

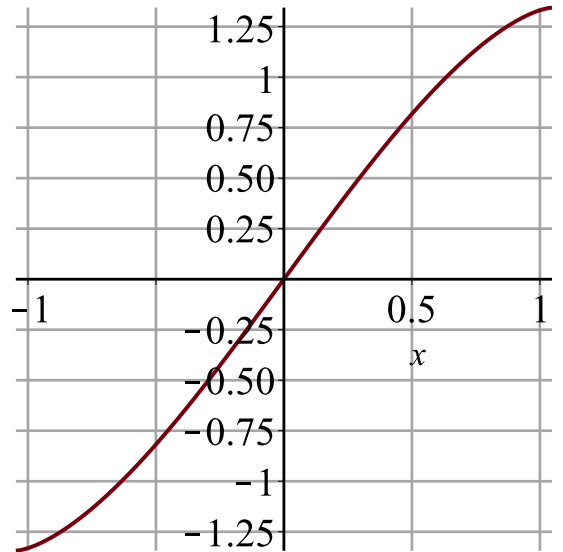
Show all work, including mental steps, in a clearly organized way that speaks for itself. Use proper mathematical notation, identifying expressions by their proper symbols (introducing them if necessary), and use EQUAL SIGNS and arrows when appropriate. Always SIMPLIFY expressions. BOX final short answers. LABEL parts of problem. Keep answers EXACT (but give decimal approximations for interpretation when appropriate). Indicate where technology is used and what type (Maple, GC).

1.  $f(x) = \int_0^x \sqrt{4 \cos^2(t) - 1} dt$  is the area function for the curve

$$y = \sqrt{4 \cos^2(x) - 1} \text{ with domain } -\frac{\pi}{3} \leq x \leq \frac{\pi}{3}. \text{ Find the}$$

length of the graph of  $f$  over this domain exactly and to 4 decimal place accuracy. Does your numerical value seem reasonable compared to the graph of  $f$  given here? If so, explain why.

2. Use a limit to evaluate the integral:  $\int_2^4 \frac{y}{\sqrt{y-2}} dy$  (you may use technology to get the antiderivative).



3. a) Show that  $p(x) = \frac{x}{a^2} e^{-\frac{x}{a}}$  (where  $a > 0$ ) is a probability distribution on the interval  $0 \leq x < \infty$ . [Be sure to use limits, and show the integration steps here and below, relying on technology for the antiderivatives you need.]

b) What is the expected value of  $x$ ?

c) At what value  $x = x_{peak}$  does the peak value of this distribution occur?

d) What is the probability that the random variable  $x$  assumes a value less than or equal to  $x_{peak}$ ?

4. Use Simpson's rule with only 2 divisions to approximate the integral  $\int_0^2 4 - x^2 dx$  (keep your evaluation exact).

Does your result agree with the exact integral as it should? Support your answer.

## ► solution

## ▼ pledge

When you have completed the exam, please read and sign the dr bob integrity pledge and hand this test sheet in on top of your answer sheets as a cover page, with the first test page facing up:  
 "During this examination, all work has been my own. I give my word that I have not resorted to any ethically questionable means of improving my grade or anyone else's on this examination and that I have not discussed this exam with anyone other than my instructor, nor will I until after the exam period is terminated for all participants."

Signature: \_\_\_\_\_

Date: \_\_\_\_\_