APPM 1235

Exam 2

INSTRUCTIONS: **Simplify** and **box** all your answers. Write neatly and **justify all answers**. A correct answer with incorrect work or no justification may receive no credit. Books, notes, electronic devices, other unauthorized devices, and help from another person are not permitted while taking the exam. The exam is worth 100 points.

Potentially useful formula:

(i) Equation of a circle: $(x - h)^2 + (y - k)^2 = r^2$

NOTE: YOU MAY TEAR OFF THIS FIRST PAGE AND USE (FRONT AND BACK) AS SCRATCH PAPER.

- i. DO NOT START UNTIL INSTRUCTED BY A PROCTOR.
- ii. THE EXAM IS ON BOTH SIDES OF EACH FOLLOWING EXAM PAGE
- iii. WRITE YOUR NAME ON THE NEXT PAGE.
- iv. WHEN YOU FINISH (IF BEFORE THE EXAM END TIME) PLEASE QUIETLY COLLECT YOUR THINGS AND FOLLOW PROCTOR INSTRUCTIONS IN UPLOADING YOUR EXAM WITH SUP-PORTING WORK TO GRADESCOPE. ONLY WORK THAT'S SUBMITTED TO GRADESCOPE WILL BE GRADED.

Name: _____

1. Answer the following for the given graph of a function y = f(x). Give answers in interval notation where relevant (10 pts):



- (a) Identify the domain of f.
- (b) Identify the the range of f.
- (c) Find the midpoint between (-2, f(-2)) and (3, f(3)).
- (d) Solve f(x) = 0. If there are no solutions write "NO SOLUTIONS."
- (e) Find $(f \circ f)(5)$. If the value does not exist write "DNE."
- (f) Find the x-values where f(x) < 2. Give your answer in interval notation.
- (g) Identify a restriction of the domain so that f is one-to-one and has the same range as in part (b).
- (h) Use your domain restriction to calculate $f^{-1}(2)$.

2. Consider the image and find the equation of the tangent line in blue that passes through (3, -4). (6 pts)



3. Find the domain of the following functions. Express your answers in interval notation. (12 pts)

(a)
$$g(x) = \frac{x}{x^2 + 12x}$$

(b)
$$s(r) = |-4r^3 + 12|$$

(c)
$$f(x) = \frac{1}{(x+2)\sqrt{2-3x}}$$

- 4. The cost of producing a certain television can be modeled by: C(t) = 20t + 300 where C is the cost to produce a television in US dollars and t is time in years after present day (with present day occuring at t = 0). Answer the following: (6 pts)
 - (a) What are the units of the slope of the model?
 - (b) Is the cost increasing, decreasing, or staying the same each year?
 - (c) What is the C-intercept of the model?
 - (d) Briefly explain, in words, what the C-intercept represents.
- 5. Fluid is leaking out of a container. How much fluid remains in the container is governed by Torricelli's Law: $V(t) = 50 \left(1 \frac{t}{20}\right)^2$ where t is in minutes and V is measured in ft³. (6 pts)
 - (a) Find the net change in volume of fluid from 0 minutes to 10 minutes.

(b) Briefly explain, in words, what the net change found in part (a) means for the fluid in the container.

6. Sketch the shape of the graph of each of the following on the provided axes. Make sure to label relevant value(s) on your axe(s) (10 pts)



7. For the graph below, this is the same graph as question 1, answer the following (6 pts):



- (a) Sketch on the same axes above: y = f(x) + 2.
- (b) Sketch on the same axes above: y = -f(x).

8. For g(x) = 1/(2x) + 1 compute the following for real number constant a and nonzero constant h: (7 pts)
(a) g(a)

(b) g(a+h)

(c)
$$\frac{g(a+h) - g(a)}{h}$$

- 9. For $P(x) = 2x^3 + 6x^2 + 4x$ answer the following. (15 pts)
 - (a) i. Identify the term that dominates the end behavior of P(x):
 - ii. Based on your answer to part (a) fill in the blanks for P(x):

 $y \to \dots$ as $x \to -\infty$ and $y \to \dots$ as $x \to \infty$.

- (b) Find the *y*-intercept of P(x).
- (c) i. Find all zeros of P(x).

ii. Identify the multiplicity of each zero.

(d) Sketch the graph of P(x) using the above information. Be sure to label all intercept(s).



10. For $h(x) = \frac{1}{2}\sqrt{x} - 1$ and $r(x) = \sqrt{2}\sqrt{x+1}$, answer the following: (10 pts) (a) Find $n(x) = (r \circ h)(x)$.

(b) Find the domain of n(x).

(c) Find $r^{-1}(x)$ (you may assume that r(x) is one-to-one).

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11. The following are unrelated. (6 pts)

(a) Is $f(x) = x^3 - 2x + 4$ odd, even, or neither? Fully justify your answer to earn credit.

(b) Is the graph given that of an odd function, even function, or neither?



- 12. A farmer is preparing to grow strawberries in a field. The number of strawberries produced by each plant depends on how densely the plants are grown. If only one strawberry plant were grown in the field, it would be expected to produce 300 strawberries. For each additional plant added to the field, the number of strawberries produced by each plant would be 3 fewer. Let n represent the number of plants grown in the field. (6 pts)
 - (a) Find a function that represents the total number of strawberries produced in the field, T, as a function of n.

(b) Use your answer from part (a) to determine how many plants should be grown in the field to maximize the number of strawberries produced.