p 042, C3

let's call it $g(x)$

C3 Express the function $y = 2x^2 - 12x + 19$ ← this is then also $g(x)$ in the form $y = a(x-h)^2 + k$. Use that form to describe how the graph of $y = x^2$ can be transformed to the graph of $y = 2x^2 - 12x + 19. = g(x)$

↳ let's call it $f(x)$

We can identify the form

$$g(x) = y = a(x-h)^2 + k$$

w/ "complete the square". This is always possible when we see a perfect square + an imperfection.

$$a(x-h)^2 + k$$

Complete the square:

$$g(x) = 2x^2 - 12x + 19$$

we want no coefficient w/ x^2

$$g(x) = 2\left(\frac{2x^2}{2} - \frac{12x}{2} + \frac{19}{2}\right)$$

$$g(x) = 2\left(\underbrace{x^2 - 6x}_{*} + \frac{19}{2}\right)$$

↳ this is the promising beginning of a perfect square of a perfect square

$$x^2 - 6x = x^2 - 2 \cdot 3x$$

would need a 3^2 for a perfect square

$$x^2 - 6x = x^2 - 2 \cdot 3x + 3^2 - 3^2 =$$

goes to the imperfection

overall zero, so ok to add them together

goes to the perfect square

$$= x^2 - 2 \cdot 3x + 3^2 - 3^2$$

$$= (x^2 - 2 \cdot 3x + 3^2) - 9$$

$$= (x-3)^2 - 9 \quad = *$$

return to $g(x)$...

$$g(x) = 2\left(\underbrace{(x-3)^2 - 9}_{*} + \frac{19}{2} \right)$$

like term can blend together $-9 + \frac{19}{2} =$

$$= -\frac{9 \cdot 2}{2} + \frac{19}{2} = \frac{-18+19}{2} = \frac{1}{2}$$

$$g(x) = 2\left((x-3)^2 + \frac{1}{2} \right)$$

$$g(x) = 2(x-3)^2 + \cancel{2} \cdot \frac{1}{\cancel{2}}$$

$g(x) = 2(x-3)^2 + 1$ overlaps w/ the form

$$g(x) = 2(x-3)^2 + 1$$

overlaps w/ the form $a(x-h)^2 + k$

$$\Rightarrow \begin{cases} a = 2 \\ h = 3 \\ k = 1 \end{cases}$$

$(x-3)^2$ fits $f(x-3)$

We assume $f(x) = x^2$ is the parent base before the transformation $g(x)$

$$\therefore \boxed{g(x) = 2f(x-3) + 1}$$

$\therefore$ $g(x)$ can be received through

1) A vertical stretch around the x-axis by a factor of 2

2) a Horiz. Shift Right by 3 units

3) a Vertical shift up by 1 unit.