

1. (28 points) The following problems are not related.

(a) (10 points) Evaluate the definite integral $\int_{-2}^0 \cos(x) \sqrt{1 + 2 \sin(x)} dx$.

(b) (10 points) Evaluate the definite integral $\int_2^0 (1 - x^2) dx$.

(c) (8 points) Suppose that $f(x) = \int_3^x \frac{t^2 + 2}{t - 1} dt$. Find $f'(4)$.

2. (24 points) The following problems are not related.

(a) (10 points) Approximate the area of the region bounded by the function $f(x) = 2 \cos(x) + 2$ and the x -axis on the interval $[-2; 3 - 2]$ by using four approximating rectangles; take the sample points to be the right endpoints.

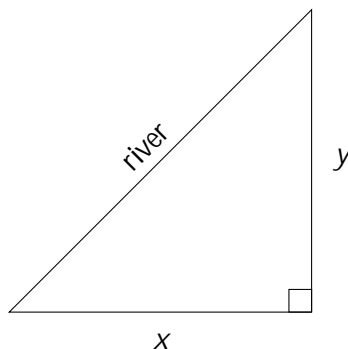
(b) (14 points) Evaluate the limit $\lim_{n \rightarrow \infty} \sum_{i=1}^n \left(\frac{1}{n} - \frac{i^3}{n^3} + \frac{2i}{n} \right)$ using summation formulas, or by evaluating an appropriate definite integral.

3. (16 points) The following problems are not related.

(a) (6 points) Suppose we want to approximate a solution to the equation $3x + 2 \cos(x) = 0$ using Newton's Method. What would the formula for x_{n+1} be? (To get full points for this question, you must provide the explicit formula for x_{n+1} in terms of x_n ; the generic formula for Newton's Method is not sufficient.)

(b) (10 points) Suppose the acceleration of an object (in m/s^2) at any time t is given by $a(t) = 6t^2 - 4$. Find the velocity $v(t)$ of the object at any time t , if $v(1) = 2 m/s$.

4. (18 points) A farmer wants to fence off a small field in the shape of a right triangle. The hypotenuse of the triangle is along a riverbank, and the farmer will not need fencing there. If the farmer wants the area of the field to be $50 m^2$, what is the minimum amount of fencing they will need? Justify your answer with calculus techniques, and include appropriate units with your answer.



5. (8 points) Write the expression $\int_a^b f(x) dx + \int_1^2 f(x) dx + \int_1^3 f(x) dx$ as a single integral of the form $\int_a^b f(x) dx$.

6. (6 points) Suppose the velocity $v(t)$ of a particle is given in the graph below:

