Composition of Functions

A function is described by a relationship or rule.

'add 3' is a simple function.
It can be written as:
$f : x \to x + 3$ or $f(x) = x + 3$.

Here are some examples of other functions:
$g : x \to 2x$ or $g(x) = 2x$
$h : x \to x^2$ or $h(x) = x^2$

Each function is usually labelled by a small letter.

A number can be input into a function to produce an output.
For example:
$f : 2 \to 2 + 3 = 5$ or $f(2) = 2 + 3 = 5$
$g : 5 \to 2 \times 5 = 10$ or $g(5) = 2 \times 5 = 10$
$h : 4 \to 4^2 = 16$ or $h(4) = 4^2 = 16$

Input number

Output number

Find the output for the following:
$f(-6)$
$g(-4)$
$h(-5)$

The output from one function can be used as the input to another.
For example:
$f(4) = 4 + 3 = 7$. This output can then be used as the input into g. So $g(7) = 2 \times 7 = 14$.

Note:
$f(4) = 7$
Then g is applied to $f(4)$.
This is written as:
$gf(4) = g(7) = 14$.

So what function has been applied to the original input? First f was applied, followed by g.
This can be shown in a flow diagram:

$$x \xrightarrow{f} x + 3 \xrightarrow{g} 2(x + 3) \text{ or } 2x + 6$$

$f(x)$ $gf(x)$

Using the notation:
$gf(x) = g(x + 3) = 2(x + 3)$

Notice that ***g*** is written first, but ***f*** is applied first

The output is simplified when appropriate.

Find the rules for the following functions:
$hf(x)$
$f^2(-4) = ff(-4)$
$hfg(x)$

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