Lecture: MWF, 9:00–9:50 AM in Hepner Hall 130
Teaching Assistant: Lucas Piepkorn (piepkorn@acmsd.edu)
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Office hours: Mondays and Wednesdays 10:10–11:00 AM and by appointment
Text: Single Variable Calculus, Fourth Edition by Stewart

Homework: Homework, worth 10% of the grade, may be prepared alone or by two or three students working together.

Quizzes: Quizzes, given in lectures, will be worth 10% of the grade. Quiz questions will be similar to homework problems and examples that are discussed in class.

Midterm and final exams: Midterm exams, worth 15% each, will be given on Wednesday, September 25, Monday, November 4, and Friday, December 6. The final exam will be worth 35%. Part will be given in class during the final week and part later at the scheduled time for the final exam. SDSU photo ID’s will be required, no books or notes may be used, and all students must work alone on exams.

Graphing calculators will be required for in-class work, homework, and exams. Only the Texas Instruments TI-83 will be supported in class. The TI-82, TI-85, and TI-86 may also be used. Calculators such as the TI-89 and TI-92 and certain HP calculators that perform symbolic calculations in algebra and calculus may not be used on quizzes or exams. Instructions and programs for TI-83 and TI-85/6 calculators will be on the web page.

Tentative schedule

Week 1

W, 9/4: Introduction to the class. Sections 1.1 and 1.2
Th, 9/5: Discussion of Section 1.1. Photos
F, 9/6: Homework 1 is due. Section 1.3

Homework 1 (due 9/6): Section 1.1 (2, 16, 25, 28, 41, 45), Section 1.2 (4, 6, 11)

Homework 2 (due 9/9): Section 1.3 (2, 5, 9, 13, 22, 39, 46, 55a, 55b)

Week 2

M, 9/9: Homework 2 is due. Section 2.2
Tu, 9/10: Discussion of Chapter 1 and Section 2.2.
W, 9/11: Quiz 1 on Chapter 1. Section 2.3
Th, 9/12: Discussion of Section 2.3
F, 9/13: Homework 3 is due. Section 2.5

Homework 3 (due 9/13): Section 2.2 (5, 9, 12, 18, 19, 21, 26, 30)

Homework 4 (due 9/16): Section 2.3 (11, 13, 18, 23, 29), Section 2.5 (33, 34, 37), and the following:

(A) The function $y = K(x)$, whose graph is shown below, is defined for $-3 \leq x \leq 3$ by

$$K(x) = \begin{cases} 
  x + 3 & \text{for } -3 \leq x \leq -1 \\
  x^3 + 1 & \text{for } -1 < x < 1 \\
  3 & \text{for } x = 1 \\
  2 & \text{for } 1 < x \leq 3.
\end{cases}$$

In which of the intervals (a) $[-3, -1]$, (b) $[-1, 0)$, (c) $(-1, 1)$, and (d) $(1, 2]$ is $K$ continuous?
(B) (a) Sketch the graph of

\[ Q(x) = \begin{cases} 
 2/x & \text{for } x < -1 \\
 2x^3 & \text{for } -1 \leq x \leq 1 \\
 2/x & \text{for } x > 1.
\end{cases} \]

(b) Find \( Q(-1) \), \( \lim_{x \to -1} Q(x) \), \( Q(0) \), \( \lim_{x \to 0} Q(x) \), \( Q(1) \), and \( \lim_{x \to 1} Q(x) \).

(c) What are the greatest and least values of \( Q(x) \) for all \( x \)?

(d) Find the three solutions \( x \) of \( Q(x) = 2x \).

(e) At what values of \( x \) is \( y = Q(x) \) discontinuous?

(C) (a) Sketch the graph of

\[ \Lambda(x) = \begin{cases} 
 2+2x & \text{for } -1 \leq x < 0 \\
 3 & \text{for } x = 0 \\
 2-2x & \text{for } 0 < x \leq 1.
\end{cases} \]

(b) What are the most extensive intervals in which \( y = \Lambda(x) \) is continuous?

(c) For what values of \( x \) is \( \Lambda(x) \geq 2 \)?

(d) Does \( \Lambda(x) \) increase or decrease as \( x \) increases from \(-1\) to \(0\)?

(e) Does \( \Lambda(x) \) increase or decrease as \( x \) increases from \(0\) to \(1\)?

(f) What one change in the definition of \( y = \Lambda(x) \) would make it continuous in \([-1, 1]\)?
The average weight of Hereford calves at birth, the average litter size of Poland China hogs, and the average number of eggs laid per year by Leghorn hens are given below as functions of the ages of the cow, sow, and hen, respectively. (There are no entries in the last two columns of the second row because pigs are not generally kept more than seven years.)

**Homework 6 (due 9/23):** Section 3.2 (4, 18, 21, 23, 24) and the following:

<table>
<thead>
<tr>
<th>Age of female</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf weight (lbs.)</td>
<td>370</td>
<td>389</td>
<td>411</td>
<td>427</td>
<td>438</td>
<td>443</td>
<td>445</td>
<td>434</td>
<td>421</td>
</tr>
<tr>
<td>Litter size</td>
<td>7.8</td>
<td>9.4</td>
<td>9.8</td>
<td>9.5</td>
<td>9.2</td>
<td>9.2</td>
<td>7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eggs per year</td>
<td>169</td>
<td>146</td>
<td>124</td>
<td>109</td>
<td>95</td>
<td>86</td>
<td>66</td>
<td>67</td>
<td>51</td>
</tr>
</tbody>
</table>

**Week 3**

**M, 9/16:** Homework 4 is due. Sections 3.1 and 3.2

**Tu, 9/17:** Discussion of Chapter 2 and Sections 3.1–3.2.

**W, 9/18:** Quiz 2 on Chapter 2. Discussion of Section 3.3. Derivatives by the definition

**Th, 9/19:** Discussion of Sections 3.1–3.3

**F, 9/20:** Homework 5 is due. Derivatives of $y = x^n$ and linear combinations. Tangent lines.

**Homework 5 (due 9/20):** Section 2.6 (3, 5, 9), Section 3.1 (6), and the following:

- **(A)** A motorcyclist, riding away from her home town, is $s(t) = 10t^2$ (miles) from the city limits at time $t$ (hours) for $0 \leq t \leq 3$. (a) What is her average velocity away from the town for $0 \leq t \leq 3$? (b) Draw the graph of $s = s(t)$ and the secant line whose slope is the average velocity from part (a). (Plot the points at $t = 0, 1, 2, 3$ on the graph of $s = s(t)$.) (c) Does she speed up or slow down during the ride? (d) What constant velocity would give her the same average velocity for $0 \leq t \leq 3$?

- **(B)** A ball rolling toward the edge of a table is $s(t) = 10/t$ centimeters from the edge at time $t$ (seconds) for $t \geq 1$. (a) When is it 5 centimeters from the edge? (b) When is it 1 centimeter from the edge? (c) When is its average velocity away from the edge for $2 \leq t \leq 10$? (d) Draw the graph of $s = s(t)$ and the secant line whose slope is the average velocity from part (c) (Plot the points at $t = 1, 2, 5, 10$ on the graph of $s = s(t)$.) (e) Does the ball fall off the table?

- **(C)** The average weight of Hereford calves at birth, the average litter size of Poland China hogs, and the average number of eggs laid per year by Leghorn hens are given below as functions of the ages of the cow, sow, and hen, respectively. (There are no entries in the last two columns of the second row because pigs are not generally kept more than seven years.) (a) At what age do cows, on average, give birth to the largest calves? (b) What is the average rate of change with respect to the sow’s age of the average size of a litter from age 1 to the age when the average litter size is greatest? (c) During what two-year period does the average egg production decrease the most?

**Week 4**

**M, 9/23:** Homework 5 is due. Derivatives of $y = x^n$ and linear combinations. Tangent lines.

**Tu, 9/24:** Discussion of Sections 3.1–3.3

**W, 9/25:** Quiz 3 on Chapter 2. Discussion of Chapter 2 and Sections 3.1–3.2. Derivatives by the definition

**Th, 9/26:** Discussion of Sections 3.1–3.3

**F, 9/27:** Homework 5 is due. Derivatives of $y = x^n$ and linear combinations. Tangent lines.

**Homework 6 (due 9/23):** Section 3.2 (4, 18, 21, 23, 24) and the following:

- **(A)** Use the definition of the derivative to find $f'(3)$ where $f(x) = 5x^2 - x$. (Answer: $f'(3) = 29$)

- **(B)** Use the definition of the derivative to find $g'(x)$ where $g(x) = \frac{50}{x+1}$.

- **(C)** Use the secant line program with the window $-2 \leq x \leq 4, -1 \leq y \leq 8$ to predict $f'(2)$ for $f(x) = \frac{x^2 + 6}{x^2 + 1}$. Copy the curve and the approximate tangent line on your paper.

- **(D)** Use the secant line program with the window $-3 \leq x \leq 3, -1 \leq y \leq 10$ to predict $g'(2)$ for $g(x) = \frac{25}{9 - x^2}$. Copy the curve and the approximate tangent line on your paper.

(Likely prediction: $f'(2) = -\frac{4}{3}$)

(Likely prediction: $g'(2) = 4$)
(E) Use the secant line program with the window $-1.5 \leq x \leq 6, -0.5 \leq y \leq 3.5$ to predict $h'(1)$ for $h(x) = (3x + 5)^{1/3}$. Copy the curve and the approximate tangent line on your paper.

(F) Use the secant line program with the window $-1 \leq x \leq 2, -0.5 \leq y \leq 4$ to predict the derivative of $y = e^x$ at $x = 0$. Copy the curve and the approximate tangent line on your paper.

(G) Use the secant line program with the window $-1 \leq x \leq 3, -1.25 \leq y \leq 32.5$ to predict the derivative of $y = \sin x$ at $x = \frac{1}{3}\pi$. Copy the curve and the approximate tangent line on your paper.

**Week 4**

**M, 9/23:** Homework 6 is due. Review

**Tu, 9/24:** Review.

**W, 9/25:** Exam 1 on Chapters 1 and 2 and Sections 3.1–3.2

**Th, 9/26:** Discussion of the formula $\frac{d}{dx}(x^n) = nx^{n-1}$, etc.

**F, 9/27:** Homework 7 is due. Estimating derivatives.

**Homework 7 (due 9/27):** Section 3.3 (3, 5, 11, 13, 14), and the following:

In Problems (A) through (D) find exact equations of the tangent lines to the curves at the given values of $x$. Then generate the curves and the tangent lines together in the indicated windows and copy them on your paper.

(A) The tangent line to $y = 4 - x^2$ at $x = 1$. Window: $-3 \leq x \leq 3, -5 \leq y \leq 8$ (Answer: $y = 3 - 2(x - 1)$)

(B) The tangent line to $y = 53 + 7x^{10}$ at $x = 1$. Window: $-0.5 \leq x \leq 2, -10 \leq y \leq 130$ (Answer: $y = 60 + 70(x - 1)$)

(C) The tangent line to $y = \frac{2}{\sqrt{x}}$ at $x = 1$. Window: $-0.5 \leq x \leq 3, -0.5 \leq y \leq 5$

(D) The tangent line to $y = x^2 + 27/x^2$ at $x = 3$. Window: $-5 \leq x \leq 5, -5 \leq y \leq 30$

**Week 5**

**M, 9/30:** Homework 8 is due. The product rule

**Tu, 10/1:** Discussion of the product and quotient rules

**W, 10/2:** Quiz 3 on Section 3.3 and estimating derivatives. The quotient rule.

**Th, 10/3:** Derivatives of trigonometric functions

**F, 10/4:** Homework 9 is due. Section 3.5: Derivatives of trigonometric functions

**Homework 8 (due 10/2):** Section 3.4 (7, 21a), and the following:

(A) The graph below gives the price $p(t)$ of newsprint in the U.S. as a function of the year. (a) During what time period was $dp/dt$ approximately zero? (b) When was $dp/dt$ negative? (c) What was the approximate percent change in the price of newsprint from 1960 to 1990? (d) Approximately how fast was the price of newsprint increasing when it was 400 dollars per ton?
(B) The table below gives the temperature $T(t)^\circ F$ of the radiator in an automobile $t$ minutes after its engine is started. (a) Approximately how fast is the temperature of the radiator increasing after 15 minutes? (b) After 22 minutes? (c) Does the temperature of the radiator increase more rapidly or less rapidly as the car heats up?

<table>
<thead>
<tr>
<th>$t$ (minutes)</th>
<th>0</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T(t)^\circ F$</td>
<td>87</td>
<td>110</td>
<td>113</td>
<td>116.5</td>
<td>119</td>
<td>121</td>
</tr>
</tbody>
</table>

(C) The table below lists the percentage of roses sold in the U.S. that were imported in the odd-numbered years from 1981 through 1993. Based on this data, when between 1981 and 1993 was the percentage of imported roses increasing the most rapidly, and how fast was it increasing then?

<table>
<thead>
<tr>
<th>Year</th>
<th>1981</th>
<th>1983</th>
<th>1985</th>
<th>1987</th>
<th>1989</th>
<th>1991</th>
<th>1993</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of roses imported</td>
<td>14</td>
<td>22</td>
<td>26</td>
<td>31</td>
<td>34</td>
<td>48</td>
<td>58</td>
</tr>
</tbody>
</table>

Homework 9 (due 10/4): Section 3.3 (not Section 3.4) (19, 23, 27, 31, 32, 49, 53, 54, 55, 57, 59)

(A) At the beginning of 1990, annual health care costs in the U.S. were $2600 per capita and were rising $260 per capita per year. At that time the population of the U.S. was 250 million and was increasing at the rate of 2.6 million per year. At what rate were the annual health costs for the entire country increasing at the beginning of 1990?

(B) Figures 1 and 2 give the number $N(t)$ (millions) of MasterCard and Visa accounts and the total outstanding debt $D(t)$ (million dollars) in the U.S. as functions of the year. What were the approximate average debt per credit card and the rate of change of the average debt per credit card at the beginning of 1988?

Homework 10 (due 10/7): Section 3.5 (1, 3, 5, 6, 7, 9, 11, 13 (not 23), 21, 22, 23, 26) In Exercises 21, 22, 23, and 26, generate the tangent lines with the curves on your calculator and copy them on your paper.

(A) The voltage in an electrical circuit is $220\sin(120\pi t)$ volts at time $t$ (seconds). (a) What is the frequency of the current? (b) What is the maximum rate of change of the voltage?

(B) A right triangle has a hypotenuse of fixed length 10 feet and one of its acute angles is $\theta$. Give the rates of change with respect to $\theta$ of its area and perimeter at $\theta = 1$. (Answer: $dA/d\theta = 50\cos^2(1) - 50\sin^2(1)$ square feet per radian; $dP/d\theta = 10\cos(1) - 10\sin(1)$ feet per radian)

(C) An acute angle $x$ in a right triangle is changing while the leg adjacent to $x$ has the constant length of 10 feet. Give a formula for the rate of change of the area of the triangle with respect to $x$. (Answer: $dA/dx = 50\sec^2 x$)
Week 6

M, 10/7: Homework 10 is due. Section 3.6: The chain rule.
Tu, 10/8: Quiz 4 on derivatives of trigonometric functions. Discussion of the chain rule.
W, 10/9: Homework 11 is due. Section 3.7: Implicit differentiation
Th, 10/10: Quiz 5 on the chain rule. Discussion of implicit differentiation
F, 10/11: Homework 12 is due. Section 3.8: Higher derivatives

Homework 11 (due 10/9): The chain rule. Section 3.6 (7, 9, 11, 13, 15, 21, 23, 47, 49, 51, 53, 55, 57, 59) and the following:

(A) What is the rate of change with respect to time of the volume \( V = w^3 \) of an expanding cubic crystal at a moment when its width is 10 millimeters and its width is increasing 3 millimeters per day?

(B) The one-dimensional density, measured in mass per centimeter, of a rod of mass 160 grams and length \( L \) centimeters is \( \rho = \frac{160}{L} \) grams per centimeter. The rod expands when it is heated. What are (a) its density and (b) the rate of change with respect to temperature of its density at a moment when it is 40 centimeters long and its length is increasing 0.01 centimeters per degree?

(C) At what rate is the radius \( r \) of a circle decreasing when the area of the circle is 16 square inches if the area is decreasing 3 square inches per minute?

Homework 12 (due 10/11): Implicit differentiation. Section 3.7 (7, 9, 15, 25, 27, 35)

Week 7

M, 10/14: Homework 13 is due. Section 3.9: Related rate problems
Tu, 10/15: Quiz 6 on implicit differentiation. Discussion of related rate problems..
W, 10/16: Sections 3.9 and 3.10: Related rate problems and differentials.
Th, 10/17: Quiz 7 on higher derivatives
F, 10/18: Homework 14 is due. Section 4.1: Maxima and minima.

Homework 13 (due 10/14): Higher derivatives. Section 3.8 (1, 3, 5, 7, 11, 43, 47)

Homework 14 (due 10/18): Related rate problems. Section 3.9 (1, 4, 5, 7, 9, 11, 13, 15, 27, 29)

Week 8

Tu, 10/22: Quiz 8 on related rate problems. Discussion of analyzing graphs.
Th, 10/24: Quiz 9 on differentials and maxima and minima.

Homework 15 (due 10/21): Differentials. Section 3.10 (21, 23, 39) and the following:

(A) How are \( df \) and \( dx \) related at \( x = 10 \) if \( f(x) = x^3 + 3x^2 \)? (Answer: \( df = 360 \, dx \))

(B) How are \( dw \) and \( dz \) related at \( z = 10 \) if \( w = 18z^{-1} - 27z^{-2} \)?

(C) By weighing a square plate of known density, it is determined that its area is 100 square centimeters with an error \( \leq 0.05 \) square centimeters. (a) What is the width of the plate if its area is exactly 100 square centimeters? (b) Use differentials to estimate the maximum error in the answer to part (a). (Answer: \( dw = 0.05 \, dA \), \( |\text{Error}| \approx |dw| = 0.05 \, |dA| \leq 0.05 \times 0.05 = 0.0025 \) centimeters)

(D) Exactly ten gallons of soup is measured to weigh 90 pounds with an error \( \leq 0.1 \) pound. (a) What is the density \( \rho \) of the soup, measured in pounds per gallon, if it weighs exactly 90 pounds? (b) Use differentials to estimate the maximum error in the answer to part (a). (Answer to (b): \( |\text{Error}| \approx \leq 0.01 \) pound per gallon)

Homework 16 (due 10/23): Maxima and minima. Section 4.1 (3, 5, 7, 15, 17, 31, 47)
Week 9

Tu, 10/29: Quiz 10 on analyzing graphs. Discussion of optimization problems.
W, 10/30: Homework 18 is due. Optimization problems.
Th, 10/31: Quiz 11 on optimization problems.
F, 11/1: Review

Homework 17 (due 10/28): Analyzing graphs. Section 4.3 (1, 5, 7, 11, 13, 15, 17, 27, 29), Section 4.4 (11, 13, 15), Section 4.5 (1, 5, 9), and use the first and second derivatives to analyze the following curves. (Generate them in suitable windows to check your work.)

(A) \( y = x + x^{-2} \)
(B) \( y = x^4 - 12x \)
(C) \( y = x^3 + x - 5 \)
(D) \( y = x^3 + x^{-3} \)
(E) \( y = 4x^{-1} + 4x^{-2} \)
(F) \( y = 1 + \frac{2}{x} + \frac{1}{x^2} \)
(G) \( y = 6\sqrt{x} - x \)

Homework 18 (due 10/30) Optimization problems. Section 4.7 (3, 5, 7, 8, 11, 17) and the following:

(A) (a) Which positive numbers \( x \) are greater than their cubes? (b) How much greater is \( \frac{1}{2} \) than \( \left( \frac{1}{2} \right)^3 \)? (c) How much greater is \( x \) than \( x^3 \) for \( 0 < x < 1 \)? (d) What positive number exceeds its cube by the greatest amount? Give the exact answer.
(B) What nonnegative number exceeds its fourth power by the greatest amount?
(C) A cylindrical can with no top is to be constructed so its volume is \( 8\pi \) cubic feet. (a) Give a formula for the total area \( A(r) \) of its base and curved sides as a function of the radius of its base. (b) Find the dimensions that minimize \( A(r) \). Justify your answer. Generate the graph of \( A = A(r) \) in the window \(-3 \leq r \leq 5, -10 \leq A \leq 100 \) with \( A \)-scale = 10 as a partial check of your answer.
(D) A rectangle is to have its base on the \( x \)-axis and its upper corners on the parabola \( y = 36 - x^2 \) as in Figure 1. (a) What are the width, height and area of the rectangle if its right side is at \( x = 4 \)? (b) For what values of \( x \geq 0 \) is the area zero? (c) What are the width, height and area of the rectangle if its right side is at \( x \) with \( 0 \leq x \leq 6 \)? (d) Find the dimensions that maximize the area of the rectangle. (e) Of all such rectangles, what are the width and height of those with minimum area? Justify your answer.

(E) A triangular prism with vertical sides and with horizontal top and bottom that are right triangles with sides of lengths \( 3x, 4x, \) and \( 5x \), is to be constructed so its volume is 12 cubic feet (Figure 2). (a) Give formulas for its height \( h \) and the total area \( A \) of its top, bottom, and three sides as functions of \( x \). Justify your answer. (b) For what value of \( x \) is \( A \) a minimum?

(F) A rectangular garden is to have an area of 150 square feet. The fencing for three sides costs $5 per foot and the fencing for the fourth side costs $10 dollars per foot. (a) Give a formula for the cost of the fence as a function of the length of the side that costs $10 per foot. (b) What is the minimum cost of the fence?
**Week 10**

**M, 11/4:** Exam 2 on Chapter 3, Sections 4.1, 4.3, 4.4, 4.5, and 4.7, and the secant line program.

**Tu, 11/5:** Discussion of Section 4.9 (Newton’s method) and and piecewise constant rates of change

**W, 11/6:** Homework 19 is due. Finding change from piecewise constant rates of change. The definite integral.

**Th, 11/7:** Quiz 12 on Homework 19 (Newton’s method and finding change from piecewise constant rates of change).

**F, 11/8:** Sections 5.1–5.2. Properties of the definite integral. A Riemann sum program.

**Homework 19 (due 11/6)** Newton’s method and piecewise constant rates of change.

(A) The step function $v = v(t)$ with the graph in Figure 1 gives the velocity in the positive direction at time $t$ of an object as it moves on an $s$-axis. The scale on the $s$-axis is given in feet, $t$ is measured in minutes, and $v$ is measured in feet per minute. The object is at $s = 300$ at $t = 10$. Where is it at $t = 60$?

(B) (a) Figure 2 shows the graph of the function $y = G(x)$ defined by

$$G(x) = \begin{cases} 
100 + 50x & \text{for } 0 \leq x \leq 4 \\
300 + 300(x - 4) & \text{for } 4 < x \leq 5.
\end{cases}$$

What is $G(5) - G(0)$? (b) Draw the graph of the derivative $r = G'(x)$ and show that $G(5) - G(0)$ equals the area of the two rectangles between the graph of $r = G'(x)$ and the $x$-axis.

(C) At 9:00 AM the world-class jogger Ranier Schein has completed eight miles of his morning run. He then runs 6 miles per hour between 9:00 AM and 9:30 AM and 8 miles per hour between 9:30 AM and 10:15 AM. How far has he run by 10:15 PM?

(D) The step function of Figure 3 is a mathematical model of the rate of rainfall $r = r(t)$ (inches per year) in Los Angeles from the beginning of 1881 to the beginning of 1886. What was the total rainfall in Los Angeles in the years 1881 through 1885?
Week 11

M, 11/11: Homework 20 is due. Sections 5.3–5.4: The Fundamental Theorem of Calculus, definite and indefinite integrals of \( y = x^n \) with \( n \neq -1 \), areas between graphs and the \( x \)-axis, and integrals of rates of change.

Tu, 11/12: Quiz 13 on the properties of the definite integral and the Riemann sum program.


Th, 11/14: Quiz 14 on the Fundamental Theorem and integrals of rates of change.

F, 11/15: Section 5.5: Integration by substitution.

Homework 20 (due 11/11) The definite integral and the Riemann sum program.

\[ \int_0^2 (4x - x^2) \, dx. \] (Use the window \( 0 \leq x \leq 2, -1 \leq y \leq 5 \). Likely prediction: \( 5 \frac{1}{2} \))

\[ \int_0^1 \pi \sin(\pi x) \, dx \] (Likely prediction: 2)

\[ \int_1^4 \frac{1}{x^2} \, dx \]

Homework 21 (due 11/13) The Fundamental theorem and integrals of rates of change.

Section 5.3 (1, 5, 7, 11, 13), Section 5.4 (1, 5, 7, 9 [expand], 17, 19, 21, 23, 25, 35, 53, 55, 59)

Week 12

M, 11/18: Homework 22 is due. Section 6.1: Areas between curves.

Tu, 11/19: Quiz 15 on integration by substitution.

W, 11/20: Homework 23 is due. Sections 7.2 and 10.4: Derivatives and integrals of \( y = e^x \) and \( y = b^x \). The differential equation \( y' = ky \) with constant \( k \).

Th, 11/21: Quiz 16 on areas between graphs.

F, 11/22: Sections 7.3 and 7.4. Derivatives of logarithms. Integrals of \( y = x^{-1} \).

Homework 22 (due 11/18) Integration by substitution. Section 5.5 (1, 3, 5, 7, 9, 11, 13, 17, 23, 37, 39, 41, 45, 49, 55) and the following:

(A) Find the exact area of the region bounded by the \( x \)-axis, the curve \( y = \sqrt{1+5x} \), and the lines \( x = 1 \) and \( x = 6 \). (Answer: \( \frac{2}{15}(31^{3/2} - 6^{3/2}) \))

(B) An object’s velocity in the positive \( s \)-direction on an \( s \)-axis is \( v = t^2(2 + t^3)^3 \) feet per minute for \( 0 \leq t \leq 1 \). It is at \( s = 3 \) (feet) at \( t = 0 \) (minutes). Where is it at \( t = 1 \)? (Answer: At \( s = 8 \frac{5}{72} \) feet)

Homework 23 Areas between graphs. Section 6.1 (1, 3, 7, 11, 13, 19, 21, 41)

Week 13

M, 11/25: Homework 24 is due. Section 7.5. Inverse trigonometric functions.

Tu, 11/26: Quiz 17 on derivatives and integrals of exponential functions and the differential equation \( y' = ky \).

W, 11/27: Homework 25 is due. Sections 7.5 and 7.6. Inverse trigonometric and hyperbolic functions

Th, 11/28: Holiday

F, 11/29: Holiday
Homework 24 (due 11/25)  Derivatives and integrals of exponential functions and the differential equation $y' = ky$. Section 7.2 (15, 29, 33, 37, 41, 43, 44, 61, 62, 63, 71, 73), Section 10.4 (1, 3) and the following:

Solve the initial-value problems A–C.

(A) $\frac{dy}{dt} = 8y, \quad y(0) = 4$ (Answer: $y = 4e^{8t}$)

(B) $\frac{dy}{dt} = -y, \quad y(4) = 10$ (Answer: $y = 10e^{-t}$)

(C) $\frac{dz}{dx} = (\ln 4)z, \quad z(2) = 15$ (Answer: $z = \frac{15}{16}4^x$)

(D) The relative rate of growth of a culture of bacteria is the constant $0.03 \text{ day}^{-1}$. Initially the mass of the culture is two grams. What is its mass one week later? (Answer: $2e^{0.21} \approx 2.367$ grams)

Homework 25 (due 11/27)  Derivatives of logarithms, integrals of $y = x^{-1}$.

Section 7.4 (3, 7, 9, 13, 15, 17, 25, 65, 67, 71, 73, 75)

Week 14

M, 12/2: Homework 26 is due. Section 7.7. L’Hopital’s Rule
Tu, 12/3: Quiz 18 on derivatives of logarithms and integrals of $y = x^{-1}$
W, 12/4: Review.
Th, 12/5: Review.
F, 12/6: Exam 3 on Sections 5.1–5.5, 6.1, 7.2–7.5, 7.7, 10.4, and the Riemann sum program.

Homework 26 (due 12/2)  Inverse trigonometric functions. Section 7.5 (23, 25, 27, 37, 40, 59, 61, 63, 65, 69)

Week 15

M, 12/9: Homework 27 is due. Review.
Tu, 12/10: Quiz 19 on l’Hopital’s rule. Review.
W, 12/11: Review.
Th, 12/12: Review.
F, 12/13: Part 1 of the final exam

Homework 27 (due 12/9)  L’Hopital’s rule. Section 7.7 (9, 11, 17, 21)