1. The quantity of oxygen that can dissolve in water depends on the temperature of the water (so thermal pollution influences the oxygen content of water). The graph shows how oxygen solubility $S$ varies as a function of the water temperature $T$.

(a) What is the meaning of the derivative $S'(T)$? What are its units?

(b) Estimate the value of $S'(16)$ and interpret it within the context of this problem.
2. Consider \( f(x) = x^2 - x \).
   (a) Is \( f(x) \) continuous at \( x = 0 \)? Explain using the mathematical definition of continuity.

(b) Evaluate each of the following limits:

\[
\lim_{x \to 0} f(x)
\]

\[
\lim_{h \to 0} \frac{f(x + h) - f(x)}{h}
\]

(c) Discuss the difference between the two limits you evaluated in part (b)? (Be sure to discuss what each limit represents in terms of \( f(x) \))
3. Use the graph of \( g(x) \) below to answer the following questions.

\( g(b) \)

\( b + h \)

\( h \)

\( g(b + h) \)

\( \frac{g(b + h) - g(b)}{h} \)

vi. The line containing the points \((b, g(b))\) and \((b + h, g(b + h))\)

vii. The line tangent to \( g(x) \) at the point \( x = b \)

(b) The slope of the line you drew for vi. above has positive / negative (circle one) slope.

(c) Fill-in-the-Blank with the letter that represents the correct word or phrase:

(A) average

(B) instantaneous

(C) at the point \( x = b \)

(D) through the points \((b, g(b))\) and \((b + h, g(b + h))\)

\[ \frac{g(b + h) - g(b)}{h} \]

represents the ______ rate of change of \( g(x) \) ______.

\[ \lim_{h \to 0} \frac{g(b + h) - g(b)}{h} \]

represents the ______ rate of change of \( g(x) \) ______.
4. Use \( f(x) = x^2 - 3 \) to answer the following:

(a) Draw the graph of \( f(x) \) on the axes below.

(b) What is the value of \( f(-2) \)? Label the point \((-2, f(-2))\) on the graph you drew in part (a).

(c) Use the **limit definition of the derivative** to find the value of \( f'(-2) \). Show all work in the space below:

(d) Determine the equation of the line tangent to \( f(x) \) at the point \( x = -2 \). Draw this line on your graph in part (a).