2. (4 points each) Suppose f and g are differentiable functions with values given by the table below:

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
1	2	9	-3	7
3	4	11	15	-19

(a) If $h(x) = f(x)g(x)$, find $h'(3)$.

$$\begin{aligned} h'(x) &= f'(x)g(x) + g'(x)f(x) \\ h'(3) &= f'(3)g(3) + g'(3)f(3) \\ &= (15)(11) + (-19)(4) \\ &= 89 \end{aligned}$$

(b) If $j(x) = \dfrac{(g(x))^3}{f(x)}$, find $j'(1)$.

Using the Quotient Rule:

$$\begin{aligned} j'(1) &= \frac{3(g(1)^2 g'(1) f(1) - (g(1))^3 f'(1)}{(f(1))^2} \\ &= \frac{3(9)^2(7)(2) - (9)^3(-3)}{(2)^2} \\ &= 1397.25 \end{aligned}$$

(c) If $d(x) = x \ln\left(e^{f(x)}\right)$, find $d'(3)$.

$$\begin{aligned} d(x) &= x f(x) \\ d'(x) &= x f'(x) + (1) f(x) \\ d'(3) &= (3) f'(3) + f(3)(1) \\ &= (3)(15) + 4 \\ &= 49 \end{aligned}$$

(d) If $t(x) = \cos(g(x))$, find $t'(1)$.

$$\begin{aligned} t'(1) &= -\sin(g(1)) g'(1) \\ &= -(7)\sin(9) \\ &\approx -2.885 \end{aligned}$$