

**MATH 1241
COMMON FINAL EXAMINATION
FREE RESPONSE SECTION
FALL 2019**

This exam is divided into three parts. These pages contain Part III which consists of 5 free response questions.

Please show all of your work on the problem sheet provided. We will not grade loose papers.

- If you are basing your answer on a graph on your calculator, sketch a picture of your graph on your sheet and be sure to label your window.
- **Make sure that your name appears on each page.**

At the end of the examination you MUST hand in all remaining test materials including test booklets, answer sheet, and scratch paper.

PROBLEM	1	2	3	4	5
GRADE					

FREE RESPONSE SCORE: _____

Name: _____ **Student ID No:** _____

Instructor: _____ **Section No:** _____

1. Suppose f is a differentiable function with the following table of values:

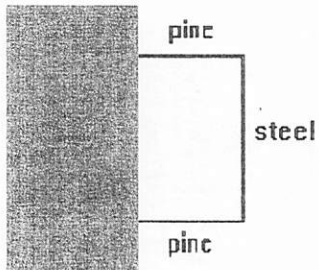
x	$f(x)$	$f'(x)$
1	2	-1
2	3	2
4	5	3
8	-2	5

(a) Let $g(x) = \frac{f(x)}{x^2}$. Evaluate $g'(1)$.

(b) Let $h(x) = \sqrt{1 + f(x)}$. Evaluate $h'(2)$.

(c) Let $k(x) = 3x + [f(x)]^2$. Evaluate $k'(4)$.

2. The management of a department store has decided to enclose a rectangular area outside of the building for display purposes. One side will be formed by the external wall of the store. Two other sides will be constructed of pine boards, and the final side will be made of steel. Pine fencing costs \$3 per foot, and steel fencing costs \$8 per foot. Management has budgeted \$960 for this project. Find the dimensions that maximize the enclosed area.



3. Let $f(x) = x^3 + ax^2 + bx + 3$, where a and b are constants such that f has an inflection point at $x = 2$ and a critical number at $x = 5$.

(a) Use the fact that f has an inflection point at $x = 2$ to determine the value of a .

(b) Use the fact that f has a critical number at $x = 5$ to determine the value of b .

(c) Does the critical number $x = 5$ give a relative maximum, relative minimum, or neither?

4. The graph of $y = f(x)$ is shown below

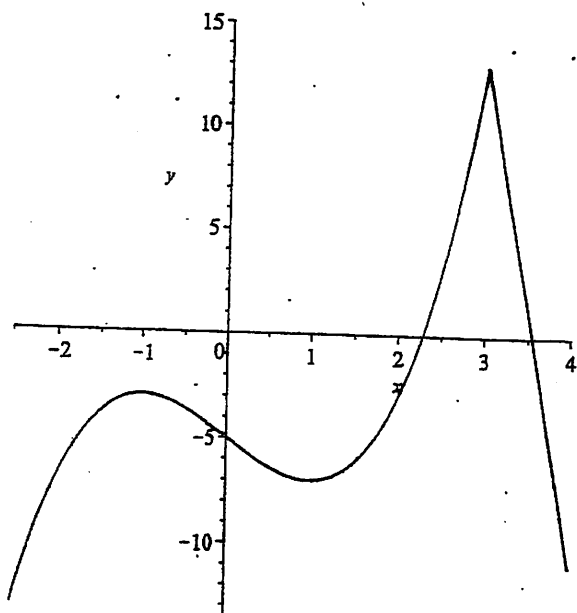
(a) On which interval(s) is f increasing?

(b) On which interval(s) is f concave up?

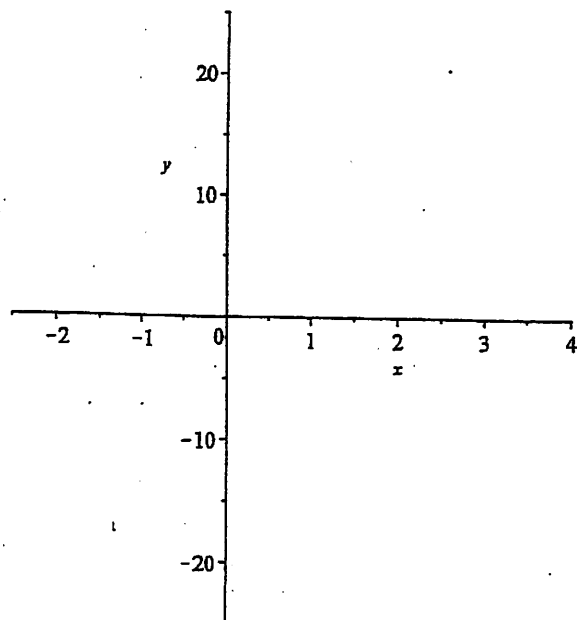
(c) List the x -coordinates of any points where $f'(x) = 0$.

(d) List any values of x where $f'(x)$ does not exist. If none, write NONE.

(d) Sketch a graph of $y = f'(x)$ on the axes at the bottom of the page..



$$y = f(x)$$



$$y = f'(x)$$

5. An object moves along the line $y = x$ with coordinates $(5t, 5t)$ at time t . An observer located at coordinates $(70, 0)$ tracks the angle θ between the x -axis and the object's position (see the diagram). What is $\frac{d\theta}{dt}$ when $t = 6$? Hint: What is $\tan(\theta)$?

