2. $f(x) = \frac{1}{x}$

Solu

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

$$f(x) = \frac{1}{x} \quad ; \quad f(x+h) = \frac{1}{x+h}$$

$$\therefore f'(x) = \lim_{h \to 0} \frac{\frac{1}{x+h} - \frac{1}{x}}{h}$$

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

$$= \lim_{h \to 0} \frac{\frac{-h}{x(x+h)}}{\frac{h}{1}}$$

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

$$= -\frac{1}{x^2}$$

H.w.

1. $f(x) = 2x^2 + 4x$
2. $f(x) = x^2 + 1$
3. $f(x) = x^2 + 3$

H.W.

1. $y = f(x) = 2x^2 + 4x$

Solu

$$f(x+h) = 2(x+h)^2 + 4(x+h)$$

$$\therefore f'(x) = \lim_{h\to 0} \frac{2(x+h)^2 + 4(x+h) - (2x^2+4x)}{h}$$

$$= \lim_{h\to 0} \frac{2(x^2+2xh+h^2)+4x+4h-2x^2-4x}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{2x^2}+4xh+2h^2+\cancel{4x}+4h-\cancel{2x^2}-\cancel{4x}}{h}$$

$$= \lim_{h\to 0} \frac{4xh+2h^2+4h}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{h}(4x+2h+4)}{\cancel{h}}$$

$$= 4x+4$$

2. $f(x) = x^2+1$; $f(x+h) = (x+h)^2+1$

$$f'(x) = \lim_{x\to h} \frac{(x+h)^2+1-(x^2+1)}{h}$$

$$= \lim_{x\to h} \frac{\cancel{x^2}+2xh+h^2\cancel{+1}-\cancel{x^2}\cancel{-1}}{h}$$

$$= \lim_{x\to h} \frac{\cancel{h}(2x+h)}{\cancel{h}}$$

$$= \lim_{x\to h} 2x+h = 2x$$

3. $f(x) = x^2 + 3$; $f(x+h) = (x+h)^2 + 3$

$$f'(x) = \lim_{h \to 0} \frac{(x+h)^2 + 3 - (x^2+3)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{x^2} + 2xh + h^2 \cancel{+3} \cancel{-x^2} \cancel{-3}}{h}$$

$$= \lim_{h \to 0} \frac{2xh + h^2}{h}$$

$$= \lim_{h \to 0} \frac{h(2x + h)}{h}$$

$$= \lim_{h \to 0} 2x + h$$

$$= 2x$$

another H.W.

1. $f(x) = x^3$