1.

a) Yes. This is definitely possible.

Example:

$f(x) = 3x^2$

$g(x) = x^4$

$$h(x) = \frac{f(x)}{g(x)}$$

$$= \frac{3x^2}{x^4}$$

$$= \frac{3}{x^2}$$

It is possible to turn 2 functions that have no restrictions into 1 function with a restriction by combining them with the quotient method. In this case the restriction is $x \neq 0$.

b) This is possible as well.

Example:

$f(x) = \frac{x^3+1}{x}$ ← restriction $x \neq 0$

$g(x) = x^2$ ← no restriction

$$f(x) \cdot g(x) = \left(\frac{x^3+1}{\cancel{x}}\right)\left(\cancel{x^2}^{\,x}\right)$$

$$= (x^3+1)(x)$$

$$= x^4 + x$$

As you can see, when the functions are combined by multiplication, the restriction goes away.

2.

a) $h(x) = 4x^2 - 9$

i) sum

$f(x) = 2x^2 - 9$

$g(x) = 2x^2$

$\rightarrow h(x) = 4x^2 - 9$

ii) prod

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

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

$\rightarrow h(x) = 4x^2 - 9$

iii) quotient

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

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

$h(x) = 4x^2 - 9$

iiii) comp

$f(x) = 4x$

$g(x) = x^2 - \frac{9}{4}$

$f[g(x)] = 4(x^2 - \frac{9}{4})$

$h(x) = 4x^2 - 9$

b) $AROC = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$ $(-2, 1)$

$= \frac{f(1) - f(-2)}{1-(-2)}$

$= \frac{(4(1)^2 - 9) - (4(-2)^2 - 9)}{3}$

$= \frac{(-5)(7)}{3}$

$= \frac{-35}{3}$

est. IROC:

$= \frac{f(x_2) - f(x_1)}{x_2 - x_1}$ $(0.9, 1.1)$

$= \frac{f(1.1) - f(0.9)}{1.1 - 0.9}$

$= \frac{(4(1.1)^2 - 9)(4(0.9)^2 - 9)}{0.2}$

$= \frac{(-4.16)-(-5.76)}{0.2}$

$= \frac{1.6}{0.2}$

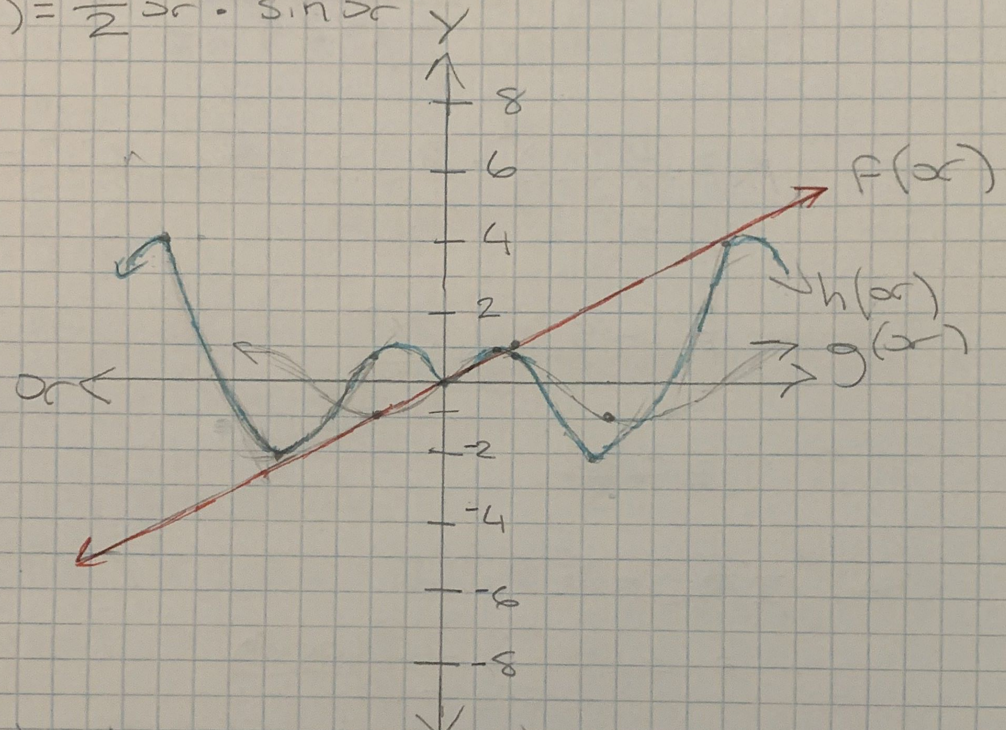
$= 8$

3.

$f(x) = \frac{1}{2}x$

$g(x) = \sin x$

$h(x) = \frac{1}{2}x \cdot \sin x$



Similarities to original function:

- amplitude increases with max value of $y = \frac{1}{2}x$
- function oscillates like sin (sinusodial behavior)
- period is the same as sin (except at origin)

Differences:

- goes through the origin similar to how cos does
- reflected on the y axis

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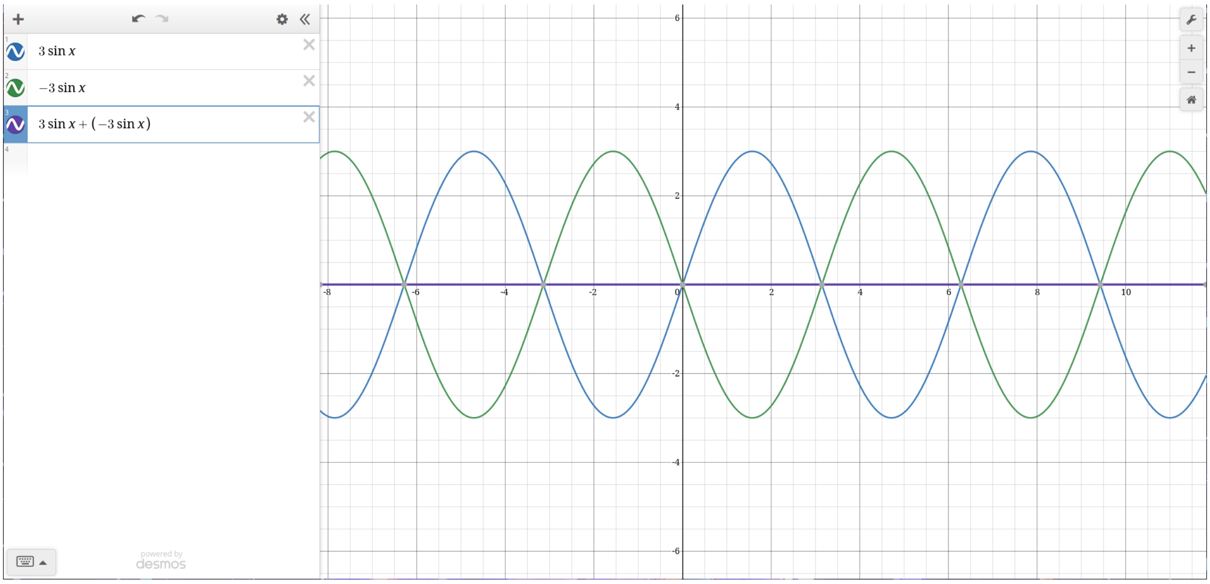
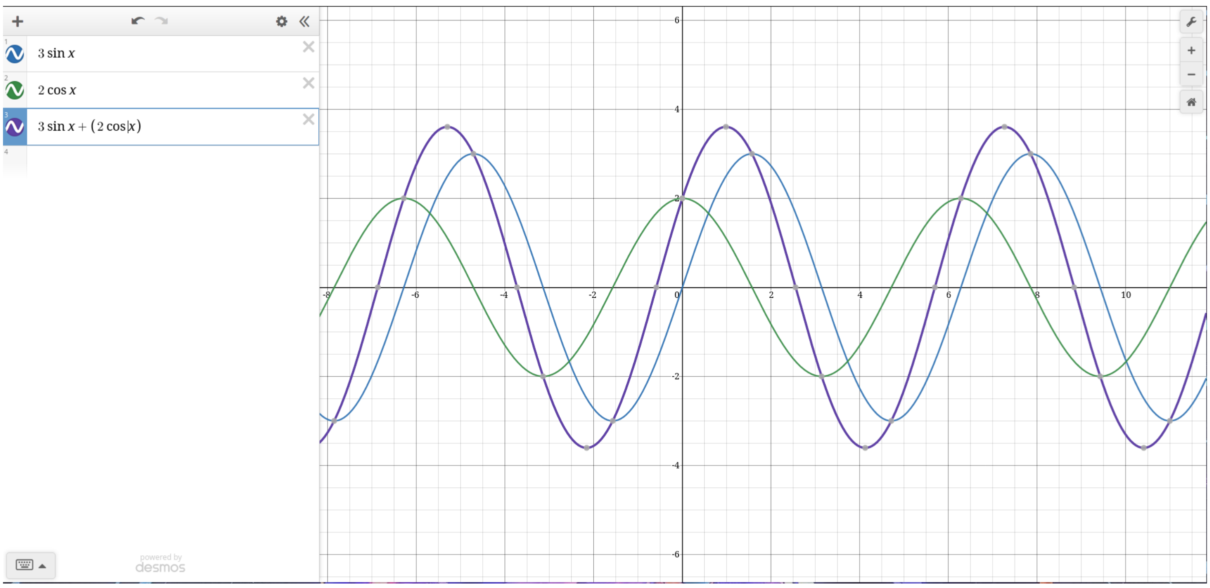
4.

Radar/Signal jamming is used by the military to prevent unwanted listening or detection of objects or communications. Signal jamming works by creating a response frequency that is approximately opposite of the target frequency. When opposite frequencies meet, they are effectively cancelled. This is known as destructive interference. This is the same reason why sometimes phones don't work in areas where there are a lot of other communication signals such as radio or structures that can reflect the signals. Depending on the intended outcome, you can use a different composition of frequencies. When two signals have the exact same amplitude (in phase), they can enhance each other, known as constructive interference.



You can see in the purple line that the frequencies cancel each other.



The purple line demonstrates that the resultant frequency is stronger (based on the amplitude).