Your Name:

Instructions: Show all of your work, and clearly indicate your answers. Use the backs of pages for the classical questions. You will need pencils/pens and erasers, nothing more. Keep all devices capable of communication turned off and out of sight.

Show all your work Each problem is worth 15 points. Good luck!

Q1 State the definition of continuity of a function f at $x = a$.

Q2 Find the limit
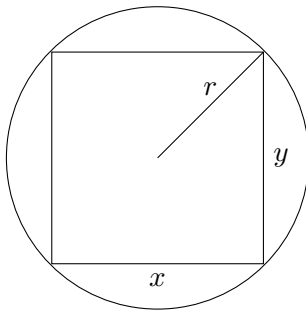$$\lim_{x \to 2} \frac{x^3 - 8}{x - 2}$$

Q3 Show that there is a root of the equation
$$3x^7 - 2x^5 + x - 1 = 0$$
between 0 and 1.

Q4 Find the equation of the tangent line to the curve $x^3 + y^3 = 2xy$ at the point $(1, 1)$.

Q5 Show that the rectangle with the largest area inscribed in a circle is a square.

Q6 Evaluate the limit:
$$\lim_{x \to \infty} (1 + x)^{1/x}$$

Q7

Let $f(x) = \dfrac{x^2 - 4}{x}$. Find

(a) domain of f , zeros of f and vertical asymptotes;

(b) the intervals of increase and decrease;

(c) all local extrema;

(d) the intervals of concavity;

(e) all inflection points; and

(f) sketch the graph of f based on the information in a.-e.