Problem 1. For each question below, circle True or False. DON’T GUESS, 2 points for each right answer, minus 2 points for each wrong answer.

(a) **True** or **False**: Suppose that two cars are racing. After \( t \) seconds the first car is traveling at velocity \( v_1(t) \) feet per second and the second car at \( v_2(t) \) feet per second. If the average value of \( v_1(t) \) on \([0, 60]\) is equal to the average value of \( v_2(t) \) on \([0, 60]\), then the cars have travelled the same distance after 60 seconds.

(b) **True** or **False**: 
\[
\int x e^x \, dx = e^x(x - 1) + C.
\]

(c) **True** or **False**: \( y = 1 + e^{2x} \) satisfies the differential equation 
\[
y' = 2y.
\]

(d) **True** or **False**: 
\[
\left. \frac{d}{dx} \left[ \int_{\frac{1}{2}}^{x} \ln t \, dt \right] \right|_{x=1} = 0.
\]

(e) **True** or **False**: As \( n \) gets very large, 
\[
\left[ \frac{1}{n} + \frac{2}{n} + \cdots + \frac{n-1}{n} \right] \cdot \frac{1}{n}
\]
approaches 1. (Hint: This is a Riemann sum.)
Problem 2. Compute the following indefinite integrals:

(a) \[ \int \sqrt{2x - 3} \, dx \]

(b) \[ \int e^{4+3x} \, dx \]
Problem 3. Compute the following definite integrals:

(a) \[ \int_0^1 \frac{3}{(4-2x)^2} \, dx \]

(b) \[ \int_0^2 \frac{e^x - e^{-2x}}{2e^x} \, dx \]
Problem 4. Suppose that the marginal revenue function for a company is $200 - 2x$. Find the additional revenue received from doubling production if currently 10 units are being produced.
Problem 5. Compute the area of the region between the curves $y = x^2 - 1$ and $y = x + 1$ from $x = 0$ to $x = 4$. 
Problem 6. For what value of $a$ do the two shaded regions below have the same area?
Problem 7. Suppose that a lake is stocked with 100 fish. After 1 month, there are 150 fish in the lake. An ecological study predicts that the lake can support 600 fish. Use a logistic growth curve to estimate the number of fish in the lake after 1 year.
Problem 8.
(a) Find the percentage rate of change of the function \( f(x) = 2x^2 - 3x \) at \( x = 2 \).

(b) Find the relative rate of change of the function \( f(x) = \sqrt[3]{\frac{(2x+1)^2}{(2-x)e^x}} \) at \( x = 1 \).
Problem 9. A company can sell \( q = \frac{2000}{p} - 200 \) units of a particular commodity at a price of \( p \) dollars per unit.

(a) Compute the elasticity \( E(p) \).

(b) If the price is currently $5 per unit, would the revenue increase or decrease when the price is raised?
Problem 10. Find the consumer’s surplus for the demand curve \( p = \frac{200}{x+10} + 10 \) at sales level \( x = 10 \).
Problem 11. Use a Riemann sum with $n = 4$ and midpoints to estimate the area under the graph of $y = 2x + 1$ on the interval $2 \leq x \leq 4$. 
Problem 12. Compute the volume of a frustrum of a right circular cone with height 1, lower base radius 2, and top radius 1, obtained by rotating the shaded region below about the $x$-axis: