(circle your TA discussion section)

- AD1, TR 11:00-12:50, Hannah Kolb Spinoza
- AD3, TR 1:00-2:50, Michael Santana
- ADB, TR 9:00-9:50, Ziying Pan
- ADD, TR 11:00-11:50, Lisa Hickok
- ADF, TR 1:00-1:50, Jian Liang
- ADH, TR 3:00-3:50, Lechao Xiao
- ADJ, TR 9:00-9:50, Meghan Galiardi
- ADL, TR 11:00-11:50, Andrew McConvey
- ADN, TR 1:00-1:50, Benjamin Fulan
- ADP, TR 3:00-3:50, Hongfei Tian
- ADR, TR 9:00-9:50, Noah Chartoff
- ADT, TR 2:00-2:50, Anna Weigandt
- AD2, TR 9:00-10:50, Ki Yeun Kim
- ADA, TR 8:00-8:50, Ziying Pan
- ADC, TR 10:00-10:50, Lisa Hickok
- ADE, TR 12:00-12:50, Andrew McConvey
- ADG, TR 2:00-2:50, Derrek Yager
-ADI, TR 4:00-4:50, Lechao Xiao
-ADK, TR 10:00-10:50, Meghan Galiardi
-ADM, TR 12:00-12:50, Benjamin Fulan
-ADO, TR 2:00-2:50, Jian Liang
-ADQ, TR 4:00-4:50, Hongfei Tian
-ADS, TR 12:00-12:50, Derrek Yager
-ADU, TR 3:00-3:50, Anna Weigandt

- You may work with other MATH 220 students. However each student should write up solutions separately and independently – nobody should copy someone else’s work.

- You may use your notes or the textbook.

- Computers are not allowed on any problem. You may use a calculator only for basic arithmetic.

- The quiz should be submitted to your TA at the beginning of your discussion section on Tuesday, November 6th.

- There is a higher expectation for the quality of your work on a take-home quiz. Everything should be written logically and legibly with sufficient work to justify each answer. Blank copies of the quiz are available on the course home page.

- Be sure that the pages are nicely stapled – do not just fold the corners.

- Note to TAs and Tutors – you should not help students with these specific problems or go over solutions until after 5pm Tuesday.
1. (2 points) The acceleration due to gravity near the surface of some planet is \(-6 \text{ m/s}^2\). An object is shot upward from the surface of this planet and 10 seconds later it has fallen back to the surface. What is the velocity of this object 2 seconds after being shot?

\[ \text{(acc)} \quad s'' = -6 \]
\[ \text{(vel)} \quad s' = -6t + C \]
\[ \text{(pos)} \quad s = -3t^2 + Ct + D \]

\[ s(0) = 0 \Rightarrow D = 0 \]
\[ s = -3t^2 + Ct \]
\[ s(10) = 0 \Rightarrow -300 + 10C = 0 \Rightarrow C = 30 \]
\[ s = -3t^2 + 30t \quad \text{and} \quad s' = -6t + 30 \]

\[ s'(2) = -12 + 30 = 18 \text{ m/s} \]

2. (2 points) Find a formula for \(g(t)\) given that \(g''(t) = 3 \cos t - 8e^t + 24t - 6\), \(g'(0) = 2\) and \(g(0) = 4\).

\[ g'(t) = 3 \sin t - 8e^t + 12t^2 - 6t + C \]
\[ g'(0) = 2 \Rightarrow 3 \sin(0) - 8e^0 + 12(0)^2 - 6(0) + C = 2 \]
\[ \Rightarrow -8 + C = 2 \]
\[ \Rightarrow C = 10 \]

\[ g'(t) = 3 \sin t - 8e^t + 12t^2 - 6t + 10 \]

\[ g(t) = -3 \cos t - 8e^t + 4t^3 - 3t^2 + 10t + D \]
\[ g(0) = 4 \Rightarrow -3 \cos(0) - 8e^0 + 4(0)^3 - 3(0)^2 + 10(0) + D = 4 \]
\[ \Rightarrow -3 - 8 + D = 4 \]
\[ \Rightarrow D = 15 \]

\[ g(t) = -3 \cos t - 8e^t + 4t^3 - 3t^2 + 10t + 15 \]
3. (2 points) Suppose that $f$ is continuous at all real numbers, $\int_1^3 f(x) \, dx = 4$ and $\int_1^5 f(x) \, dx = 13$.

What is the value of $\int_3^5 (2f(x) + 10) \, dx$?

$$\int_3^5 (2f(x) + 10) \, dx = 2 \int_3^5 f(x) \, dx + \int_3^5 10 \, dx$$

$$= 2 \cdot 9 + 10 \cdot 2$$

$$= 38$$

4. (2 points) Evaluate the following limit.

$$\lim_{n \to \infty} \sum_{k=1}^{n} \left( \frac{20}{n^4} + \frac{15k^2}{n^3} + \frac{8k}{n^2} + \frac{7}{n} \right) = \lim_{n \to \infty} \left( \frac{20}{n^4} \cdot \sum_{k=1}^{n} k + \frac{15}{n^3} \cdot \sum_{k=1}^{n} k^2 + \frac{8}{n^2} \cdot \sum_{k=1}^{n} k + \frac{7}{n} \cdot \sum_{k=1}^{n} 1 \right)$$

$$= \lim_{n \to \infty} \left( \frac{20}{n^4} \cdot n^2 + \frac{15}{n^3} \cdot \frac{n(n+1)(2n+1)}{6} + \frac{8}{n^2} \cdot \frac{n(n+1)}{2} + \frac{7}{n} \cdot n \right)$$

$$= \lim_{n \to \infty} \left( \frac{20}{3} + \frac{30n^2 + 45n^2 + 15n}{6n^3} + \frac{8n^2}{2n^2} + \frac{7}{n} \right)$$

$$= \lim_{n \to \infty} \left( \frac{20}{n^3} + 5 + \frac{15n}{2n^2} + \frac{5}{2n^2} + 4 + \frac{7}{n^2} \right)$$

$$= 0 + 0 + 0 + 0 + 4 + 0 + 7$$

$$= 16$$
5. (2 points) The area between the x-axis and the graph of \( f(x) = x^2 \) on the interval [3, 7] can be written as a limit of Riemann sums in many different ways. I have shown how to do this for two of the six ways indicated below. Fill in the missing information for the remaining limits so that the only variables appearing are \( n \) and \( k \). Do not evaluate these limits.

(a) Using a limit of right Riemann sums,

\[
AREA = \lim_{n \to \infty} \sum_{k=1}^{n} \left[ (3 + k \cdot \frac{4}{n})^2 \cdot \frac{4}{n} \right]
\]

(b) Using a limit of right Riemann sums,

\[
AREA = \lim_{n \to \infty} \sum_{k=0}^{n-1} \left[ (3 + (k+1) \cdot \frac{4}{n})^2 \cdot \frac{4}{n} \right]
\]

(c) Using a limit of left Riemann sums,

\[
AREA = \lim_{n \to \infty} \sum_{k=1}^{n} \left[ (3 + (k-1) \cdot \frac{4}{n})^2 \cdot \frac{4}{n} \right]
\]

(d) Using a limit of left Riemann sums,

\[
AREA = \lim_{n \to \infty} \sum_{k=0}^{n-1} \left[ (3 + k \cdot \frac{4}{n})^2 \cdot \frac{4}{n} \right]
\]

(e) Using a limit of midpoint Riemann sums,

\[
AREA = \lim_{n \to \infty} \sum_{k=1}^{n} \left[ (3 + (k-0.5) \cdot \frac{4}{n})^2 \cdot \frac{4}{n} \right]
\]

(f) Using a limit of midpoint Riemann sums,

\[
AREA = \lim_{n \to \infty} \sum_{k=0}^{n-1} \left[ (3 + (k + 0.5) \cdot \frac{4}{n})^2 \cdot \frac{4}{n} \right]
\]