

3.) $f(x) = \sin 4x$ $g(x) = \sqrt{x}$
 $f(g(x)) = \sin 4(\sqrt{x})$
 $f(g(x)) = \sin 4\sqrt{x}$
 $g(f(x)) = \sqrt{\sin 4x}$

$f(x) = 3x^2$ $g(x) = 9x - 2$ $m(x) = 4x$ $r(x) = \sqrt{3x}$
 8.) $f(r(x)) = 3(\sqrt{3x})^2$
 $= 3(3x)$
 $f(r(x)) = 9x$

4.) $m(x) = 3 + x^2$ $n(x) = \tan x$
 $m(n(x)) = 3 + (\tan x)^2$
 $m(n(x)) = 3 + \tan^2 x$
 $n(m(x)) = \tan(3 + x^2)$

12.) $g(m(f(x))) =$
 $m(f(x)) = 4(3x^2)$
 $m(f(x)) = 12x^2$
 $g(m(f(x))) = 9(12x^2) - 2$
 $g(m(f(x))) = 108x^2 - 2$

5.) $w(x) = p(p(x))$ $p(x) = 2x + 1$
 $w(x) = p(p(x)) = 2(2x + 1) + 1$
 $= 4x + 2 + 1$
 $w(x) = p(p(x)) = 4x + 3$

17.) $l(x) = (f(x))^2 = \cos^2 2x$
 $= (\cos 2x)^2$
 $f(x) = \cos 2x$

6.)

x	0	1	2	3	4	5
p(x)	1	0	5	2	3	4
q(x)	5	2	3	1	4	8
p(q(x))	4	5	2	0	3	undefined

19.) $A = f(r)$ area of circle radius r
 $r = h(t)$ radius of circle at time t
 $f(h(t))$ gives the area of the circle as a function of time, t

$p(q(0)) = p(5) = 4$
 $p(q(1)) = p(2) = 5$
 $p(q(2)) = p(3) = 2$
 $p(q(3)) = p(1) = 0$
 $p(q(4)) = p(4) = 3$
 $p(q(5)) = p(8) = \text{undefined}$

22.) $t(v)$ time of a trip at velocity v
 $v = f(h)$ is velocity at temp h
 $t(f(h))$ gives the time as a function of the temperature, h

$$f(x) = g(h(x)) \text{ Find } h(x) + g(x)$$

$$24) f(x) = (x+3)^2$$

$$\boxed{h(x) = x+3 \quad g(x) = x^2}$$

$$25) f(x) = \sqrt{1+\sqrt{x}}$$

$$\boxed{h(x) = \sqrt{x} \quad g(x) = \sqrt{1+x}}$$

or

$$\boxed{h(x) = 1+\sqrt{x} \quad g(x) = \sqrt{x}}$$

$$26) f(x) = 9x^2 + 3x$$

$$\boxed{h(x) = 3x \quad g(x) = x^2 + x}$$

$$28) h(x) = f(g(x))$$

x	f(x)	g(x)	h(x)
0	1	2	5
1	9	0	1
2	5	1	9

$$f(2) = f(g(0)) = 5$$

$$h(1) = f(g(1)) = f(0) = 1$$

$$h(2) = f(g(2)) = f(1) = 9$$

$$* 34) \frac{f(x+h) - f(x)}{h} \quad f(x) = x^2 + x$$

$$\frac{(x+h)^2 + x+h - [x^2 + x]}{h}$$

$$\frac{x^2 + 2hx + h^2 + x+h - x^2 - x}{h}$$

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

$$\boxed{h+2x+1}$$

$$39) a) f(f(1)) = f(2) = \boxed{4}$$

$$b) g(g(1)) = g(3) = \boxed{1}$$

$$c) f(g(2)) = f(2) = \boxed{4}$$

$$d) g(f(2)) = g(4) = \boxed{0}$$

$$46) \text{ Find } f(f(1)) \text{ for}$$

$$f(x) = \begin{cases} 3 & \text{if } x \leq 0 \\ 3x+1 & \text{if } 0 < x < 2 \\ x^2-3 & \text{if } x \geq 2 \end{cases}$$

$$f(1) = 3(1)+1 = 4$$

$$f(4) = 4^2-3 = \boxed{13}$$

$$48) f(x) = 12-4x \quad g(x) = \frac{1}{x} \quad h(x) = \sqrt{x-4} \quad \text{Find Domain:}$$

$$a) g(f(x)) = \frac{1}{12-4x} \quad 12-4x \neq 0 \Rightarrow -4x \neq 12$$

$$\boxed{\text{ALL REALS, SUCH THAT } x \neq -3}$$

$$b) h(f(x)) = \sqrt{12-4x-4} = \sqrt{8-4x} \quad 8-4x \geq 0$$

$$-4x \geq -8 \quad \boxed{\text{ALL REALS SUCH THAT } x \leq 2}$$

$$49) y = \frac{1+x^2}{2+x^2} \quad \text{Decompose into } u(v(x))$$

$$a) v(x) = x^2 \quad \boxed{u(x) = \frac{1+x}{2+x}}$$

$$b) v(x) = x^2+1$$

$$\boxed{u(x) = \frac{x}{x+1}}$$

$$50) y = e^{-\sqrt{x}} \quad a) u(x) = e^x$$

$$\boxed{v(x) = -\sqrt{x}}$$

$$b) v(x) = \sqrt{x}$$

$$\boxed{u(x) = e^{-x}}$$