$$f(x) \approx f(a) + f'(a)(x - a) = f + f'h$$

$$g(x) \approx g(a) + g'(a)(x - a) = g + g'h$$

$$\left(f + f'h\right)\left(g + g'h\right) = fg + fg'h + f'hg + \cancel{f'h^2}$$

$$= \boxed{fg + h\left(fg' + f'g\right)}$$

$$\left(fg\right) \approx fg + \left(fg\right)'\left(fg - a\right)$$

$$= fg + \left(f'g + fg'\right)\left(fg - a\right)$$

$$= \boxed{fg + h\left(f'g + fg'\right)}$$

equiv