

INSTRUCTIONS: Books, notes, flying monkeys and electronic devices are not permitted. Write your (1) name, (2) student number, (3) instructor's name, and (3) when your lecture meets on the front of your bluebook. Also make a scoring table, with places for 6 problems, plus a total score. This exam has 6 problems, on both sides of this sheet. Work all **6 problems**. Start each problem on a **new page**. Show your work. Box in your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

1. (10 points) Let $y(x) = \sqrt{|x|}$.

- What is the domain of $y(x)$? What is its range?
- Sketch the graph of $y(x)$.
- Is $y(x)$ odd, even or neither? Justify your answer.

2. (10 points) Let $g(x) = \sqrt{x} \sin(1/x)$.

- Does $\lim_{x \rightarrow 0^+} g(x)$ exist? Why or why not? If YES, what is the limit?
- Does $\lim_{x \rightarrow 0^-} g(x)$ exist? Why or why not? If YES, what is the limit?

3. (20 points)

The curves $y_1 = x^2 + ax + b$ and $y_2 = cx - x^2$ have a common tangent line at the point (1,0).

- Find a, b and c .
- What is the equation of their common tangent line?

4. (20 points)

Evaluate each limit, or explain why it doesn't exist.

- $\lim_{x \rightarrow 1} \frac{1 - \sqrt{x}}{1 - x}$
- $\lim_{x \rightarrow 0} \frac{|x|}{x}$
- $\lim_{x \rightarrow 0} \frac{\sin(\pi/2)}{\pi}$
- $\lim_{x \rightarrow 4} \left(\frac{1}{x+4}\right)\left(\frac{1}{x} + \frac{1}{4}\right)$
- $\lim_{x \rightarrow 4^-} \left(\frac{1}{x+4}\right)\left(\frac{1}{x} + \frac{1}{4}\right)$

5. (20 points)

a) What is the definition of the derivative of a function $g(t)$?

b) Let $g(t) = \frac{1}{t^2}$, $t \neq 0$.

Use the definition of a derivative to find $g'(t)$ for $t \neq 0$.

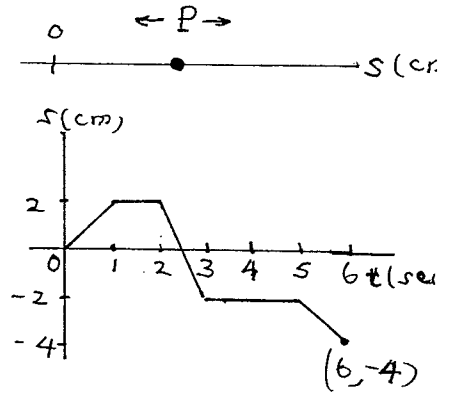
c) For the same $g(t)$, use the quotient rule to find $g'(t)$ for $t \neq 0$.

d) Evaluate $g'(1)$, $g'(2)$, $g'(\sqrt{3})$.

(OVER)

6. (20 points) A particle P moves on the real-number line shown to the right. The graph below it shows the position of P as a function of time, t .

- When is P moving to the left? When is it moving to the right? When is it standing still?
- Graph the particle's velocity and its speed (2 graphs), where each is defined.



I THINK WE MIGHT ALL LEARN A LESSON FROM HOW THIS UTTERLY UNIQUE AND EXQUISITE CRYSTAL...

