

Name _____

Student ID Number _____

Section _____

You may use one sheet of notes. No other notes, books or calculators. There are 9 questions, on front and back. Write answers on the exam and turn in only this paper. Show enough work so that we can see how you arrived at your answers.

1. (10 pts) Find $\frac{d^2}{dx^2}(\sec x)$.
2. (12 pts) Differentiate $x^{(e^x)}$.
3. (10 pts) If $h(x) = f(g(x))$ and $f(0) = 0$, $g(0) = 1$, $f'(0) = 2$, $g'(0) = 3$, $f'(1) = 4$, $g'(1) = 5$, find $h'(0)$.
4. (12 pts) If $x^2 + y^3 = 17$ and $dx/dt = 10$, find dy/dt when $x = 3$.
5. (11 pts) A cube is measured to be 6cm on each side, with a possible error of ± 0.5 cm. Use a linear approximation or differentials to estimate the error in computing the volume of the cube.

6. (12 pts) Find all local and absolute minima and maxima of the function $f(x) = x^2(x + 6)$ on the interval $[-5, 3]$.

7. (11 pts) Verify that $f(x) = x^3 + x - 1$ satisfies the hypotheses of the Mean Value Theorem on the interval $[0, 2]$, and find all points c for which the conclusion of the Mean Value Theorem holds.

8. (10 pts) Compute

$$\lim_{x \rightarrow 0} \frac{x + x^2}{e^x - e^{-x}}$$

9. (12 pts) Use the information below to sketch the graph of $y = (x - 1)/x^2$. Show any local or absolute maxima and minima and any inflection points by plotting them on your sketch and labelling them with their x and y coordinates.

- The domain of $f(x) = (x - 1)/x^2$ is $(-\infty, 0) \cup (0, \infty)$.
- $\lim_{x \rightarrow 0^+} (x - 1)/x^2 = \lim_{x \rightarrow 0^-} (x - 1)/x^2 = -\infty$.
- $\lim_{x \rightarrow \infty} (x - 1)/x^2 = \lim_{x \rightarrow -\infty} (x - 1)/x^2 = 0$.
- $y = 0$ at $x = 1$, $y < 0$ on $(-\infty, 0) \cup (0, 1)$, and $y > 0$ on $(1, \infty)$.
- $y' = (2 - x)/x^3$; $y' = 0$ at $x = 2$, $y' < 0$ on $(-\infty, 0) \cup (2, \infty)$, and $y' > 0$ on $(0, 2)$.
- $y'' = (2x - 6)/x^4$; $y'' = 0$ at $x = 3$, $y'' < 0$ on $(-\infty, 0) \cup (0, 3)$, and $y'' > 0$ on $(3, \infty)$.