Show all work on a separate sheet

1. Let R be the region in the first quadrant enclosed by the graphs of $y = x^2 - 2x + 2$ and $y = 1 + 2\sin x$.

   a) Write an expression involving one or more integrals to find the area of the region R.

   b) Write an expression involving one or more integrals to find the volume of the solid generated when R is revolved about the x-axis.

   c) The base of a solid is the region R. Each cross section of the solid perpendicular to the x-axis is a semicircle. Write an expression involving one or more integrals that gives the volume of the solid.

2. The sales of a small company are expected to grow at a rate given by $\frac{ds}{dt} = 100\left(3^{0.2t}\right)$ where t is measured in days and sales in hundreds of dollars.

   a) Determine the average rate of growth over the first 10 days.

   b) Show the geometric meaning of the average rate of growth on a graph of the rate function and explain its significance.

   c) Find the accumulated sales of the company through the first 20 days.

2. Evaluate the following:

   (a) $\int x\cos\left(3x^2\right)dx$ (b) $\int \frac{x^2}{8+3x^3}dx$ (c) $\int 5e^{\cos(3x)}\sin\left(3x\right)dx$

   (d) $\int \frac{\sec^2 x}{1+\tan x}dx$ (e) $\int \sin^3(4x)\cos(4x)dx$

3. The acceleration of a particle is given by $a(t) = 5 + 2t \quad ft/s^2; t \geq 0$;
   At $t = 0, v(t) = 0$

   (a) What is the velocity of the object at $t = 3$ seconds?

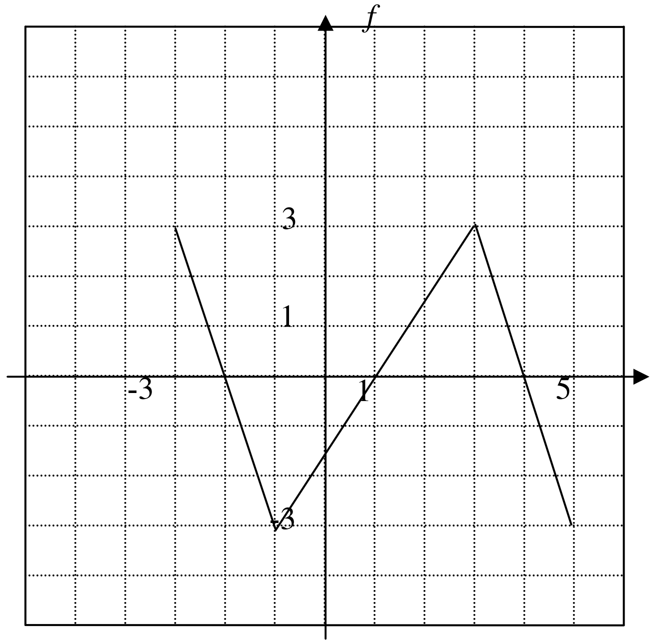
   (b) What is the total distance covered by the object during the first 3 seconds?

AB CALCULUS

SEMESTER B REVIEW

2. The graph of a function f defined on the closed interval [-3,5] is given below. Let g be the function defined by $g(x) = \int_1^x f(t)dt$.

(a) Find each of the following: g(1), g(4), g(-1).
(b) Find all values of x for which g has a relative maximum on the open interval (-3,5). Justify your answer.
(c) Find all values of x for which g is decreasing.
(d) Write an equation of the tangent line to the graph of g at $x = 4$.
(e) Find the x-coordinate of each point of inflection of the graph of g on the open interval (-3,5). Justify your answer.



2. Given that $\int_0^5 f(x)dx = 8$ and $\int_0^5 g(x)dx = 4$, evaluate each of the following:

(a) $\int_0^5 [f(x)+4]dx$ (b) $\int_0^5 [3g(x)+x]dx$

7. (a) $\frac{d}{dx}\int_1^x \frac{dt}{t^2+1}$ (b) If $f(x) = \int_1^x e^t \cos t dt$, find $f'(2)$

8. Let $f(x) = 3\sin\left(\frac{x}{3}\right)+1$ and $g(x) = x^2 - 8x + 10$

(a) Sketch the graphs of f and g and find their points of intersection.
(b) Find the area enclosed by the graphs of f and g.

AB CALCULUS

SEMESTER B REVIEW

8. Use $u = 5x - 2$ to write an integral equivalent to $\int_0^3 x^2 \sqrt{5x-2}\,dx$

9. Sales of televisions grow at a rate proportional to the amount present (t is measured in days).
   (a) Set up a differential equation to model this problem.
   (b) Solve the differential equation if at t = 0, there are 20 televisions sold and after 3 days, 500 televisions are sold.

11. NO CALCULATOR

(a) $\int_1^e \frac{x+1}{x}dx$ (b) $\int_0^2 \left(3t^2 + 4t + 6\right)dt$

12. Let $f(x) = \frac{\ln x}{x}$. Find the average value of f on [2, 5].

13. Solve:

a) $\frac{dy}{dx} = xy$ for y, if $y(4) = e$.

b) $\frac{dy}{dx} = \frac{x^2 - 1}{3y}, y(0) = 2$ when y(0) = 2

14. Let $F(x)$ be an antiderivative of $x\cos\left(x^2\right)$. If F(0) = 0, find F(3).

15. The rate at which a student learns vocabulary words is given by the equation $\frac{dw}{dt} = (75 - w)$.
   a) Solve the differential equation if at t = 0, 10 words are learned.
   b) What is the maximum number of words learned?