p 015 q19

19. a) Predict the relationship between the graph of $y = x^3 - x^2$ and the graph of $y + 3 = (x - 2)^3 - (x - 2)^2$.

b) Graph each function to verify your prediction.

a) Let's call $y = x^3 - x^2$ $f(x)$.

i.e. $y = f(x) = x^3 - x^2$

The 2nd function looks like a transformation, so we'll call it $g(x)$, but 1st we isolate y, so we can say "$y = g(x) = \ldots$"

$y + 3 = (x-2)^3 - (x-2)^2$ | (-3)

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

notice the pattern:

$y = \square^3 - \square^2 - 3$

this part looks like

$f(x) = y = x^3 - x^2$

but w/ $(x-2)$ instead of x

b/c $f(x-2) = (x-2)^3 - (x-2)^2$

$\therefore$ $g(x) = y = f(x-2) - 3$

↳ ∴ $g(x) = y = f(x-2) - 3$

Therefore the relationship between $f(x)$ & $g(x)$ is a transformation that shifts horizontally 2 units to the right & shifts vertically down by 3 units.

b) Click on the Desmos link to see the graph.

https://www.desmos.com/calculator/w60wlsjaag