PART 5

1. Integrate:

(a) $\int_1^2 (2x^3 - x + 5)dx$ (b) $\int (x^2+7)^2 dx$ (c) $\int_0^1 2x(3x^2-1)^4 dx$ (d) $\int 4xe^{2x} dx$

(e) $\int \frac{x}{(x+1)^2} dx$ (f) $\int (2x^2 - 3x + 5)dx$ (g) $\int \left(3e^x - \frac{1}{x}\right)dx$ (h) $\int \frac{\ln x}{\sqrt{x}} dx$

(i) $\int_0^1 (2x-5)e^{x^2-5x} dx$ (j) $\int \frac{2x^2+x-1}{x^2} dx$ (k) $\int xe^x dx$ (l) $\int_1^4 \left(\sqrt{x} + \frac{1}{x}\right) dx$

(m) $\int \frac{e^{\sqrt{x}}}{\sqrt{x}} dx$ (n) $\int_1^e \frac{\ln x}{x^2} dx$ (0) $\int \frac{e^x}{e^x+1} dx$ (p) $\int \frac{e^x+1}{e^x} dx$

(q) $\int x^2 e^x dx$ (r) $\int \ln x \, dx$ (s) $\int_2^3 x\sqrt{x^2-4}\, dx$ (t) $\int_{-e}^{-1} \frac{1}{x} dx$ (u) $\int_{-e}^{1} \frac{1}{x} dx$

2. Consider the graph of f below. The graph is not drawn to a consistent scale but the roots are valid as marked. Also, suppose that the following integral values all apply to the function f.

$$\int_c^d f(x)dx = 5 \qquad \int_e^c f(x)dx = -2 \qquad \int_d^b f(x)dx = 4 \qquad \int_a^b f(x)dx = 0$$

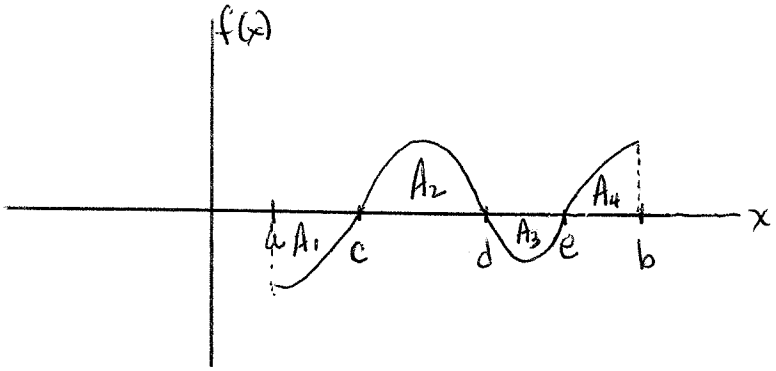
Find the values for the areas (between f and the x-axis) indicated.

$A_1 =$

$A_2 =$

$A_3 =$

$A_4 =$



3. (a) Find the cost function $C(x)$ if the marginal cost is $C'(x) = 4x - 5$ and the fixed cost is \$8.

(b) Find the function $f(x)$ such that $f'(x) = 6x^2 - 4$ and $f(2) = 5$.

4. (a) Find the area of the region enclosed by $f(x) = x^2 - 2$ and $g(x) = x$.

(b) Find the area of the region bounded by $f(x) = x^2 + 2x + 1$ and $g(x) = 2x - 4$ on the interval $[-1, 3]$.

(c) Find the area of the region enclosed by $f(x) = x^2 - 2x$ and $g(x) = x$ on the interval $[-1, 4]$.

(d) Find the total area between the curves $f(x) = 3x^3 + x^2 + 4x + 1$ and $g(x) = 2x^3 + x^2 + 20x + 1$ over the interval $[-5, 2]$.

(e) Sketch the area enclosed by $y = x^2 - 4x$, $y = 2x$, $x = 1$ and $x = 4$. Set up, but do not evaluate, the integral needed to calculate the area of the enclosure.

5. An object is moving back and forth in a straight line with a velocity expressed by the following function: $v(t) = t^2 - t - 6$. It starts at a position +8 cm from the origin.
(a) Find its position as a function of time
(b) Where will it be when $t = 2$?
(c) Where will it be when its velocity is zero?

6. The derivative of function f is $f'(x) = 3x^2 - 4x + 1$.
(a) Find $f(x)$, given that the point (2, 15) is on the graph of f.
(b) What is the total signed area of f on the interval [0, 2] ?
(c) What is the average value of f over the interval [0, 2] ?

7. (a) Find the average value of the function $f(x) = x^2 - 2$ on the interval [-1, 5] ?

(b) The price per share of stock is found to be $S(t) = 25 - 5e^{-.01t}$. Find the average price of the stock over the first six years.

8. The "Can You Dig It" backhoe company has installed a new assembly line for their latest model of energy efficient machines. They expect to produce backhoes at the rate of $30\sqrt{t}$ machines/week at the end of t weeks.
(a) How many backhoes do they expect to produce during the first 36 weeks of production?
(b) What is the average number of backhoes they expect to produce each week during this 36 week time period?

9. An annuity provides a constant income for a retiree's life time of \$10,000 per year. The typical person lives 15 years after retirement. Suppose the money can be invested at a rate of 8% per year compounded continuously. What is the present value of the annuity? (You may leave your answer in exponential form)

10. A parent saving for her child's college expenses is transferring money into a savings account at a constant rate of $5000 per year. The account earns 5% compounded continuously. How much will the account be worth at the end of 12 years? (You may leave your answer in exponential form)

11. Congratulations! You have won second place in a beauty contest. You are offered a choice between two prizes. Which will you take if you know that you can invest your winnings in a savings account that pays 4% compounded continuously? Prize Choice A: $60 per year, paid at a continuous rate, for 25 years! Prize Choice B: $1,300 cash right now!

12. You own investments into which income is flowing continuously at a rate of $2,000 per year over the next five years. Your investment earns interest at a rate of 12% compounded continuously.

(a) What is the total money flow during the five year period?

(b) What is the present value of your investments.

(c) What will be the accumulated value of your investments at the end of five years?

(d) What will be the total interest earned if you hold on to your investments for the entire five years?

13. The yearly income for your business is coming in at a rate of $f(t) = 1000t$. Assume that the money is coming in continuously throughout the year.

(a) What is the total money flow over the next four years?

(b) What is the present value of the company over the next four years if you can get a 25% return on it?

(c) What is the total accumulated value of the money after four years?

14. Do these integral converge or diverge? If an integral converges, find its value. In either case, justify your answer.

(a) $\int_1^\infty \frac{1}{\sqrt{x}}\,dx$ (b) $\int_1^\infty \frac{1}{x}\,dx$ (c) $\int_1^\infty \frac{1}{x^2}\,dx$ (d) $\int_1^\infty \frac{1}{x^3}\,dx$