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

$$\boxed{\begin{array}{l} f(x+h) = f(x) + f'(x)h + \epsilon h \\ \epsilon \to 0 \quad \text{as} \quad h \to 0 \end{array}}$$

$$\frac{1}{f(x+h)} - \frac{1}{f(x)}$$

$$= \frac{f(x) - f(x+h)}{f(x+h)f(x)}$$

$$\frac{\frac{1}{f(x+h)} - \frac{1}{f(x)}}{h}$$

$$= \frac{-\frac{f(x+h)-f(x)}{h}}{f(x+h)\,f(x)}$$

$$\lim_{h\to 0} \frac{\cancel{1/f(x+h)} - \cancel{1/f(x)}}{h}$$

$$= \frac{-f'(x)}{[f(x)]^2}$$

$$\left(\frac{1}{f}\right)' = \frac{-f'}{f^2}$$

$$\because \ (fg)' = f'g + fg'$$

$$\therefore \left(\frac{f}{g}\right)' = \left(f \cdot \frac{1}{g}\right)'$$

$$= f'\left(\frac{1}{g}\right) + f\left(\frac{1}{g}\right)'$$

$$= f'\left(\frac{1}{g}\right) + f\left(\frac{-g'}{g^2}\right)$$

$$= \frac{f'g - fg'}{g^2}$$