

1. (2 points) Write the limit definition for  $f'(x)$ .

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

For the following problems, let  $f(x) = x^2 - 5x + 1$ .

2. (4 points) Find  $f'(4)$  using the limit definition of the derivative.

$$f'(4) = \lim_{h \rightarrow 0} \frac{f(4+h) - f(4)}{h} = \lim_{h \rightarrow 0} \frac{(4+h)^2 - 5(4+h) + 1 - 4^2 + 5(4) - 1}{h}$$

$$= \lim_{h \rightarrow 0} \frac{4^2 + 8h + h^2 - 5(4) - 5h + 1 - 4^2 + 5(4) - 1}{h}$$

$$= \lim_{h \rightarrow 0} \frac{h^2 + 3h}{h} = \lim_{h \rightarrow 0} \frac{h(h+3)}{h} = \lim_{h \rightarrow 0} h+3 = \boxed{3}$$

3. (4 points) Find the equation of the line tangent to the graph of  $f(x)$  at the point  $(4, -3)$ .

$$m=3 \quad (x_1, y_1) = (4, -3) \quad y - y_1 = m(x - x_1)$$

$$y + 3 = 3(x - 4)$$

$$y = 3x - 12 - 3$$

$$\boxed{y = 3x - 15}$$