20. $f(x)=\frac{1}{x^2}$ $g(x)=\frac{1}{x+1}$

a) $(fg)(\frac{1}{2})$

$=\frac{1}{x^2}\cdot\frac{1}{x+1}$

$=\frac{1}{x^2(x+1)}$

$=\frac{1}{x^3+x^2}$

$=\frac{1}{(\frac{1}{2})^3+(\frac{1}{2})^2}$

$=\frac{1}{\frac{1}{8}+\frac{1}{4}}=\frac{1}{\frac{3}{8}}=\frac{8}{3}$

b) $(\frac{f}{g})(0)=\frac{\frac{1}{x^2}}{\frac{1}{x+1}}$

$=\frac{1}{x^2}\cdot\frac{x+1}{1}$

$=\frac{x+1}{x^2}$

$=\frac{0+1}{0^2}$

$=\frac{1}{0}$

N.S.

16. b) $f(x)=\sqrt{x-3}$ $g(x)=x^2-4$

$(f-g)(1)=\sqrt{x-3}+(-x^2+4)$

$=\sqrt{x-3}-x^2+4$

$=\sqrt{1-3}-(1)^2+4$

$=\sqrt{-2}-1+4$

$=3+\sqrt{2}\,i$

8.1 Composition of fnns

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

Ex: Find $(f \circ g)(x)$ if $f(x) = 2x - 3$
and $g(x) = x^2 + 1$

$f(g(x)) = 2(x^2+1) - 3$
$= 2x^2 + 2 - 3$
$= 2x^2 - 1$

$(g \circ f)(x) = g(f(x))$
$= (2x-3)^2 + 1$
$= (2x-3)(2x-3) + 1$
$= 4x^2 - 6x - 6x + 9 + 1$
$= 4x^2 - 12x + 10$

Ex: $(f \circ g)(1)$ if $f(x) = x^2 - 3x + 5$ and

$g(x) = 2x$.

$f(g(x))$

$= (2x)^2 - 3(2x) + 5$

$= 4x^2 - 6x + 5$

$= 4(1)^2 - 6(1) + 5$

$= 4 - 6 + 5$

$= \boxed{3}$

$(g \circ f)(1)$

$g(f(1))$

$= 2(x^2 - 3x + 5)$

$= 2x^2 - 6x + 10$

$= 2(1)^2 - 6(1) + 10$

$= \boxed{6}$

Domain: Find the domain of $(f \circ g)(x)$ if $f(x) = \frac{1}{x-9}$ and

$g(x) = \sqrt{x}$

- $\mathbb{R}$ unless:
  1. zero in the denominator (fractions)
  2. negative in the even root (roots)

$f(g(x)) = \frac{1}{\sqrt{x}-9}$

$\sqrt{x-2} + 3$

1. $\sqrt{x} - 9 = 0$

   $+9 \quad +9$

   $\sqrt{x}^2 = 9^2$

   $x \neq 81$

2. $x \geq 0$

$x - 2 \geq 0$

$+2 \quad +2$

$x \geq 2$

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odds extra credit