MATH1003 WINTER 2021 — ASSIGNMENT 2.2
DUE THURSDAY FEBRUARY 18, 1PM, IN CROWDMARK

1. Newton's Inverse Square Law states that the force of gravitational attraction between two bodies with masses m_1 and m_2 is given by

$$F(r) = \frac{Gm_1m_2}{r^2}$$

where G is a gravitational constant and $r > 0$ is the distance between the two bodies.

   (a) (1 mark) Use the definition of derivative to compute $F'(r)$.

   (b) (1 mark) Determine (with proof) whether the gravitational force is a decreasing function of distance r.

2. Let $f(x) = x^2 - x$.

   (a) (1 mark) Use the definition of the derivative as a limit to find $f'(x)$.

   (b) (1 mark) Use the definition of the derivative as a limit to find $f''(x)$.

3. (2 marks) You are given that $f'(x) = \dfrac{x}{1+x^2}$ and $f''(x) = \dfrac{1-x^2}{(1+x^2)^2}$. Determine the values of x for which $f(x)$ is increasing and concave up.