NAME: _____

Instructor: _____

Time your class meets: _____

Math 160 Calculus for Physical Scientists I
Exam 2
March 10, 2016, 5:00-6:50 pm

"How can it be that mathematics, being after all a product of human thought independent of experience, is so admirably adapted to the objects of reality?" *-Albert Einstein*

1. Turn off your cell phone and other devices (except your calculator).
2. Write your name on every page of the exam. Write your instructor's name on the cover sheet.
3. You may use a scientific calculator on this exam. No graphing or symbolic calculator is allowed. You must provide your own calculator; you may not use a laptop computer or smart phone.
4. No notes or other references, including calculator manuals or notes stored in calculator memory, may be used during this exam.
5. Use the back of the facing pages for scratch work and for extra space for solutions. Indicate clearly when you wish to have work on a facing page read as part of a solution to a problem.

HONOR PLEDGE
I have not given, received, or used any unauthorized assistance on this exam. Furthermore, I agree that I will not share any information about the questions on this exam with any other student before graded exams are returned.

_____
(Signature)

_____
(Date)

Please do not write in this space.

1. (12pts)	
2. (10pts)	
3. (10pts)	
4-9. (19pts)	
10. (8pts)	
11. (16pts)	
12. (10pts)	
13. (15pts)	
TOTAL	

Algebra Mistakes:	
Trigonometry Mistakes:	

1. (12pts) Calculate the indicated derivatives by using the Differentiation Rules (Theorems). Answers must be accompanied by supporting work that shows how you calculated the derivative. **You do not need to simplify your answers.** If you do simplify an answer, you must simplify correctly. Answers will be scored right or wrong. Dont expect partial credit for incorrect answers or answers with no supporting work.

   (a) $h(x) = \sqrt[3]{\sin(x) - 5x^2}$

   $h'(x) =$ _____

   (b) $f(x) = \dfrac{\cos(x)}{2 - 3x} + \pi$

   $f'(x) =$ _____

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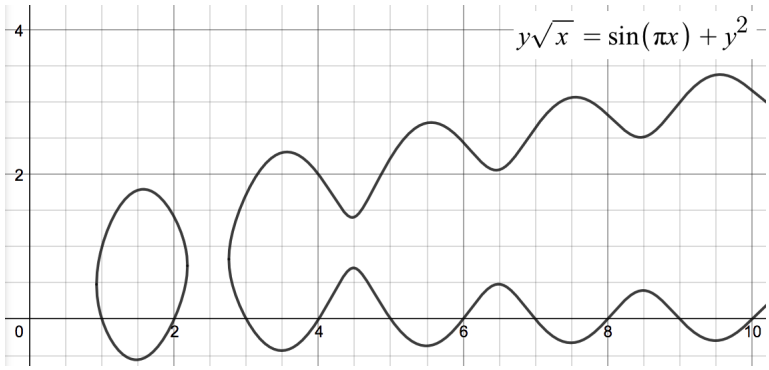
2. (10pts) Suppose that the position of a particle is given by $s(t) = \tan(\pi t) + \frac{1}{3}\sqrt[3]{t}$

   (a) Find the function, $v(t)$, that will provide the velocity of the particle at time t.

   (b) What is the velocity of the particle at time $t = 1$?

3. (10pts) Below is the graph of the implicitly defined function $y\sqrt{x} = \sin(\pi x) + y^2$. You may leave values in exact form. If you choose to use decimals, round to 3 decimal places.



(a) Use calculus to find $\dfrac{dy}{dx}$

(b) Find the slope of the line tangent to $y\sqrt{x} = \sin(\pi x) + y^2$ at $(4, 0)$.

Multiple Choice: for #4-9. Circle only one answer for each problem unless it indicates otherwise.

4. (3pts) Given that $G(x) = x^2 \cdot f(x)$, for some function, $f(x)$, what is $G'(x)$?

   (a) $2x \cdot f(x)$
   (b) $2x \cdot f'(x)$
   (c) $x^2 \cdot f'(x) + 2x \cdot f(x)$
   (d) None of the above.

5. (3pts) Given that $x = 2$ and $x = 5$ are critical points of a polynomial $f(x)$, what are the critical points for the function $G(x) = f\left(\frac{x}{3}\right)$?

   (a) $x = \frac{2}{3}$ and $x = \frac{5}{3}$
   (b) $x = 6$ and $x = 15$
   (c) $x = 2$ and $x = 5$
   (d) None of the above.

6. (3pts) What is the equation of the line tangent to $f(x) = 2x + 5$ at $(-2, 1)$?

   (a) $y = 2x$
   (b) $y = 2$
   (c) $y = 2x + 5$
   (d) $y = -(2x + 5)$

7. (3pts) If $f(x)$ is continuous on the interval $(-3, 3)$, then which of the following statements is **always** true?

   (a) $\lim_{x \to -2} f(x)$ exists.
   (b) $f'(-2)$ exists.
   (c) $f(x)$ attains an absolute maximum value on the interval $(-3, 3)$.
   (d) There is a point c in $(-3, 3)$ such that $f'(c) = \frac{f(3) - f(-3)}{6}$.
   (e) None of the above.

8. (3pts) If $f(x)$ is differentiable on the interval $(-3, 3)$, then which of the following statements is **always** true? (CIRCLE ALL CORRECT RESPONSES)

   (a) $f(x)$ is continuous at $x = -2$.
   (b) $f'(-2)$ exists.
   (c) $f(x)$ attains an absolute maximum value on the interval $(-3, 3)$.
   (d) There is a point c in $(-3, 3)$ such that $f'(c) = \frac{f(3) - f(-3)}{6}$.
   (e) None of the above.

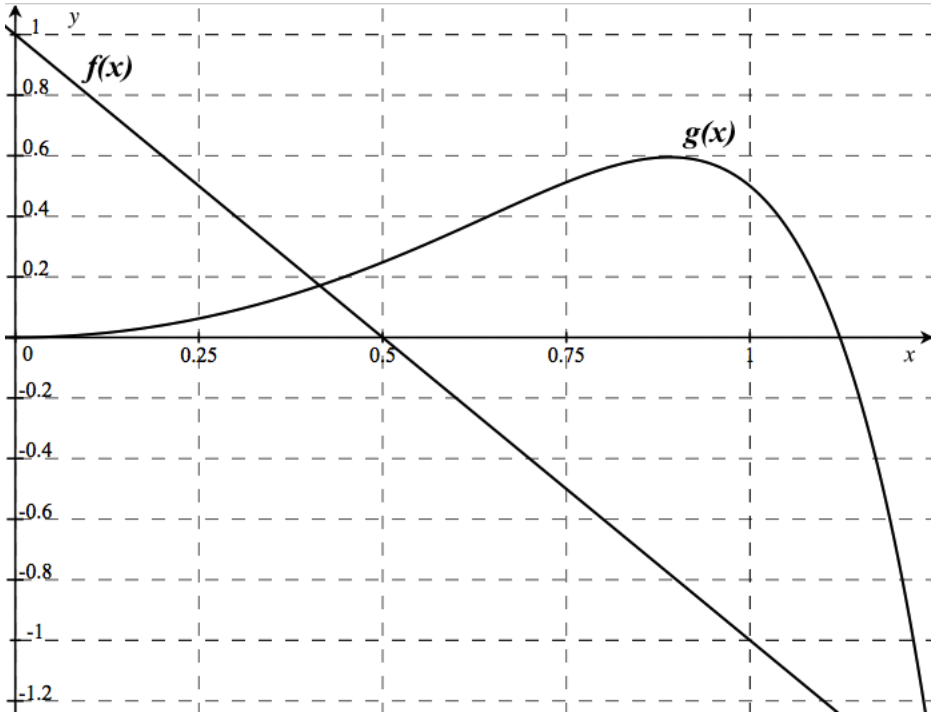
9. (4pts) The function $h(x)$ is defined as $h(x) = f(g(x))$. The graphs of $f(x)$ and $g(x)$ are provided below. Given that $g(0.25) = 0.06$ and $f(0.25) = 0.5$, determine which of the following values *best* represents the value of $h'(0.25)$.

   (a) 0.45

   (b) 0.9

   (c) -0.12

   (d) -1



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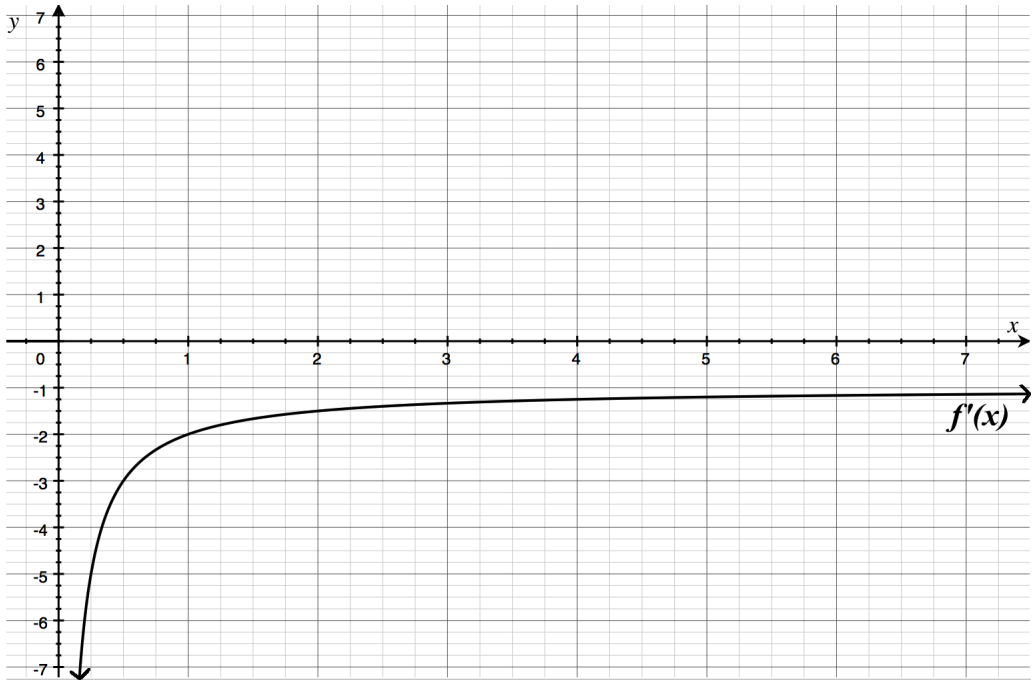
10. (8pts) The graph of $f'(x)$ is provided below. Draw the graph of $f(x)$ in the same axes.



11. (16pts) The statement below is true sometimes. Give an example of a function for which it holds true and an example of a function for which it does not hold true. Explain your reasoning. Provide your answers by filling in the table below.

Note that your example may be a graph or an equation.

If $f(x)$ is defined on $[-1, 4]$, then $f(x)$ attains both a maximum and minimum value on $[-1, 4]$.

Example of True	Example of False
Why is the statement true for your example?	Why is the statement false for your example?

12. (10pts) Clark is driving by car 213 miles from Fort Worth to Austin. She took exactly 3 hours on her trip and made no stops.

(a) Explain why you can apply the Mean Value Theorem to this problem.

(b) Using the Mean Value Theorem, prove that at some point Clark went above 70 mph.

13. (15pts) Use $f(x) = \dfrac{3}{x}$ to answer the following

(a) Use the limit definition of the derivative to find $f'(1)$.

(b) Find $f'(x)$ using a derivative rule.

(c) Use your result from (b) to find $f'(1)$.