

Calculus I

Instructions

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- This homework should be submitted via Gradescope by 23:59 by deadline.
 - There are three main ways you might want to write up your work.
 - Write on this pdf using a tablet
 - Print this worksheet and write in the space provided
 - Write your answers on paper, clearly numbering each question and part.
 - * If using either of the last two options, you can use an app such as OfficeLens to take pictures of your work with your phone and convert them into a single pdf file. Gradescope will only allow pdf files to be uploaded.
 - **You must show all work.** You may receive zero or reduced points for insufficient work. **Your work must be neatly organised and written.** You may receive zero or reduced points for incoherent work.
 - If you are writing your answers on anything other than this sheet, you should only have **one question per page**. You can have parts a), b) and c) on the page for example, but problems 1) and 2) should be on separate pages.
 - When uploading to Gradescope, **you must match each question to the page that your answer appears on**. If you do not you will be docked a significant portion of your score.
 - **Put a box or circle around your final answer** for each question.
 - The problems on this assignment will be **graded on correctness and completeness**.
 - These problems are designed to be done without a calculator. Whilst there is nothing stopping you using a calculator when working through this assignment, be aware of the fact that you are not permitted to use calculators on exams so you might want to practice without one.

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1. Use the chain rule to find the following derivatives. Leave your answer in the form $f'(g(x))g'(x)$. That is, **do not** simplify.

(a) $a(x) = (2x + 1)^5$

(b) $c(s) = \left(1 - \frac{s}{7}\right)^{-7}$

(c) $\varepsilon(o) = \left(\frac{o^2}{8} + o - \frac{1}{o}\right)^2$

(d) $g(a) = \sin^3(a)$

(e) $\iota(r) = e^{-5r}$

(f) $k(p) = e^{5-7p}$

(g) $m(l) = \sin(4l)$

(h) $o(\varepsilon) = \sin(\cos(\varepsilon))$

(i) $q(w) = \ln(\cos(w))$

(j) $s(g) = \ln(\ln(g))$

$$(k) \quad u(h) = \sqrt[3]{\cos(h)}$$

$$(l) \quad w(c) = (c^2 - 6c + 1)^3 + 3(c^2 - 6c + 1)^2 + 3c^2 - 18c + 4$$

$$(m) \quad y(v) = \sqrt{\sqrt{\sqrt{v^2 + 1}}}$$

2. Differentiate the following. They use a combination of chain, product and quotient rules. You do need not simplify your answer fully for these questions.

(a) $f(x) = \frac{1}{2} \sin(x) \cot(x)$

(b) $F(y) = \left(\frac{1}{y^2} - \frac{3}{4y} \right) (y + 5y^3)$

(c) $G(x) = \frac{x^2 - 2}{2x + 1}$

(d) $y = x^2 \sin(x) \tan(x)$

(e) $a(t) = \sin(t \cos(t))$

(f) $f(\theta) = \cos^4(\sin^3(\theta))$

3. Using the information given in the table below find each of the following derivatives.

x	1	2	3	4
$f(x)$	4	3	2	1
$f'(x)$	3	1	4	2
$g(x)$	1	4	3	2
$g'(x)$	2	3	1	4

(a) $h'(4)$ if $h(x) = f(g(x))$

(b) $h'(2)$ if $h(x) = g(f(x))$

(c) $h'(1)$ if $h(x) = \sqrt{g(x)}$

(d) $h'(4)$ if $h(x) = (f(x))^{3/2}$

(e) $h'(3)$ if $h(x) = f(x)g(x)$

(f) $h'(2)$ if $h(x) = \frac{f(x)}{g(x)}$