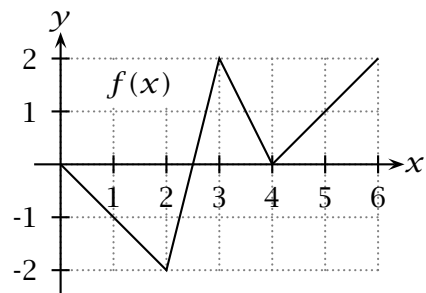


1. The graph to the right shows a function f . Let $g(x) = \int_0^x f(x) dx$. At what values of x does g have relative extrema? inflection points? Explain. (8 points)



2. Evaluate the following integrals by hand. Show your work. Check your answers using your calculator if you like. (8 points each)

(a) $\int \frac{x+1}{\sqrt{x^2+2x}} dx$

(b) $\int_0^{\frac{\pi}{2}} x \cos(2x) dx$

3. Calculate the improper integral $\int_0^1 \frac{1}{\sqrt{x-1}} dx$ by hand. Be sure to show all the details. (8 points)

4. Approximate the area enclosed by the curves $y = 16 - x^2$ and $y = e^x$ correct to two decimal places. (8 points)

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5. Find the volume of the solid obtained by rotating about the x -axis the area contained between the curves $y = \sqrt{x}$ and $y = \frac{1}{2}x$. Use your calculator, but give the exact answer. (9 points)

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6. Find the exact arclength of one arch of the cycloid given by $x = t - \sin t$ and $y = 1 - \cos t$ from as t goes from 0 to 2π . (9 points)

7. Let $f(x) = 16 - x^2$ and let f_{ave} denote the average value of f on the interval $[0, 4]$. Find a number $c \in [0, 4]$ so that $f(c) = f_{\text{ave}}$. (9 points)

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8. Find the centroid of the region in the first quadrant of the xy -plane that lies under the curve $y = \sin^2 x$ from $x = 0$ to $x = \pi$. (9 points)

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9. Your calculator can compute $\int \frac{1}{x^3 - x^2 + x - 1}$. Explain step-by-step what your calculator does to compute this integral. Be sure to mention partial fractions in your explanation. (8 points)

10. Find the family of solutions for the differential equation $y' = \frac{x^2}{1 - y^2}$. Then find the equation of the solution that contains the point $(0, \frac{1}{2})$. Sketch a graph of this solution. (8 points)

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11. Find the family of orthogonal trajectories for the family of curves given by $x^2 + 2y^2 = k^2$. Sketch the graph of a few curves from each family on one set of axes. (8 points)