

INSTRUCTIONS: Outside paper and electronic devices are **not** permitted. Exam is worth 100 points. Neatness counts. Unless indicated, answers with no supporting work may receive no credit. BOX your final answers.

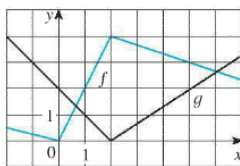
1. (18 points) Consider the functions  $g(x) = 2 - 2x$  and  $h(x) = x^2 - 5x + 4$ 
  - (a) Find the equation of the secant line through  $h(0)$  and  $h(2)$ . Write your answer in slope-intercept form.
  - (b) Find the equation of the tangent line through  $h(0)$ . Write your answer in slope-intercept form.
  - (c) Find  $(g/h)'(x)$ .

2. (18 points) Consider the function  $f(x) = \sqrt{x + 2}$ .
  - (a) What is the average rate of change of  $f(x)$  on  $[7, 14]$ ?
  - (b) What is the instantaneous rate of change of  $f(x)$  at  $x = 7$ ?

(c) Evaluate the expression:  $\lim_{x \rightarrow 7} \left[ \frac{f(x) - f(7)}{x - 7} \right]$ .

3. (15 points) Consider the function  $f(x) = \frac{1}{\sqrt{x}}$ . Find  $f'(x)$  with the limit definition of derivative.

4. (18 points) The following questions are not necessarily related.

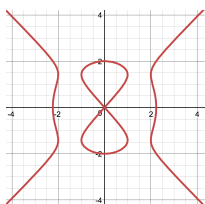


- (a) Consider the following graph: Let  $u(x) = (f \circ g)(x)$ , what is  $u'(1)$ ?

(b)  $y = \left[ \frac{x \cot(2x)}{5} \right] \implies \frac{dy}{dx} = ?$

(c) Given  $y = \left[ \frac{|2x - 2|}{x - 1} \right]$ , graph  $y$  and find  $\frac{dy}{dx}$ .

5. (15 points) Consider the graph of  $y^2(y^2 - 4) = x^2(x^2 - 5)$  seen below. Find  $\frac{dy}{dx}$  and evaluate it at  $(1, \sqrt{2})$ .



6. (16 points) Only the answer will be graded on the following questions; no work is required.

I. Where is  $y = \frac{3x^2 - x - 4}{x^2 - 1}$  non-differentiable?

A.  $x = 1, x = -1$

C.  $x = -1$

E.  $x = \frac{4}{3}$

B.  $x = 1$

D.  $x = -1, x = \frac{4}{3}$

F. Nowhere

II. Suppose the position of a moving object (in meters) at any time (in seconds) is given by the expression  $s(t) = -4.5t^2 + 10t + 20$ . What is the acceleration of the object after 10 seconds?

A. 4.5 m/s<sup>2</sup> upwards

C. 9 m/s<sup>2</sup> upwards

E. 0 m/s<sup>2</sup>.

B. 4.5 m/s<sup>2</sup> downwards

D. 9 m/s<sup>2</sup> downwards

F. None of the above

III. Given that  $y = x^3 \cdot \cos\left(\frac{2}{x}\right)$ , find  $y'$ .

A.  $2x \sin\left(\frac{2}{x}\right)$

C.  $6 \sin\left(\frac{2}{x}\right)$

E.  $3x^2 \cos\left(\frac{2}{x}\right) - x^3 \sin\left(\frac{2}{x}\right)$

B.  $-3x^2 \sin\left(\frac{2}{x}\right)$

D.  $2x \sin\left(\frac{2}{x}\right) + 3x^2 \cos\left(\frac{2}{x}\right)$

F. None of the above

IV. Find  $f'(1)$ , given  $f(x) = \begin{cases} x & , x < 1 \\ 3 & , x = 1 \\ 2 - x^2 & , 1 < x \leq 2 \\ x - 3 & , x > 2 \end{cases}$ .

A. 1

C. 0

E. D.N.E.

B. 3

D. -2

F. None of the above