_____ /100

Show all work, including indications of mental steps, on the lined paper provided. Label and separate clearly each part of each problem, organizing your work well. Box each short final response requested (and nothing else). Use proper mathematical notation: "symbol" = "expression representing symbol" = ⋯. Don't misuse equal signs, but do connect equal expressions with equal signs. Give exact answers, not decimal approximations (unless requested). Nothing on the test may be justified or supported by technology output, but you may use technology to check your work. This is a test about thinking, reasoning, and good communication of the process. You may not access the web or any existing computer files for help. Simplify all results.

① $f(t) = 12t \sin 6t$

a) Evaluate $\int f(t)\,dt$

b) Evaluate $\int_0^{\pi/3} f(t)\,dt$ exactly; give its numerical value.

c) Evaluate the average value of f for $0 \le t \le \pi/3$ exactly; give its numerical value.

d)

t	0	$\frac{\pi}{12}$	$\frac{2\pi}{12}$	$\frac{3\pi}{12}$	$\frac{4\pi}{12}$
$f(t)$	0	π	0	-3π	0

This table are the data points for the n=4 Riemann division of this interval. Use the midpoint rule (not the trapezoid rule) to estimate the average value of part c) as accurately as possible, using only these data points. Give the exact estimate and its numerical value.

② a) Evaluate $\int \dfrac{x}{(8-2x)^{1/3}}\,dx$.

b) Evaluate $\int_0^{7/2} \dfrac{x}{(8-2x)^{1/3}}\,dx$ (exactly).

③ a) Evaluate $\int \dfrac{x}{x^2-9}\,dx$.

b) Does $\int_{-1}^{2} \dfrac{x}{x^2-9}\,dx = \ln\left(\dfrac{5}{9}\right)^{1/2}$? Explain.

④ Find the area between the curves $y = \cos x$ and $y = \sin x$ over the interval $0 \le x \le \pi/2$.

⑤ Use the Riemann sum limit definition to evaluate $\int_1^3 (3-x)\,dx$.

$\left[\text{Recall } \displaystyle\sum_{i=1}^{n} 1 = n,\ \sum_{i=1}^{n} i = \dfrac{n(n+1)}{2},\ \sum_{i=1}^{n} i^2 = \dfrac{n(n+1)(2n+1)}{6}.\right]$
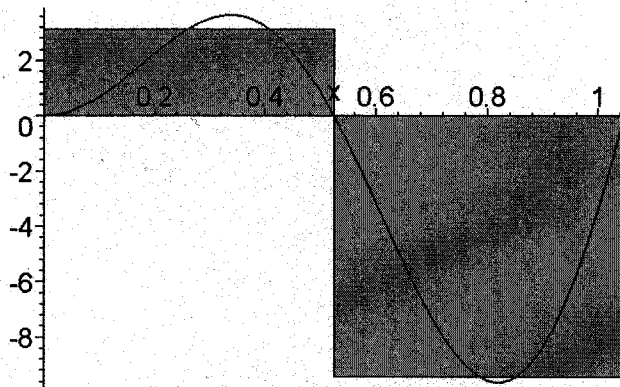
After completing the exam, read and sign the following pledge, if it applies to you:

During this examination, all work has been my own and I have not opened any software other than MAPLE on my computer. I give my word as a decent human being that I have not resorted to any ethically questionable means of improving my performance or that of any one else on this examination, nor will I after I complete it.
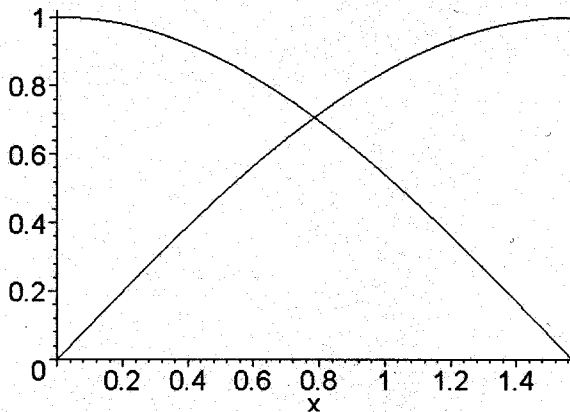
Date: March 2, 2001   Signature:

```
> with(student): f:=t->12*t*sin(6*t); middlebox(f(x),x=0..Pi/3,2);
```

$$f := t \rightarrow 12\,t\sin(6\,t)$$


```
> plot([cos(x),sin(x)],x=0..Pi/2,color=black);
```



```
>
```