MULTIPLE CHOICE SECTION - EACH PROBLEM IS WORTH 5 POINTS
(In Problems 1-11 mark the correct answer on the front cover)

1. An investment grows at the rate of $s(t) = 1000e^{0.05t}$ dollars per year. If $10,000 was initially invested, find the value of the investment after t years.

(a) $50e^{0.05t} + 10,000$ (b) $20,000e^{0.05t} + 10,000$ (c) $50e^{0.05t} + 9,950$

(d) $20,000e^{0.05t} - 10,000$ (e) $10,000e^{0.05t}$

2. Consider the initial value problem:

$$\frac{dy}{dx} = 4x^{\frac{1}{3}} - 2, \quad y(0) = -1.$$

What is $y(1)$?

(a) 7/3 (b) 2 (c) 0 (d) $-9/4$ (e) 1

3. The substitution $u = x - 2$ changes the integral

$$\int x\sqrt{x-2}\ dx$$

into which of the following integrals?

(a) $\int \sqrt{u}\ du$ (b) $\int (u^2 + 2u) du$ (c) $\int (u^{\frac{3}{2}} + 2u) du$

(d) $\int (u^{\frac{3}{2}} + 2u^{\frac{1}{2}}) du$ (e) $\int (u^{\frac{5}{2}} - 2u^{\frac{1}{2}}) du$

4. Which of the following expressions is the Riemann sum for the integral

$$\int_0^2 \frac{1}{1+x} dx$$

using 4 subintervals and left endpoints?

(a) $\frac{1}{2}(1 + \frac{2}{3} + \frac{1}{2} + \frac{2}{5})$ (b) $\frac{1}{2}(1 + \frac{3}{2} + 2 + \frac{5}{2})$ (c) $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$

(d) $\frac{1}{2}(\frac{2}{3} + \frac{1}{2} + \frac{2}{5} + \frac{1}{3})$ (e) $\frac{3}{2} + 2 + \frac{5}{2} + 3$

5. Which of the following expressions gives the area between the line $y = 1 - x$ and the x-axis from $x = 0$ to $x = 3$? Hint: Sketch the graph.

(a) $\int_0^3 (1-x) dx$ (b) $\int_0^1 (1-x) dx - \int_1^3 (1-x) dx$

(c) $-\int_0^3 (1-x) dx$ (d) $-\int_0^2 (1-x) dx + \int_2^3 (1-x) dx$

(e) $-\int_0^{1.5} (1-x) dx + \int_{1.5}^3 (1-x) dx$

6. Using the method of integration by parts with $u = x^2$ and $v' = e^x$, the integral

$$\int x^2 e^x dx$$

becomes which of the following expressions?

(a) $2xe^x - \int x^2 e^x dx$ (b) $\int x^2 e^x dx - 2xe^x$ (c) $x^2 e^x - \int 2xe^x dx$

(d) $x^2 e^x - \int xe^x dx$ (e) $\int x^2 e^x dx + xe^x$

7. Find $\int_{-3}^{3} \sqrt{9 - x^2}\ dx$.

(a) 9π (b) $-\dfrac{9\pi}{2}$ (c) $-\dfrac{9\pi}{4}$ (d) $\dfrac{9\pi}{4}$ (e) $\dfrac{9\pi}{2}$

8. Find $\displaystyle\int_0^2 \frac{4x + 4}{x^2 + 2x + 1} dx.$

(a) $2 \ln 9$ (b) $-\frac{160}{81}$ (c) $\ln 9$ (d) $-\frac{80}{81}$ (e) $2 \ln 8$

9. Suppose the function $f(x)$ takes the following values:

x	-1	-0.5	0	0.5	1
$f(x)$	-2	2	1	-1	0

Estimate $\int_{-1}^{1} f(x)dx$ by computing a Riemann sum with 4 subintervals and right endpoints.

(a) -1 (b) -2 (c) 0 (d) 2 (e) 1

10. Which of the following methods would you use to find $\int x^3 \ln(2x)dx$?

(a) Substitution with $u = x^2$.
(b) Integration by parts with $u = x^3$ and $v' = \ln(2x)$.
(c) Substitution with $u = \ln(2x)$.
(d) Integration by parts with $u = \ln(2x)$ and $v' = x^3$.
(e) Partial fractions.

11. The graph of a function $f(x)$ is sketched below. If the area of region A is 2 and the area of region B is 3, what is $\int_{-2}^{3} f(x)dx$?

(a) -2 (b) -1 (c) 1 (d) 3 (e) 5

PARTIAL CREDIT SECTION
(In Problems 12-14 show all work on the paper)

12. (Partial credit, 15 points) The marginal profit function for producing and selling x widgets is given by $MP = -2x + 1000$. When 100 widgets are sold, the company's profit is \$40,000.

a) Determine how many widgets should be sold for the company to maximize its profit.

b) Find the profit function.

c) Compute the maximum possible profit.

13. (Partial credit, 10 points)

a) Find the partial fractions decomposition of the function $f(x) = \frac{1}{x^2+4x+3}$. That is find A and B so that

$$\frac{1}{x^2+4x+3} = \frac{1}{(x+1)(x+3)} = \frac{A}{x+1} + \frac{B}{x+3}.$$

b) Find $\displaystyle\int_4^6 -\frac{1/3}{x+2} dx$.

14. (Partial credit, 10 points) Consider the functions $f(x) = x^2 - 8$ and $g(x) = 2x + 7$.

a) Find the x-values of the points where the graphs of $f(x)$ and $g(x)$ intersect.

b) Write (in simplified form) the definite integral which gives the area of the region enclosed by the graphs of $f(x)$ and $g(x)$. **Do not** evaluate the integral.