If a box with a square cross section is to be sent by a delivery service, there are restrictions on its size such that its volume is given by $V = x^2(108 - 4x)$, where x is the length of each side of the cross section (in inches).

a) Is V a function of x?

yes, every x gives only one V

b) If $V = V(x)$, find $V(10)$ and $V(20)$.

$V(10) = (10)^2(108-40)$ $= 100(108-40)$ $= 6800 \text{ in}^3$

$V(20) = 20^2(108-80)$ $= 400(108-80)$ $= 11{,}200 \text{ in}^3$

c) What restrictions must be placed on x (the domain) so that the problem makes physical sense?

$x > 0$ $V > 0$

$x^2(108-4x) > 0$

$x^2 > 0$

$108 - 4x > 0$

$x > 27$

$0 < x < 27 \text{ in}$

<u>Function Operations</u>

Sum $(f+g)(x) = f(x) + g(x)$

Difference $(f-g)(x) = f(x) - g(x)$ ← distribute negative

Product $(fg)(x) = f(x) \cdot g(x)$

Quotient $\left(\frac{f}{g}\right)x = \frac{f(x)}{g(x)}$

Composition $(f \circ g)(x) = f(g(x))$

For example: $f(x) = (x-1)^2$ *and* $g(x) = 1 - 2x$

Find the following:

$(f+g)(x) = (x-1)(x-1) + 1 - 2x$

$= x^2 - 2x + 1 + 1 - 2x$

$= x^2 - 4x + 2$ ←

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

$= x^2$ ←