Author 1 _____

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09 – The Derivative

Definition: The Derivative at a

The **derivative of f at a**, is a *number* denoted $f'(a)$, defined by

$$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a} = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

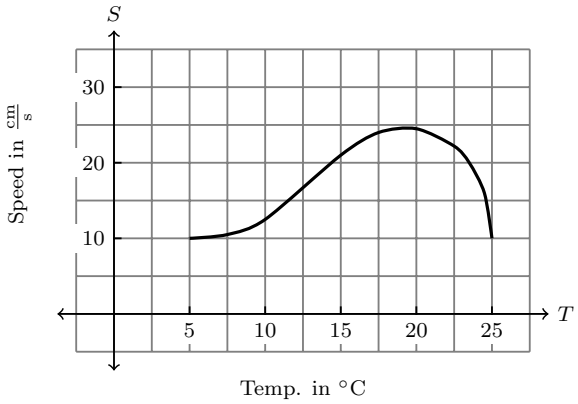
provided the limit exists. (Both limits yield the same answer, so you can choose which to use.)

Definition: The Derivative Function

The **derivative of f**, is a *function* denoted $f'(x)$, defined by

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

1. The graph below shows the influence of the temperature T on the maximal sustainable swimming speed S of Coho salmon. Estimate $S'(15)$ (include the units), and describe the meaning of $S'(15)$. *Make sure to show your work, which may include drawing on the graph.*

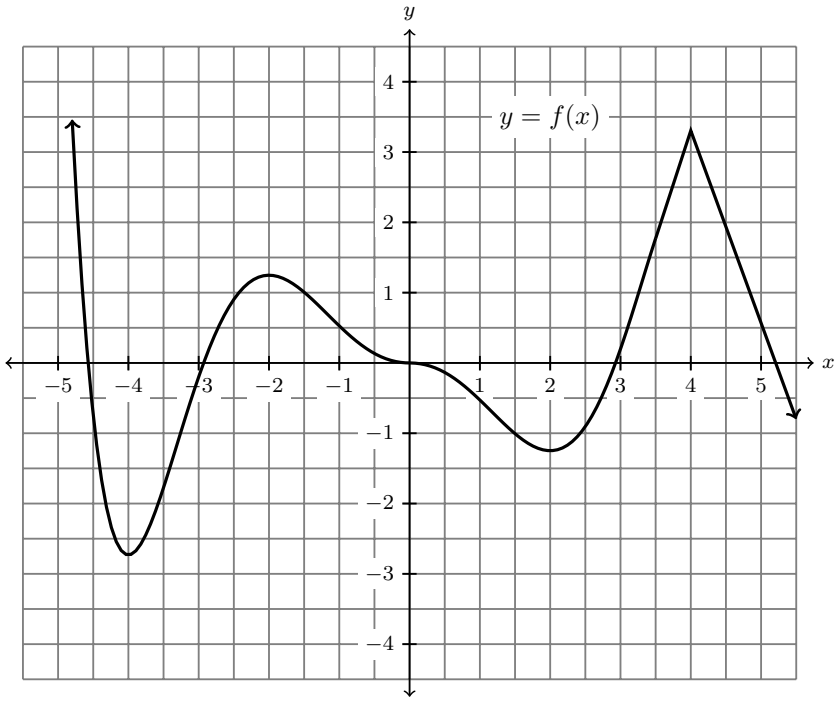


2. Let $f(x) = x^2 - 2x$. Find a formula for $f'(x)$, and use it to compute $f'(0)$, $f'(1)$, and $f'(2)$.

Definition: Differentiablitiy

We say f is **differentiable at** a if $f'(a)$ exists.

3. The graph of $y = f(x)$ is given below.



(a) Use the graph above to fill in the table below for $f'(x)$.

(b) Determine all x-values (if any) where f is not differentiable: $x =$_____

(c) Sketch the graph of $f'(x)$ below.

x	$f'(x)$
-5	
-4	
-3	
-2	
-1	
0	
1	
2	
3	
4	
5