

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. Please 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**). 3) give exact answers, rather than decimal approximations to the answer.

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.

You are to answer two of the last three questions. Please indicate which problem is not to be graded by crossing through its number on the table below.

Name _____

Section _____

Last four digits of student identification number _____

Question	Score	Total
p. 1		14
p. 2		14
p. 3		14
p. 4		14
p. 5		14
Q 10		14
Q 11		14
Q 12		14
Free	2	2
		100

1. Find the equation of the tangent line to the graph of $f(x) = x^3 + 2x^2 + 2x$ at $x = -1$. Put your answer in the form $y = mx + b$.

$y =$ _____

2. Find the limits.

(a) $\lim_{x \rightarrow 0} \frac{\sin^2 x}{5x^2}$.

(b) $\lim_{x \rightarrow \infty} \sin\left(\frac{\pi}{2} + \frac{4}{x}\right)$

(a) _____, (b) _____

3. Suppose that f is defined by

$$f(x) = \begin{cases} \frac{x^2 + 3x + 2}{x + 2}, & \text{for } x \neq -2 \\ A, & x = -2 \end{cases}$$

Find A so that f is continuous at $x = -2$.

$A =$ _____

4. Find the linear approximation $L(x)$ to $f(x) = \sqrt{1 + 2x}$ at $x = 4$. Use this linear approximation to compute an approximate value for $f(3.7)$.

$L(x) =$ _____, $f(3.7) \approx$ _____

5. Let $f(x) = \frac{1-x}{1+x}$. Compute the derivative, $f'(x)$, and use the derivative to find the intervals where f is increasing or decreasing.

$f'(x) =$ _____

Intervals of decrease _____

Intervals of increase _____

6. Find the absolute maximum value and absolute minimum value of the function $f(x) = \frac{1}{1+x^2}$ on the interval $[2, 5]$.

Absolute maximum value _____, absolute minimum value _____

7. Find the derivatives. (a) $\frac{d}{dx} \int_2^x \sin(t^2) dt$, (b) $\frac{d}{dx} \int_x^4 \cos(t^2) dt$.

(a) _____, (b) _____

8. Suppose that a particle is moving along the x -axis so that after t seconds, the particle is $x(t)$ meters to the right of the origin. The acceleration of the particle is 12 meters/second² for all t . At time $t = 0$, the particle is located at the origin and at time $t = 2$ seconds, the velocity of the particle is -40 meters/second. Find the position function $x(t)$.

$x(t) =$ _____

9. Evaluate the following integrals.

(a) $\int_0^4 \frac{x}{\sqrt{x^2 + 9}} dx$

(b) $\int_{-2}^2 x \sin(x^2) dx$

(c) $\int_1^4 \frac{x^2 + 2}{x^2} dx$

(a) $\int_0^4 \frac{x}{\sqrt{x^2 + 9}} dx = \underline{\hspace{4cm}}$

(b) $\int_{-2}^2 x \sin(x^2) dx = \underline{\hspace{4cm}}$

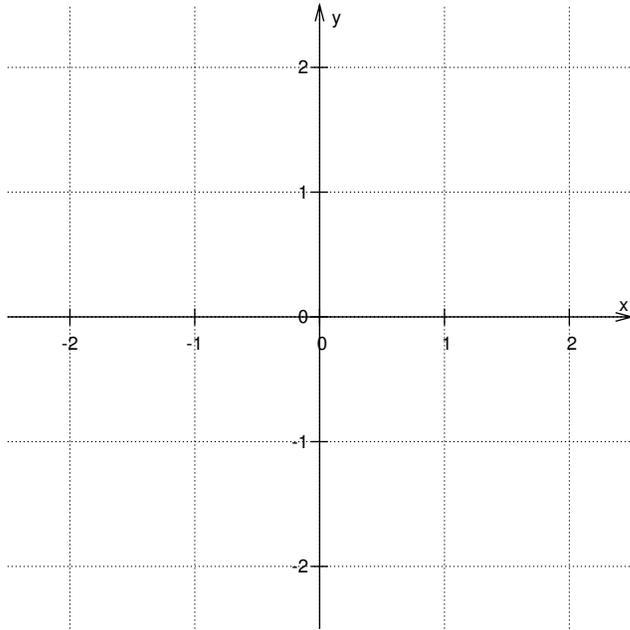
(c) $\int \frac{x^2 + 2}{x^2} dx = \underline{\hspace{4cm}}$

Work two of the following three problems. Indicate the problem that is not to be graded by crossing through its number on the front of the exam.

10. (a) Give the definition of the derivative of a function f at a point x .
- (b) Let $g(x) = \frac{1}{1+2x}$. Use the definition to compute g' , the derivative of g .
- (c) Give the domain of $g'(x)$.

11. Let $f(x) = x^2$ and $g(x) = \sqrt{x}$.

- (a) Find the points where the graphs of f and g intersect.
- (b) Make a rough sketch of the graphs of f and g .
- (c) Find the area enclosed by the graphs of f and g .



12. Let R be the region enclosed by the parabola $y = x^2$ and the line $y = 1$. Let S be the solid of revolution obtain by rotating the region R about the line $y = 3$.

- (a) Sketch the region, R .
- (b) Write an integral which gives the volume of S .
- (c) Evaluate the integral from part (c).

