Q1 (10 points)

Sketch a function $y = g(x)$ satisfying the following:

(i) $g(x)$ is continuous on $(-\infty, 2) \cup (2, \infty)$;

(ii) $g'(x)$ is positive on $(0, 1) \cup (1, 2)$;

(iii) $g'(x)$ is negative on $(-\infty, 0) \cup (2, \infty)$;

(iv) $g''(x)$ is positive on $(1, 2) \cup (2, \infty)$;

(v) $g''(x)$ is negative on $(-\infty, 0) \cup (0, 1)$;

(vi) $\lim_{x \to \infty} g(x) = -2$ and $\lim_{x \to -\infty} g(x) = 1$;

(vii) $\lim_{x \to 2^-} g(x) = +\infty$ and $\lim_{x \to 2^+} g(x) = +\infty$; and

(viii) $g(-1) = 0$, $g(0) = -2$, $g(1) = -1$, $g(1.5) = 0$ and $g(2.5) = 0$.

Label all maxima, minima, corners and points of inflection. Label all horizontal and vertical asymptotes using dashed lines and label these by their equation (e.g. $x = 3$ is an example of an equation for a vertical line which potentially could be a vertical asymptote of some function). Clearly label your axes and make sure the graph is clear. Marks will be deducted for sloppyness.

If there are either no maxima, minima, corners, or points of inflection, state in your answer which do not exist.

Graph :