## 1 October 2014 The Chain Rule

(1) Practice the chain rule by differentiating the following functions.
(a) $f(x)=(10-5 x)^{4}$
(b) $g(x)=e^{x^{2}}$
(c) $F(x)=\frac{1}{x^{1 / 2}+x^{3 / 2}}$ (do this one without using the quotient rule)
(d) $G(x)=(3 x+5)^{100}(4 x-6)^{200}$
(2) Suppose $h(x)=\sqrt{4+3 f(x)}$ where $f(1)=7$ and $f^{\prime}(1)=4$. Find $h^{\prime}(1)$.
(3) Practice the chain, chain, chain rule by differentiating the following functions.
(a) $g(x)=e^{\left(4 x^{2}-10\right)^{3}}$
(b) $h(x)=\left(\frac{e^{x^{2}}}{x+1}\right)^{5}$
(4) A table of values for $f, g, f^{\prime}, g^{\prime}$ is given below.

| $x$ | $f(x)$ | $g(x)$ | $f^{\prime}(x)$ | $g^{\prime}(x)$ |
| :---: | :---: | :---: | :---: | :---: |
| 1 | 3 | 2 | 4 | 6 |
| 2 | 1 | 8 | 5 | 7 |
| 3 | 7 | 2 | 7 | 9 |

(a) If $h(x)=f(g(x))$, find $h^{\prime}(1)$.
(b) If $H(x)=g(h(x))$, find $H^{\prime}(1)$.
(5) For what values of $r$ does the function $y=e^{r x}$ satisfy the differential equation

$$
y^{\prime \prime}-4 y^{\prime}+y=0 ?
$$

