

$$3. \quad f(x) = \begin{cases} x^2 - 4x + 3, & x \geq 2 \\ 2x - 3, & x < 2 \end{cases}$$

$$g(x) = 2x + 3$$

$$(f \circ g)(x) = f(g(x)) = \begin{cases} g^2(x) - 4g(x) + 3, & g(x) \geq 2 \\ 2g(x) - 3, & g(x) < 2 \end{cases}$$

Mes $g(x) \geq 2$

$$\Rightarrow 2x + 3 \geq 2$$

$$2x \geq -1$$

$$x \geq -\frac{1}{2}$$

$g(x) < 2$

$$2x + 3 < 2$$

$$2x < -1$$

$$x < -\frac{1}{2}$$

$$g^2(x) - 4g(x) + 3 =$$

$$= (2x + 3)^2 - 4(2x + 3) + 3$$

$$= 4x^2 + 12x + 9 - 8x - 12 + 3$$

$$= 4x^2 + 4x$$

$$2g(x) - 3 =$$

$$= 2(2x + 3) - 3$$

$$= 4x + 6 - 3$$

$$= 4x + 3$$

$$\therefore (f \circ g)(x) = \begin{cases} 4x^2 + 4x & x \geq -\frac{1}{2} \\ 4x + 3 & x < -\frac{1}{2} \end{cases}$$