5. (a) (4 points) Let the function f be defined as follows:

$$f(x) = \begin{cases} 2^p \, (x-1) & \text{for} \quad x > 2 \\ x^2 & \text{for } 0 \le x \le 2 \\ \cos(x^2) + k & \text{for} \quad x < 0 \end{cases}$$

Find the values of p and k so that f is a continuous function.

$p = $ _____

$k = $ _____

(b) (4 points) Using $f(x)$ as determined in part (a) and $g(x)$ given by:

$$g(x) = \begin{cases} \dfrac{x^3}{3} & \text{for } x \ge 3 \\ |x| & \text{for } x < 3 \end{cases}$$

find

(i) $\displaystyle\lim_{x \to 3^+} f(x)g(x)$

(ii) $\displaystyle\lim_{x \to 3^-} f(x)g(x)$