# Homework Set 4

## The Chain Rule

## (sect 2.5)

Write the composite function in the form: $f\big(g(x)\big)$ [ie: clearly identify the inner and outer functions]. Then find the derivative $\frac{dy}{dx}$.

1. $y = e^{x^2-3x}$

$u = g(x) =$

$y = f(u) =$

2. $y = \sin(\tan x)$

$u = g(x) =$

$y = f(u) =$

For some composite functions, the derivative can be found without using the chain rule. This is only possible if the function can be rewritten in such a way that another rule can be used.

3. $y = (1-2t)^2$
   a. If possible, compute $\frac{dy}{dt}$ without using the chain rule.

   b. Find $\frac{dy}{dt}$ using the chain rule.

   c. Are the answers for part (a) and part (b) the same function?

Compute the derivatives of the following functions. Simplify your answers where applicable (hint: look for compound fractions and trig functions).

4. $e^{5x}$

5. $\sin x^2$

6. $\cos^2 \theta$

7. $\ln x^7 + \ln 7x$

8. $(\ln t)^7$

9. $(w^2 - 3w + 1)^{12}$

10. $\ln(\sec y + \tan y)$

11. $\ln(x^{29} - 3x^{15} + 7x^6 + 3x^2 - 1)$

12. $\sqrt{\arctan x}$

13. $\arctan\left(\frac{t+1}{3}\right)$

14. $(r^2 - (4 - r)^5)^3$

15. $\left(4 - e^{x^2} + 5\ln x\right)^6$

16. $\ln(\sec x^4)$

17. $2^{5^{x^2}} - \log_2(\cos x)$

18. $\arcsin(\cos\theta)$

Use the definition of the Chain rule to answer the following questions.

19. If $h(x) = \sqrt{5 + 2f(x)}$ where $f(0) = 2$ and $f'(0) = -6$, find $h'(0)$.

20. A table for the values for $f, g, f', g'$ at the given values is given below:

| $t$ | $f(t)$ | $g(t)$ | $f'(t)$ | $g'(t)$ |
|---|---|---|---|---|
| 1 | 3 | 2 | 4 | 6 |
| 2 | 1 | 8 | 5 | 7 |
| 3 | 7 | 2 | 7 | 9 |

a. Let $h(t) = f\big(g(t)\big)$. Compute $h'(1)$.

b. Let $k(t) = f\big(f(t)\big)$. Compute $k'(2)$.