5. [6 points] Find a number $k$ so that the following function is continuous on any interval.

$$j(t) = \begin{cases} 
(t + 4)^3 & t < -2 \\
k t & t \geq -2
\end{cases}$$

Using your value of $k$, explain why this function is continuous on any interval.

**Solution:** On intervals not containing $t = -2$, this function is continuous since the functions $(t + 4)^3$ and $kt$ are both polynomials, and thus continuous, regardless of the value of $k$. So we must find the value of $k$ which makes $j(t)$ continuous at $t = -2$. So we set

$$\lim_{t \to -2^-} j(t) = (-2 + 4)^3 = -2k = \lim_{t \to -2^+} j(t).$$

Solving this, we get $k = -4$. Now for any interval containing $t = -2$ we have that $j(t)$ is continuous.

6. [5 points] Using the limit definition of the derivative, write an explicit expression for the derivative of the function $E(x) = x \cos x$ at $x = 2$. Do not try to calculate this derivative.

**Solution:**

$$E'(2) = \lim_{h \to 0} \frac{(2 + h) \cos(2 + h) - 2 \cos 2}{h}.$$