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1. () Each part of the following question is worth 2 points. NO PARTIAL CREDIT will be given.

(i) Describe the difference between the graphs of $y = f(x)$ and $y = f(x + 1)$.

(ii) State the Intermediate Value Theorem.

(iii) Find the derivative of the function $f(x) = e^{2x}/over \cos(x) - 1$

(iv) Find $\lim_{x\to\infty} \frac{\ln(x)}{x}$.

(v) Give an example of a function which is continuous but not differentiable at $x = 0$.

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(vi) State the Fundamental Theorem of Calculus part I.

(vii) State the Fundamental Theorem of Calculus part II.

(viii) Find the average value of the function $f(x) = e^x$ on the interval $[0, 1]$.

(ix) Express $\frac{1}{x(x-1)}$ in partial fractions.

(x) $f(x) = \frac{x}{x-1}$. $f'(x) =$

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2. () Find the following integrals.

(i) $\displaystyle\int \frac{1}{(x+5)^2(x-1)}\,dx.$

(ii) $\displaystyle\int_1^2 \frac{\sqrt{x^2-1}}{x}\,dx$

(iii) $\int \tan^5(x)\, dx$

(iv) $\int x^2 \sin(2x)\, dx$

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3. () Consider the function $f(x) = \frac{1}{x}$ from $x = 1$ to $x = 3$. Use the midpoint rule with 4 intervals to estimate $\int_1^3 f(x)dx$. With reference to the graph of $y = f(x)$ determine whether your estimate is larger or smaller than the exact value of the integral. Using Simpson's Rule, how large must n be to calculate the integral correct to within 10^{-5}?

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4. () Find the volume of the solid whose base is enclosed by the circle $x^2 + y^2 = 1$ and whose cross-section perpendicular to the x axis is always an equilateral triangle.

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5. () Consider the function $f(x) = 1 - \frac{1}{2}x^2 + \sin(x)$.

(i) f has one critical number. Find it correct to one decimal place. (Hint: you may want to use Newton's method.)

(ii) Determine whether f has a maximum or a minimum at the critical number. Justify your answer.

(iii) Sketch the graph of $y = f(x)$.

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6. () Find the largest area of a rectangle inscribed inside the graph of $y = \sqrt{2 - x}$ so that the left side of the rectangle is on the y-axis, the bottom of the rectangle is on the x-axis and the top right vertex of the rectangle is on the graph.

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7. (10) Sketch the graph of $y = \dfrac{x^2}{x^2 - x - 2}$.