Composition Number Line

A) $g(f(-1))$

$f(-1) = -1 - 4$
$= -5$

$g(x) = -x^2 + 2$
$f(x) = x - 4$

$g(f(-1)) = -(-5)^2 + 2$
$-25 + 2$
$= -23$

B) $g(x) = x - 3$
$f(x) = 2x^2 - 4x$

$(2g \circ f)(8)$
$2g(f(8))$

$f(8) = 2(8)^2 - 4(8) = 96$

$2g(x) = 2(x-3) = 2x - 6$

$2(96) - 6$
$= 186$

H) $-3[(g \circ f)(1)] = -3(g(f(1)))$

$g(x) = x^2 + 4x - 1$
$f(x) = 9x$

$f(1) = 9(1) = 9$

$g(f(1)) = (9)^2 + 4(9) - 1$
$= 116$

$-3(g(f(1)) = 116(-3) = -348$

Proving Inverses

1. Show that $f(x) = \frac{-13}{x+10}$ and $f^{-1}(x)$ are inverses.

$$(y+10)x = \left(\frac{-13}{y+10}\right)(y+10)$$

$$\frac{(y+10)x}{x} = \frac{-13}{x}$$

$$y + 10 = \frac{-13}{x}$$

$$-10 \qquad -10$$

$$\boxed{f^{-1}(x) = \frac{-13}{x} - 10}$$

① $f(f^{-1}(x)) = x$

$$\frac{-13}{\left(\frac{-13}{x} - 10\right) + 10}$$

$$= \frac{-13}{\left(\frac{-13}{x}\right)}$$

$$= -13\left(\frac{x}{-13}\right)$$

$$= x \checkmark$$

② $f^{-1}(f(x)) = x$

$$\frac{-13}{\left(\frac{-13}{x+10}\right)} - 10$$

$$-13\left(\frac{x+10}{-13}\right) - 10$$

$$x + 10 - 10$$

$$= x \checkmark$$

2. $\boxed{f(x) = 2x + 5}$

$$x = 2y + 5$$

$$-5 \qquad -5$$

$$\frac{x-5}{2} = \frac{2y}{2}$$

$$\boxed{f^{-1}(x) = \frac{x-5}{2}}$$

① $f(f^{-1}(x)) = x$

$$2\left(\frac{x-5}{2}\right) + 5$$

$$x - 5 + 5$$

$$= x \checkmark$$

② $f^{-1}(f(x)) = x$

$$\frac{(2x+5)-5}{2}$$

$$\frac{2x}{2}$$

$$= x \checkmark$$