Use the definition of a derivative to find the derivative of each function with respect to x.

1. $f(x) = -2x + 5$ $\quad -2$

2. $f(x) = 4x^2 + 1$ $\quad 8x$

3. $f(x) = 3x^2 + 3x + 3$ $\quad 6x + 3$

4. $f(x) = \sqrt{4x - 5}$ $\quad \frac{2}{\sqrt{4x-5}}$

5. $f(x) = \frac{1}{x+2}$ $\quad -\frac{1}{(x+2)^2}$

5 $f'(x) = \lim_{h\to 0} \frac{\frac{1}{x+h+2} - \frac{1}{x+2}}{h}$

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

$= \lim_{h\to 0} \frac{x+2-x-h-2}{(x+h+2)(x+2)} \cdot \frac{1}{h}$

$= \lim_{h\to 0} \frac{-1}{(x+h+2)(x+2)} = \frac{-1}{(x+2)^2}$

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

$= \lim_{h\to 0} \frac{3x^2 + 6xh + 3h^2 + 3x + 3h + 3 - 3x^2 - 3x - 3}{h}$

$\lim_{h\to 0} (6x + 3h + 3) = 6x + 3$

4 $f'(x) = \lim_{h\to 0} \frac{\sqrt{4(x+h)-5} - \sqrt{4x-5}}{h} \cdot \frac{\left(\sqrt{4(x+h)-5} + \sqrt{4x-5}\right)}{\left(\sqrt{4(x+h)-5} + \sqrt{4x-5}\right)}$

$= \lim_{h\to 0} \frac{4(x+h)-5-(4x-5)}{h\left(\sqrt{4(x+h)-5} + \sqrt{4x-5}\right)} = \lim_{h\to 0} \frac{4x+4h-5-4x+5}{}$

$= \lim_{h\to 0} \frac{4}{\sqrt{4(x+h)-5} + \sqrt{4x-5}} = \frac{4}{\sqrt{4x-5} + \sqrt{4x-5}} = \frac{4}{2\sqrt{4x-5}}$