

MATH 165
Exam 1
Spring 2020

Student name: _____
Recitation instructor: _____
Section: _____

*This exam is closed book and closed notes. No electronic devices, including calculators and headphones, are allowed. Drawing pictures to help understand and solve the questions is encouraged. Answer each question completely using exact values; you do not need to simplify your answers unless otherwise indicated. Show your work neatly, including correct notation and showing the steps in your work, as well as writing legibly; **answers without work and/or justifications will not receive credit.** Circle your final answer for each problem. Each problem is worth 10 points.*

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DO NOT BEGIN THIS EXAM UNTIL INSTRUCTED TO START

Do not write
in these boxes
on the exam



score

1. Using the limit definition of the derivative, find the derivative of

$$f(t) = 2 + \sqrt{5 - 3t}.$$

(No credit will be given for the derivative found by any other method.)

score

2. Find all horizontal asymptotes of the graph of

$$f(x) = \frac{2x^3 - 3}{|x|^3 + 1}.$$

Justify your response using limits.

score

3. An object moves along the horizontal s -axis. Its position relative to the origin at time $t \geq 0$ seconds is given by

$$s(t) = (t^3 - 9t^2 + 24t + 4) \text{ meters}$$

(a) Find all t value(s) for which the velocity of the object is 0 m/sec.

(b) Is the object moving from right to left or from left to right at time $t = 3$ seconds? Briefly(!) explain your answer.

(c) For what value(s) of $t \geq 0$ is the acceleration of the object equal to 0 m/sec²?

score

4. Given that $y = 2x + 1$ is a tangent line to the graph of $y = f(x)$ at $x = 1$, and $y = -4x + 5$ is a tangent line to $y = g(x)$ at $x = 1$, find an equation of a tangent line to $y = f(g(x))$ at $x = 1$.

score

5. Given that a function $f(x)$ satisfies the following:

- The average rate of change from $x = 10$ to $x = 20$ is 15,
- The average rate of change from $x = 20$ to $x = 30$ is 5, and
- The average rate of change from $x = 30$ to $x = 40$ is -2 .

(a) Find the average rate of change of $f(x)$ from $x = 10$ to $x = 40$.

(b) Determine the number p so the function $g(x) = f(x) + px$ has an average rate of change of 23 between $x = 10$ and $x = 30$.

score

6. Find the following derivatives.

(a) $\frac{d}{dx} \left(x^{2/3} e^{\pi} \left(\cos \left(\frac{x}{2} \right) - e^{-x} \right) \sin (2x) \right)$

(b) $\frac{d}{d\theta} \left(\tan(3\theta) \cos(2\theta) - \sec^2(\pi\theta) + \tan \left(\frac{\theta}{7} + 2 \right) \right)$

score

7. (a) List the condition(s) for a function to $f(x)$ be continuous at the point $x = c$.

(b) For the following function $g(x)$, list all possible values of x where the function *might* be discontinuous.

$$g(x) = \begin{cases} \frac{2x + a + \sqrt{x+3}}{x+2} & x > -2 \\ |x+4| + b & x \leq -2 \end{cases}$$

(c) Find values for a and b so that the function $g(x)$ from part (b) *is* continuous.

score
