Midterm 3 Mock Exam B

(1) Use the properties of exponents and logarithms to simplify
   (a) \((-2t^{-3})(3t^{2/3})\)
   (b) \(\ln(x^2\sqrt{4-x^2})\)

(2) Differentiate
   \[ g(x) = x^2 \ln x \]

(3) Compute \(\int (3t^2 - \sqrt{5}t + 2)\,dt\)

(4) Evaluate \(\int \frac{1}{x \ln x} \,dx\).

(5) Suppose $1000 is invested at an annual interest rate of 5%. Compute the balance after 10 years of the interest is compounded
   (a) Quarterly
   (b) Monthly
   (c) Continuously

(6) Use logarithmic differentiation to find the derivative of
   \[ f(x) = x^3e^{-x}(3x + 5)^3 \]

(7) Evaluate \(\ln \frac{e^3\sqrt{e}}{e^{1/3}}\) using properties of the natural logarithm.

(8) Evaluate \(\int_0^1 e^{-x}(4 - e^x)\) using the fundamental theorem of calculus.

(9) A book publisher estimates that his profits from the sale of a particular book will be
   \[ P(x) = 1000e^{\sqrt{3x}} \]
   when \(x\) thousand copies of the book are produced. The publisher is currently planning to produce 3000 copies of the book. Use calculus to estimate the marginal increase in profit when an additional 1000 copies of the book are produced.

(10) Find the function \(f(x)\) which has derivative \(f'(x) = 3x^2 + 6x - 2\) and passes through the point \((0, 6)\).