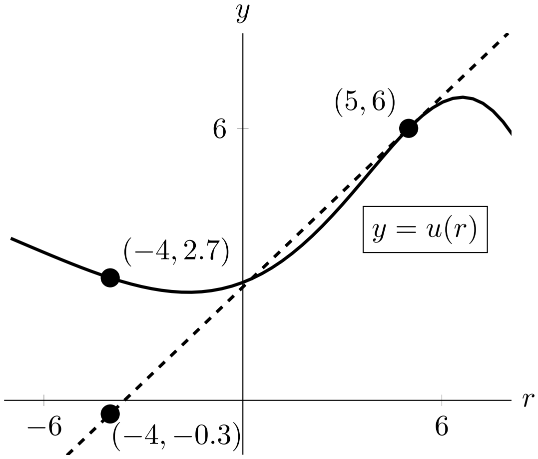
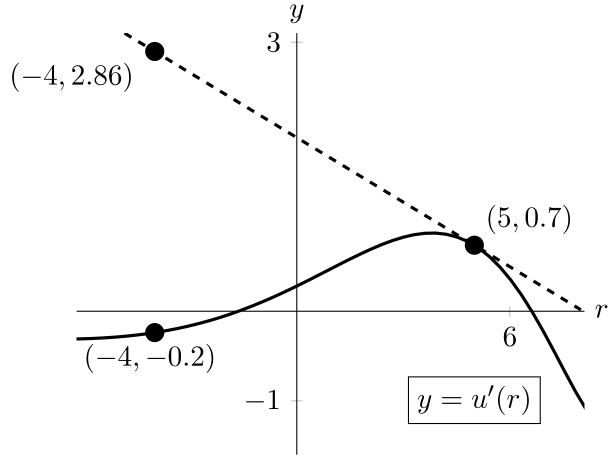
9. [9 points] The graphs of $u(r)$ and $u'(r)$ are shown below. The graphs also show tangent lines to both functions at $r = 5$.





The table below shows some values of $h(s)$ and $h'(s)$. Both h and h' are differentiable.

s	-6	-4	-2	0	2	4	6
$h(s)$	1	4	5	-1	-3	4	7
$h'(s)$	3	2	-4	-1	0	2	1

a. [5 points] Let $g(t) = u(h(t))$. Find a formula for $\ell(t)$, the local linearization of $g(t)$ near $t = -2$, and use this to approximate a solution to $g(t) = 6.14$.

Solution: In order to find $\ell(t)$ we need to find $g(-2)$ and $g'(-2)$.
$g(-2) = u(h(-2)) = u(5) = 6$
$g'(-2) = u'(h(-2))h'(-2) = u'(5) \cdot (-4) = 0.7 \cdot (-4) = -2.8$
So $\ell(t) = g(-2) + g'(-2)(t + 2) = 6 - 2.8(t + 2)$.
To approximate a solution to $g(t) = 6.14$, we want to find a value of t so that $\ell(t) = 6.14$.
Using the formula we found for $\ell(t)$ and solving for t gives us $t = -2.05$.

Answer: $\ell(t) =$ $6 - 2.8(t + 2)$

Answer: $g(t) = 6.14$ when $t \approx$ -2.05

b. [2 points] Write a formula for $c(r)$, the quadratic approximation of $u(r)$ at $r = 5$. (Recall that a formula for the quadratic approximation $Q(x)$ of a function $f(x)$ at $x = a$ is $Q(x) = f(a) + f'(a)(x - a) + \frac{f''(a)}{2}(x - a)^2$.)

Solution: For this we need $u(5) = 6$, $u'(5) = 0.7$,
and $u''(5) = \dfrac{2.86 - 0.7}{-4 - 5} = \dfrac{2.16}{-9} = -0.24$.

Answer: $c(r) =$ $6 + 0.7(r - 5) - 0.12(r - 5)^2$

c. [2 points] Use the data provided to estimate $h''(-5)$.

Answer: $h''(-5) \approx$ $\dfrac{3 - 2}{-6 - (-4)} = \dfrac{-1}{2}$