1. Let f be the function defined by

$$f(x) = \frac{x^2}{(-2x+1)^2}.$$

   (a) Determine the vertical and horizontal asymptotes (show all limits). (4)
   (b) Use the sign pattern for $f'(x)$ to determine
      (i) the interval(s) over which f rises and where it falls; (4)
      (ii) the local extrema. (2)
   (c) Use the sign pattern for $f''(x)$ to determine
      (i) where the graph of f is concave up and where it is concave down. (4)
      (ii) the inflection points (if any) (2)

   [16]

2. The volume of a cube is increasing at a rate of 1200 cm^3/min at the moment the lengths of the sides are 20 cm. How fast are the lengths of the sides increasing at that moment?

   [8]

3. Find the exact value of $\cos ec\left(\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \sin^{-1}\left(-\frac{\sqrt{3}}{2}\right)\right).$

   [6]

4. Use L'Hôpital's Rule to determine

   (a) $\lim\limits_{x \to 0^+} \left(\frac{1}{x} - \frac{2}{\ln(1+2x)}\right)$ (6)

   (b) $\lim\limits_{x \to \infty} \frac{\ln(\ln x)}{2x}$ (7)

   (c) $\lim\limits_{x \to \infty} (1 + \frac{1}{x})^{2x}$ (7)

   [20]

   TOTAL: [50]