Directions:

- **This is a Mini-Checkpoint designed to give sufficient opportunities to level up on the most recent Learning Targets. Only Learning Targets 12–16 are represented here.**
- Do only the problems that you need to take and feel ready to take. If you have already earned Mastery on a Learning Target, do not attempt a problem for that Target! You can skip a Target if you need more time to practice with it, and take it on the next round.
- Each Learning Target problem is to be written up on a separate sheet, scanned to separate PDF files, and submitted to the appropriate Learning Target "assignment" on Blackboard. **Please do not submit more than one Learning Target in the same PDF, and make sure you are submitting it to the right Blackboard area.**
- If you are handwriting, submit your work by **scanning your work** using a scanning app or scanning device; **do not just take a picture** but scan your work to a clear, legible, black and white PDF file of size less than 100 MB. **Work submitted as an image file (JPG, PNG, etc.) will not be graded.**
- Please consult the grading criteria found in the Information on Learning Targets and Checkpoints document found in the *Learning Targets* area on Blackboard prior to submitting your work, to make sure your submission has met all the requirements.
- Please use the approved resources to double-check your work against errors prior to submitting your work.

Learning Target 12 (Core): *I can set up and use derivatives to solve applied optimization problems.*

Set up and solve the optimization problem found below the bullet list. **In order for your work to meet quality standards, it needs to contain ALL of the following. Check carefully before turning in your work to make sure you've included each one.** A lengthy solution is not necessary, but the written solution for Exercise 3 that was posted earlier would be a good guide for you.

- A clear indication of what each variable in the solution represents;
- A clear statement of what quantity you are optimizing;
- A formula for the quantity you are optimizing and a clear indication of how you obtained it;
- If you use a constraint in the problem, a clear statement of what that constraint is and how you used it;
- The use of a derivative to find the input that optimizes your quantity;
- Reasoning that explains why your solution is correct — *don't just find a value but explain how you know that value optimizes the target quantity.*

Problem for this Learning Target: Allendale Printers is making a sign with top and bottom margins of 3 inches and side margins of 2 inches. The area of the printed material on the sign has to be exactly 400 square inches. What are the length and width of the sign that has the smallest possible total area?

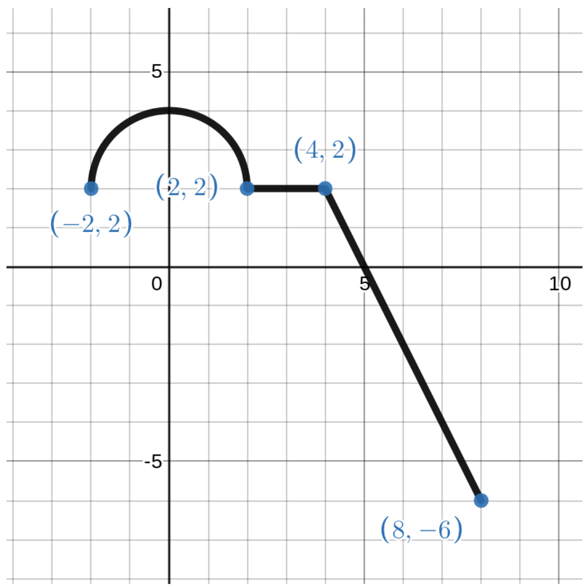
Learning Target 13: *I can calculate the area under a curve, net change, and displacement using geometric formulas and Riemann sums.*

Consider the function $f(x) = \sin(x) + 2$. Estimate the area under the curve, above the x-axis, and between $x = 0$ and $x = 6$, using the following Riemann sums. **On each one**: Clearly state the value of Δx, clearly state which points you are using to construct the rectangles, and show the setup of your calculation. **Keep all approximations to four (4) decimal places, and be sure your computer software or calculator is in radian mode.**

1. L_6
2. M_4

Learning Target 14: *I can evaluate a definite integral using geometric formulas and the Properties of the Definite Integral.*

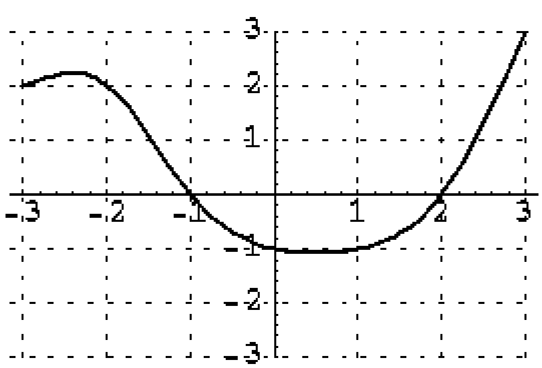
The graph of $f(x)$ is shown below. All curved portions are parts of circles; everything else is made of line segments. Four of the points are labelled. **Using only the graph**, evaluate the **exact** value — no decimal approximations — of each of the integrals shown below. **Note: Antidifferentiation is not allowed in solutions to this problem, nor are decimal approximations**. Also, **show all your work** — answers with insufficient work or no work will not meet the grading criteria.



1. $\int_{-2}^{0} f(x)\,dx$
2. $\int_{0}^{5} f(x)\,dx$
3. $\int_{-2}^{8} f(x)\,dx$

Learning Target 15: *I can explain the meaning of each part of the definition of the definite integral in terms of a graph, and interpret the definite integral in terms of areas, net change, and displacement.*

The graph below shows the rate, $r(t)$, in thousands of rabbits per year, at which a population of rabbits is growing where t is in years. The graph passes through whole number coordinates, for example $(-2, 2)$ and $(1, -1)$, whenever it goes through the corner of one of the grid marks.



1. What are the units of $\int_{-3}^{3} r(t)\, dt$? Explain.
2. Compared with the size of the population at time $t = -3$, which of the following can you conclude about the population at time $t = 2$, based on this graph: Is the population at $t = 2$ *bigger* than the population at $t = -3$, is it *smaller*, is it *about the same*, or is it *impossible to tell*? State which of these you believe is true and explain.
3. On the interval $[-3, 2]$, at what t-value did the population of rabbits reach its highest value? Explain. (*Note*: This is a different interval than in part (2).)

Learning Target 16 (Core): *I can find antiderivatives of a function and evaluate a definite integral using the Fundamental Theorem of Calculus.*

Find the exact value of each of the following definite integrals by using the Fundamental Theorem of Calculus (not geometry or Riemann sums).

A correct solution must do the following:

1. Clearly state the antiderivative of the integrand;
2. Show the "Fundamental Theorem step" explained in class and on the discussion board; and
3. Give an **exact value** of the answer with *no decimal approximations* that is **fully simplified**; *and*
4. Give a decimal form of the exact answer that agrees with the exact form to four decimal places.

Two sample solutions of this form are found on Campuswire in a post from April 12. If any of the solutions are missing any of these four items, the work will be considered to not meet the grading standard.

1. $\displaystyle\int_0^{\frac{\pi}{4}} \sin(y) + \sec^2(y)\ dy$
2. $\displaystyle\int_{-2}^{4} v^3 - 7v^2 + 3v\, dv$
3. $\displaystyle\int_1^4 \frac{6}{x^3} - \frac{1}{3x^2}\, dx$