APPM 1350 **Exam 3** **Fall 2018**

On the front of your bluebook, please write: a grading key, your name, lecture number, and instructor name. This exam is worth 100 points and has 5 questions on both sides of this paper.

- Make sure all of your work is in your bluebook. Nothing on this exam sheet will be graded. Please begin each problem on a new page.
- **Show all work and simplify your answers!** Name any theorem that you use. Answers with no justification will receive no points unless the problem explicitly states otherwise.
- Notes, papers, calculators, cell phones, and other electronic devices are not permitted.

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1. **Core Section: Integration** (30 pts)

   (a) $\displaystyle\int \frac{\csc^2(1/t)}{t^2}\,dt$

   (b) $\displaystyle\int_0^4 \left(|x-1| + \sqrt{16-x^2}\right)dx$

   (c) Find the average value of $f(x) = \dfrac{18x}{(x^2+9)^2}$ on $[0,3]$.

   (d) Find the value of $\displaystyle\lim_{n\to\infty}\sum_{i=1}^{n}\left(4-5\left(-2+\frac{2i}{n}\right)^4\right)\frac{2}{n}$. (*Hint: Evaluate an integral.*)

2. (15 pts) Beulah Bug is crawling along the curve $y = x^2$. Find the x-coordinates of the points on the curve where Beulah is closest to her home located at $(0,1)$.

3. (24 pts) The following three problems are not related.

   (a) Find an equation for the slant asymptote of $y = \dfrac{9x^2+3x}{3x+5}$. (It is not necessary to justify your answer with limits.)

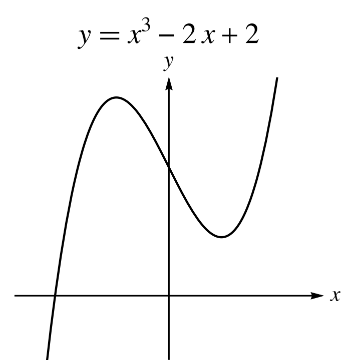
   (b) If $\displaystyle\sum_{i=1}^{n}(4i-2) = 7200$, what is the value of n?

   (c) Apply Newton's Method to $y = x^3 - 2x + 2$ with an initial approximation of $x_1 = 0$.

      i. Calculate the next two approximations x_2 and x_3.

      ii. Copy the graph of the function. (It is not necessary to draw a precise graph.) Sketch the lines used to find x_2 and x_3.

      iii. Explain what happens to x_n as $n \to \infty$. Will x_n approach the root?



TURN OVER—More problems on the back!

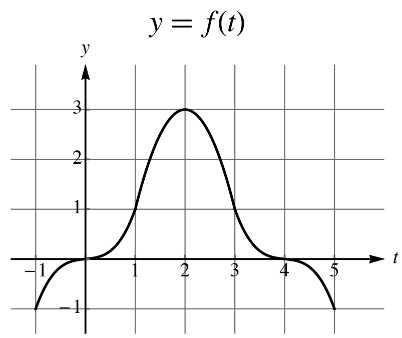
4. (15 pts) Ralphie is driving her car at 60 feet per second when she sees a red light ahead, 180 feet away. She immediately brakes with a constant acceleration of $-k$ ft/sec^2, $k > 0$.

   (a) Find the car's velocity and position functions, $v(t)$ and $s(t)$, in terms of k. Assume that the initial position is 0 feet.

   (b) How many seconds will it take for Ralphie to come to a complete stop? Express your answer in terms of k.

   (c) Find the value of k that will cause Ralphie to stop right at the light.

5. (16 pts)



The graph of a differentiable function f on the interval $[-1, 5]$ is shown above. The graph of f has a horizontal tangent line at $t = 2$. Let $g(x) = 5 + \int_2^x f(t)\,dt$ for $-1 \le x \le 5$. No explanations are necessary for the following questions.

   (a) Find the values of $g(2)$, $g'(2)$, and $g''(2)$.

   (b) On what interval(s) is g decreasing?

   (c) On what interval(s) is g concave down?

Formulas

$$\sum_{i=1}^{n} i = \frac{n(n+1)}{2} \qquad \sum_{i=1}^{n} i^2 = \frac{n(n+1)(2n+1)}{6} \qquad \sum_{i=1}^{n} i^3 = \left(\frac{n(n+1)}{2}\right)^2$$