

Answer all of the following questions. Additional sheets are available if necessary. No books or notes may be used. You may use a calculator. You may not use a calculator which has symbolic manipulation capabilities. When answering these questions, please be sure to 1) check answers when possible, 2) clearly indicate your answer and the reasoning used to arrive at that answer (*unsupported answers may not receive credit*). Each question is followed by space to write your answer. Please lay out your solutions neatly in the space below the question. You are not expected to write each solution next to the statement of the question.

Name _____

Section _____

Question	Score	Total
1		12
2		16
3		12
4		10
5		15
6		10
7		10
8		15
Total		100

1. Compute the following derivatives.

(a) $\frac{d}{dx}e^{x^2}$

(b) $\frac{d}{dx}\frac{\ln x}{1+x^2}$

(c) $\frac{d^2}{dx^2}xe^{2x}$

2. Evaluate the following definite and indefinite integrals.

(a) $\int x \sin x \, dx$

(b) $\int \frac{3}{1+x^2} \, dx$

(c) $\int_2^4 \frac{x}{x^2+1} \, dx$

(d) $\int \frac{x+1}{\sqrt{1-x^2}} \, dx$

3. (a) Find the following limits.

i. $\lim_{x \rightarrow 0} \frac{\tan(5x)}{x}$

ii. $\lim_{x \rightarrow \infty} \frac{e^x}{x^2 + 1}$.

iii. $\lim_{x \rightarrow 1} \frac{e^x}{x^2 + 1}$.

(b) Carefully state the version of l'Hopital's rule that may be used to find the limit in part (a)(i).

4. Find the values of λ for which $y(x) = e^{\lambda x}$ satisfies the equation

$$y'' - 2y' - 3y = 0.$$

5. A population of critters grows exponentially. At time $t = 0$, there are 400 critters and after 3 hours, there are 500 critters.
- (a) Find an expression for the population after t hours.
 - (b) Find the number of critters after 5 hours.
 - (c) When will the population reach 20,000?

6. Simplify the following expressions to write them without trigonometric functions. Please explain your reasoning.

(a) $\sin(\cos^{-1}(4/5))$

(b) $\cos^{-1}(\cos(7\pi/4))$

(c) $\tan(\sin^{-1}(x))$

7. There are numbers a and b so that

$$\int x^{10} e^{2x} dx = ax^{10} e^{2x} + b \int x^9 e^x dx.$$

- (a) Integrate by parts to establish this formula.
- (b) Give the values of a and b .

8. Let $f(x) = \cos(x)$ with domain $[0, \pi]$ and let $g(x)$ be the inverse function.
- (a) What are the domain and range of g ?
 - (b) What is $g(0)$?
 - (c) Sketch the graphs of f and g .
 - (d) Derive the formula for the derivative of g using the formula for the derivative of inverse functions.

