

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.

Please write your solutions neatly in the space below the question. You are not expected to write each solution next to the statement of the question. If you use the back of a sheet, indicate this by 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. 2/Q1 | | 14 |
| p. 3/Q2-3 | | 14 |
| p. 4/Q4-5 | | 14 |
| p. 5/Q6 | | 14 |
| p. 6/Q7-8 | | 14 |
| p. 7/Q9 | | 14 |
| p. 8/Q10 | | 14 |
| p. 9/Q11 | | 14 |
| Free | 2 | 2 |
| | | 100 |

1. Find the derivatives. In part (b), you must simplify your answer.

(a) $f(x) = \sqrt{x^2 + 3x}$ (b) $g(x) = \frac{x^2 - 1}{x^2 + 1}$ (c) $h(x) = x \sin(x^2)$.

(a) $f'(x) = \underline{\hspace{10em}}$, (b) $g'(x) = \underline{\hspace{10em}}$

(c) $h'(x) = \underline{\hspace{10em}}$

2. An object is dropped from a height of 180 meters. Find the speed when it hits the ground. Use that the acceleration of gravity is 10 meters/second² in the downward direction.

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3. Find the equation of the line which is perpendicular to the graph of $f(x) = \frac{1}{x}$ at $x = 2$.

4. Use calculus to find all values of x so that $f(x) = x^5 - 5x$ has a local maximum or minimum at x .

Local maximum at _____

Local minimum at _____

5. Find the limit by expressing the limit as a definite integral and evaluating the integral.

$$\lim_{n \rightarrow \infty} \frac{1}{n} \sum_{k=1}^n \sin\left(\frac{k\pi}{n}\right)$$

6. Evaluate. (a) $\int_0^1 (x^3 - x^{5/2}) dx$, (b) $\int_0^{\pi/3} \cos^3(\theta) \sin(\theta) d\theta$, (c) $\int x\sqrt{x^2 - a^2} dx$

(a) _____ , (b) _____

(c) _____

7. Let R be the region which lies between the lines $x = 2$, $x = 5$, $y = 3$ and $y = 4 + x$. Let S be the solid of revolution created by rotating R about the line $y = 1$. Write an integral that represents the volume of S . Do not evaluate the integral.

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8. Find all intervals where the function

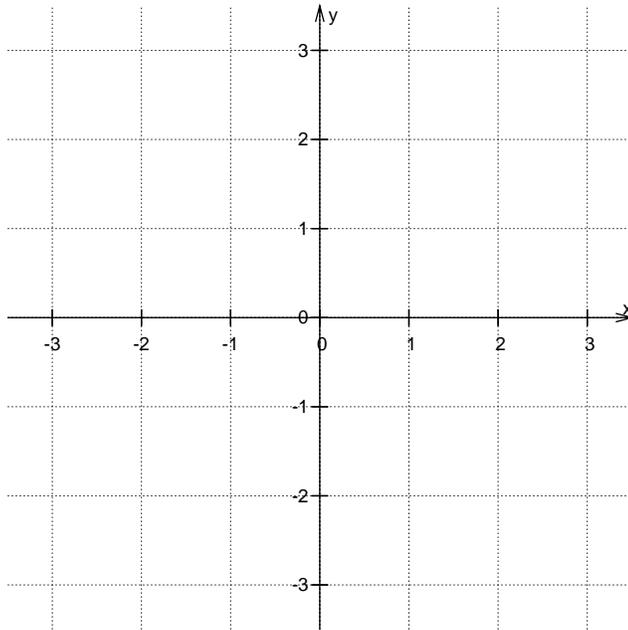
$$g(x) = \int_0^x \frac{1}{2 + t^4} dt$$

is concave up.

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.

9. (a) State the definition of the derivative of a function f at a number x .
- (b) Use the definition to compute the derivative of $g(x) = \frac{1}{x+1}$. No credit will be given for computing the derivative with the differentiation rules. You may want to use the differentiation rules to check your answer.

10. (a) Sketch the graphs of $y = x^2 - 2$ and $y = x$.
- (b) Use the definite integral to write an expression which gives the area between the graph of $y = x^2 - 2$ and the graph of $y = x$.
- (c) Use your answer to (b) to find the area between the graphs of $y = x^2 - 2$ and $y = x$.



11. (a) Sketch a region R so that if R is rotated about the x -axis, the resulting solid of revolution is a sphere of radius 2.
- (b) Write down a definite integral which represents the volume of the sphere that we obtain when the region R in part (a) is rotated about the x -axis.
- (c) Evaluate the integral in (b) to find the volume of a sphere of radius 2.

