099 §3.8 #s 1-21, 27-37, 39-44 ALL

#s 1-8 $f(x)=4x-3,\ g(x)=2x+5 \Longrightarrow$

(1) $f+g = 4x-3+2x+5 = \boxed{6x+2}$

(3) $g-f = 2x+5-(4x-3) = 2x+5-4x+3 = \boxed{-2x+8}$

(5) $fg = f(x)g(x) = (4x-3)(2x+5)$

$= 8x^2+20x-6x-15$

$= \boxed{8x^2+14x-15}$

(7) $\dfrac{g}{f} = \dfrac{g(x)}{f(x)} = \boxed{\dfrac{2x+5}{4x-3}}$

#s 9-26 $f(x)=2x+1,\ g(x)=4x+2,\ h(x)=4x^2+4x+1$

$\Longrightarrow$

(9) $g+f = 4x+2+2x+1 = \boxed{6x+3}$

(11) $g+h = 4x+2+4x^2+4x+1$

$= \boxed{4x^2+8x+3}$

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

$= \boxed{2x+1}$

(15) $fg = (2x+1)(4x+2) = 8x^2+4x+4x+2$

$= \boxed{8x^2+8x+2}$

099 §3.8 #s 17-21, 27-37, 39-44 ALL

17 $fh = (2x+1)(4x^2+4x+1)$ Concept

$$\left.\begin{aligned} &= 8x^3+8x^2+2x \\ &\quad\; +4x^2+4x+1 \\ \hline &\boxed{8x^3+12x^2+6x+1} \end{aligned}\right\}$$ Technical execution

19 $\dfrac{h}{f} = \dfrac{4x^2+4x+1}{2x+1} = \dfrac{(2x+1)^2}{2x+1} = \boxed{2x+1}$!

$4x^2+4x+1$

$(2x)^2+2(2x)(1)+1^2$ is perfect square trinomial!

$a^2+2ab+b^2$ You can also factor by

$=(a+b)^2$ other means

21 $\dfrac{f}{h} = \boxed{\dfrac{1}{2x+1}}$ by #19 ! (Reciprocal !)

Dang! Did the wrong functions!

#s 9-26 $f(x)=3x-5$, $g(x)=x-2$, $h(x)=3x^2-11x+10$

9 $g+f = x-2+3x-5 = \boxed{4x-7}$

11 $g+h = x-2+3x^2-11x+10 = \boxed{3x^2-10x+8}$

13 $g-f = x-2-(3x-5) = x-2-3x+5 = \boxed{-2x+3}$

099 §3.8 #s 15-21, 27-37, $\underline{39\text{-}44}$
ALL

(15) $fg = (3x-5)(x-2) = 3x^2-6x-5x+10$

$= \boxed{3x^2-11x+10} = h(x)$!

(17) $fh = (3x-5)(3x^2-11x+10)$

$= 9x^3-33x^2+30x$

$-15x^2+55x-50$

$\boxed{9x^3-48x^2+85x-50}$

Ask!

(19) $\frac{h}{f} = \frac{3x^2-11x+10}{3x-5} = \frac{(3x-5)(x-2)}{3x-5} = \boxed{x-2}$ $\left(x \neq \frac{5}{3}\right)$

Factor $3x^2-11x+10$ if you didn't make an observation from #15

$(3)(10)=30$

$(-5)(-6)=30$

$-5-6=-11$

$3x^2-6x-5x+10$

$3x(x-2)-5(x-2)$

$(x-2)(3x-5)$

(21) $\frac{f}{h} = \frac{1}{x-2}$ $\left(x \neq \frac{5}{3}, x \neq 2\right)$ Ask!

049 §3.8 #s 27–37, 39–44 ALL

27–38 $f(x) = 2x+1$, $g(x) = 4x+2$ $\left(= 2(2x+1) \right)$, $h(x) = 4x^2+4x+1$ $\left(= (2x+1)^2 \right)$

27 $(f+g)(2) = f(2) + g(2)$

$= 2(2)+1 + 4(2)+2 = 5 + 10 = \boxed{15}$

29 $(fg)(3) = f(3)g(3) = (2(3)+1)(4(3)+2)$

$= (7)(14) = \boxed{98}$

31 $\left(\frac{h}{g}\right)(1) = \frac{h(1)}{g(1)} = \frac{4(1)^2+4(1)+1}{2(1)+1} = \frac{9}{3} = \boxed{3}$

(If you used factoring:

$\frac{h}{g} = \frac{4x^2+4x+1}{2x+1} = \frac{(2x+1)^2}{(2x+1)} = (2x+1)^1 = 2x+1$

So $\left(\frac{h}{g}\right)(1) = 2(1)+1 = 3$!)

33 $(fh)(0) = (2(0)+1)(4(0)^2+4(0)+1) =$

$= (1)(1) = \boxed{1}$

35 $(f+g+h)(2) = f(2)+g(2)+h(2)$

$= 2(2)+1 + 4(2)+2 + 4(2)^2+4(2)+1$

$= 5 + 10 + 16 + 9 = \boxed{40}$

099 §3.8 #s 37, 39-44 ALL

37 $(h+fg)(3) = h(3) + f(3)\,g(3)$

$= 4(3)^2 + 4(3) + 1 + (2(3)+1)(4(3)+2)$

$= 4(9) + 12 + 1 + (7)(14)$

$= 36 + 13 + 98 = 49 + 98 = \boxed{147}$

39 $f(x) = x^2,\ g(x) = x+4 \implies$

(a) $(f \circ g)(5) = f(g(5)) = f(5+4) = f(9) = 9^2 = \boxed{81}$

(b) $(g \circ f)(5) = g(f(5)) = g(5^2) = g(25) = 25+4$

$= \boxed{29}$

(c) $(f \circ g)(x) = f(g(x)) = (g(x))^2 = (x+4)^2$

$= \boxed{x^2 + 8x + 16}$ → VERY DIFFERENT!

$x^2 + 2(x)(4) + 4^2$

(d) $(g \circ f)(x) = g(f(x)) = g(x^2) = \boxed{x^2 + 4}$

099 § 3.8 #s 40-44 All

(40) $f(x) = 3 - x \overset{\text{OR}}{=} -x + 3$, $g(x) = x^3 - 1$

(a) $(f \circ g)(0) = f(g(0)) = f(0^3 - 1) = f(-1)$

$= 3 - (-1) = \boxed{4}$

(b) $(g \circ f)(0) = g(f(0)) = g(3 - 0) = g(3)$

$= 3^3 - 1 = 27 - 1 = \boxed{26}$

(c) $(f \circ g)(x) = f(g(x)) = f(x^3 - 1) = 3 - (x^3 - 1)$

$= 3 - x^3 + 1 = \boxed{4 - x^3}$

(d) $(g \circ f)(x) = g(f(x)) = g(3 - x) = (3 - x)^3 - 1$

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

$$\begin{array}{ccccccc} & & & 1 & & & \\ & & 1 & & 1 & & \\ & 1 & & 2 & & 1 & \\ 1 & & 3 & & 3 & & 1 \end{array}$$

$= 27 - 9x + 3x^2 - x^3 - 1$

$= \boxed{26 - 9x + 3x^2 - x^3}$

$= -x^3 + 3x^2 - 9x + 26$ is better style

(Descending order)

099 §3.8 #s 41-44 ALL

41 $f(x) = x^2+3x$, $g(x) = 4x-1$

(a) $(f\circ g)(0) = f(g(0)) = f(4(0)-1) = f(-1)$

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

(b) $(g\circ f)(0) = g(f(0)) = g(0^2+3(0)) = g(0)$

$= 4(0)-1 = \boxed{-1}$

(c) $(f\circ g)(x) = f(g(x)) = f(4x-1)$

$= (4x-1)^2 + 3(4x-1)$

$= 16x^2 - 2(4x)(1) + 1^2 + 12x - 3$

$= 16x^2 - 8x + 1 + 12x - 3$

$= \boxed{16x^2+4x-2}$

(d) $(g\circ f)(x) = g(f(x)) = g(x^2+3x)$

$= 4(x^2+3x) - 1 = \boxed{4x^2+12x-1}$

099 § 3.8 #s 42-44 ALL

42 $f(x) = (x-2)^2,\ g(x) = x+1 \Longrightarrow$

(a) $(f \circ g)(-1) = f(g(-1)) = f(-1+1) = f(0)$

$= (0-2)^2 = (-2)^2 = \boxed{+4}$

(b) $(g \circ f)(-1) = g(f(-1)) = g((-1-2)^2)$

$= g((-3)^2) = g(9) = 9+1 = \boxed{10}$

(c) $(f \circ g)(x) = f(g(x)) = f(x+1)$

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

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

$= x^2 - 4x + 4 + 1 = \boxed{x^2 - 4x + 5}$

#s 43-4 Show $(f \circ g)(x) = (g \circ f)(x) = x$

First Exposure to INVERSE Functions!

099 §3.8 #s 43, 44

43 $f(x) = 5x-4, \; g(x) = \frac{x+4}{5}$

$(f \circ g)(x) = f(g(x)) = f\left(\frac{x+4}{5}\right)$

$= 5\left(\frac{x+4}{5}\right) - 4 = x+4-4 = x$ ✓

$(g \circ f)(x) = g(f(x)) = g(5x-4) = \frac{(5x-4)+4}{5}$

$= \frac{5x}{5} = \boxed{x}$ ✓

44 $f(x) = \frac{x}{6} - 2, \; g(x) = 6x+12$

$(f \circ g)(x) = f(6x+12) = \frac{6x+12}{6} - 2 = x+2-2$

$= x$ ✓

$(g \circ f)(x) = g(f(x)) = g\left(\frac{x}{6} - 2\right) = 6\left(\frac{x}{6} - 2\right) + 12$

$= x - 12 + 12 = x$ ✓