi \sin(t)$ at $\left(\frac{2\pi}{3}, f\left(\frac{2\pi}{3}\right)\right)$.

4. Consider the function $f(x) = 4x^5 - 5x^4$.

[3] a) Find the x-intercepts and y-intercept of f.

[2] b) Find $f'(x)$ and $f''(x)$.

[6] c) Determine the intervals where f is increasing and where is decreasing. Conclude giving the first entry of the local maximums and local minimums of f.

[6] d) Determine the intervals where f is concave upward and where is concave downward. Conclude giving the first entry of the inflection points of f.

[8] 5. Consider the function $f(x) = \sqrt{2x}$. Using limits, compute $f'(x)$. Also, determine the domain of $f'(x)$.

[7] 6. Find all the solutions of $\sin(2x) = 2\sin(x)$ on $[0, 2\pi]$.

[7] 7. Consider the function $f(x) = e^x$. Find all the points where the slope m of the tangent line to f is of the form $m = e^{x^2}e^{x-4}$.