1. Points and functions. If $f(a) = b$, then we plot the point (a, b).

    (a) If $f(4) = 2$, what point does f pass through?

    (b) If a function g goes through $(-1, 7)$, what is $g(-1)$?

    (c) If a function h goes through $(3, 5)$, what is $h(3)$?

2. Tangent Lines. The equation of any line (including tangent lines) going through the points (a, b) and (c, d), is
$$y - b = m(x - a)$$
    or
$$y - d = m(x - c)$$
    where
$$m = \text{ slope } = y' = f'(a) = \frac{dy}{dx} = \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x} = \frac{d - b}{c - a}$$

   (a) If $f(x) = 3x^2 + 1$ then $f'(x) = 6x$. What is the equation of the tangent line at $f(4) = 49$?

    (b) If $g(x) = \frac{1}{3}x^3 - 1$ then $g'(x) = x^2$. What is the equation of the tangent line at $g(-3) = -10$?

    (c) The tangent line to the graph of $h(x)$ at the point $(-2, 3)$ passes through the point $(5, 1)$. Find $h(-2)$ and $h'(-2)$

    (d) The tangent line to the graph of $j(x)$ at the point $(4, 7)$ passes through the point $(1, 1)$. Find $j(4)$ and $j'(4)$
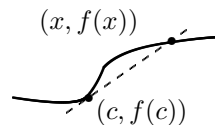
3. Definition of Derivative. Derivative is slope at a point. In general:

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

$(x+h, f(x+h))$

$(x, f(x))$
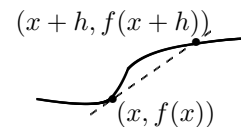
At a point c:

$$\lim_{x \to c} \frac{f(x) - f(c)}{x - c}$$

$(x, f(x))$

$(c, f(c))$

(a) If $f'(x) = \lim\limits_{h \to 0} \dfrac{(5(x+h)^3 - 3(x+h)) - (5x^3 - 3x)}{h}$ what is $f(x)$?

(b) If $g'(x) = \lim\limits_{h \to 0} \dfrac{(4\sin^2(x+h)) - (4\sin^2 x)}{h}$ what is $g(x)$?

(c) If $h'(2) = \lim\limits_{x \to 2} \dfrac{(3x^2 - 7x) - (3(2)^2 - 7(2))}{x - 2}$ what is $h(x)$?

(d) If $j'(1) = \lim\limits_{x \to 1} \dfrac{e^x - e^1}{x - 1}$ what is $j(x)$?