$$f'(3)=\lim_{h\to 0}\frac{f(3+h)-f(3)}{h}=\lim_{h\to 0}\frac{\frac{3+h}{(3+h)-5}-\frac{3}{3-5}}{h}$$

$$=\lim_{h\to 0}\left[\frac{3+h}{(3+h)-5}-\frac{3}{3-5}\right]\cdot\frac{1}{h}$$

$$=\lim_{h\to 0}\left[\frac{(3+h)(3-5)}{[(3+h)-5](3-5)}-\frac{3[(3+h)-5]}{(3-5)[(3+h)-5]}\right]\cdot\frac{1}{h}$$

$$=\lim_{h\to 0}\frac{(3+h)(3-5)-3[(3+h)-5]}{[(3+h)-5](3-5)h}$$

$$=\lim_{h\to 0}\frac{3\cdot 3+3\cdot(-5)+3h-5h-[3\cdot 3+3h+3\cdot(-5)]}{[(3+h)-5](3-5)h}$$

$$=\lim_{h\to 0}\frac{\cancel{9}-\cancel{15}+\cancel{3h}-5h-\cancel{9}-\cancel{3h}+\cancel{15}}{[(3+h)-5](3-5)h}$$

$$=\lim_{h\to 0}\frac{-5\cancel{h}}{[(3+h)-5](3-5)\cancel{h}}$$

$$=\lim_{h\to 0}\frac{-5}{[(3+h)-5](3-5)}=\frac{-5}{[(3+0)-5](3-5)}$$

$$=\frac{-5}{(3-5)^2}=\frac{-5}{4}$$