

$u(fu) \geq 0$					$D_f = [1, 5] \cup [-5, 0]$	۱
u	$[-5, 0]$	$[0, 1]$	$[1, 5]$	$[-5, -1]$		
$f(u)$	-	+	+	-		
$u(fu)$	+	-	+	-		

$\frac{-u}{f(u)} \geq 0, f(u) \neq 0$					$D_f = (-5, 0) \cup (0, 2)$	۲
u	$[-5, -3]$	$(-3, 0)$	$(0, 2)$	$[2, 5]$		
$f(u)$	-	+	-	+		
$\frac{-u}{f(u)}$	-	+	+	-		

$$u=2 \quad f(1)-2f(2) = 4-6+4 = -2 \quad -f(2)=2 \rightarrow f(1)=-2$$
$$u=-1 \quad f(-1)-2f(2) = 1+6+4 = 11 \quad f(-1)-2(-2) = 11$$
$$f(-1)+4 = 11 \rightarrow f(-1) = 10$$

D ✓

$u=1 \Rightarrow u \leq 3 \rightarrow 2u+3 \rightarrow 2(1)+3=5$ if $u=5 \rightarrow u \geq 3 \rightarrow u-\sqrt{u+4}$
 $\Rightarrow 5-\sqrt{5+4} = 5-\sqrt{9} = 5-3 = 2$ و $f(f(1)) = 2$
 $f(5) = 2$ if $u=2 \rightarrow u \leq 3 \rightarrow 2u+3 \rightarrow 2(2)+3=7$
 $و f(f(5)) = 7$ $7+2=9$ Ⓟ ✓

$$f(u-1) = a(u-1)^2 - b(u-1) + 2 \rightarrow a(u^2 - 2u + 1) - bu + b + 2$$
$$\Rightarrow au^2 - 2au + a - bu + b + 2 \quad f(u) = au^2 - bu + 2$$
$$f(u-1) - f(u) = \cancel{au^2} - 2au + a - \cancel{bu} + b + 2 - \cancel{au^2} + \cancel{bu} - 2$$
$$-2au + a + b = 4u + 2 \quad a + b = 2 \quad a - b = -2 - 5 = -7$$
$$-2a = 4 \rightarrow a = -2 \quad \textcircled{2} \quad -2 + b = 2 \rightarrow b = 4$$

$-2a=4 \rightarrow a=-2 \quad -2+b=2 \rightarrow b=4$					
---	--	--	--	--	--

$$f(3) = 3^2 - 3(3) + 1 = 9 - 9 + 1 = 1$$

$$f(-1) = (-1)^2 - 3(-1) + 1 = 5$$

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

$$\frac{2f(2) + f(-1)}{f'(2)} = \frac{2(1) + 5}{(-1)^2} = 7$$

(2) ✓

$$u = 4 \rightarrow u > 2 \rightarrow 3u + 1 = 3(4) + 1 = 13$$

$$u = -2 \rightarrow u < 2 \rightarrow 3u + 1 = 3(-2) + 1 = -5$$

$$u = 2 \rightarrow u \geq 2 \rightarrow 3u + 1 = 3(2) + 1 = 7$$

$$\frac{3f(4) - 3f(-2)}{f(2)}$$

$$\Rightarrow \frac{3(13) - 3(-5)}{7} = \frac{72}{7}$$

(2) ✓

$$f(4) = 1 \quad f(1) = 4 \rightarrow f(f(4)) = 4$$

$$f(3) = 2 \quad f(2) = 4 \rightarrow f(f(3)) = 4$$

$$f(1) = 4$$

$$\frac{4 - 4}{4 - 2} = \frac{0}{2} = 0$$

$$\frac{f(f(4)) - f(f(3))}{f(1) - 2}$$

(2) ✓

$$f(u) = \frac{(u^2 + 4u + 5) + 4}{u^2 + 4u + 5} = 1 + \frac{4}{u^2 + 4u + 5}$$

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

$$f(\sqrt{3} - 2) = 1 + \frac{4}{(-1) + 5} = \frac{7}{4}$$

$$\rightarrow u^2 + 4u = -1$$

(1)

mb1

$$f(\sqrt{u}) = (\sqrt{u})^2 + \frac{1}{(\sqrt{u})^2} = u + \frac{1}{u}$$

$$(f(\sqrt{u}))^2 = (u + \frac{1}{u})^2 = u^2 + \frac{1}{u^2} + 2$$

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

$$f(\sqrt{3} - 2) = \frac{(\sqrt{3} - 2 + 2)^2 + 5}{(\sqrt{3} - 2 + 2)^2 + 1} = \frac{3 + 5}{3 + 1} = 2$$

$$f(f(\sqrt{3} - 2)) = f(2) = \frac{(2 + 2)^2 + 5}{(2 + 2)^2 + 1} = \frac{21}{17}$$