This week, we study Laplace Transforms, one of the most useful transforms in all of mathematics, because it allows us to move from the “differential” domain to an algebraic domain, operate algebraically to a solution, and then transform back into equation space.

1.) If the electric current$ i$, is the derivative of the charge q, and q’= $i$ =$ 2t $ , find the charge.

3.) An inductor in an electric circuit $V\_{L}=20-.2t$ for a 4 H inductor. Find the current in the circuit

after 10.

4.) Integrate 

5.) Integrate 

6) Integrate using trigonometric substitution 

**Show all work for full credit.**

7) Find the first 5 terms of the geometric sequence: , n = 1,2,3,…

8) Find the first six partial sums of the following series to determine if it converges

or diverges. Give answers correct to five decimal places. 

 S1 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S2 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 S3 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S4 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 S5 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ S6 = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Converge or diverge?

Circle one.

9) Find the Taylor Series approximation for f(x) = cos (-πx) where n = 5 and a = π/3.

10) Find a Maclaurin Series approximation for f(x) = cos(5x) where n = 5.

 **Show all work for full credit.**

11) Find at least three cosine and three sine terms of the Fourier series for 

Give exact values. Use ComDenom to simplify the exact value into a single fraction where necessary.

a0= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a1= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a2= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a3= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b1= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b2= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

b3= \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

f(x) = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Graph the piecewise function and

the Fourier function found above:

12) Solve the differential equation y’ - 2y = 2x + ex

**Show all work for full credit.**

1. The slope of a curve is given by the expressions y’=. Find the equation for

the curve if it passes through the point (-1, 2).

14.) Find the particular solution of the differential equation satisfying the given conditions

, y = 2 and y’ = 1 when x = 1

Use the following table to find the transforms needed for problems 15–20.

 TABLE OF LAPLACE TRANSFORMS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| f(t) = L-1(F) | L(f)= F(s) |  | f(t) = L-1(F) | L(f) = F(s) |
| 1 |  |  | te-at |  |
|  | , n = 1,2,3, |  | tn-1e-at  |  |
| e-at |  |  | e-at (1 – at) |  |
| 1 - e-at |  |  | [(b – a)t + 1] e-at |  |
| cos at  |  |  | sin at – at cos at |  |
| sin at |  |  | t sin at |  |
| 1 - cos at |  |  | sin at + at cos at |  |
| at - sin at |  |  | t cos at |  |
| e-at – e-bt |  |  | e-at sin bt |  |
| ae-at – be-bt |  |  | e-at cos bt |  |

15) Find the LaPlace Transform of the given function.

 f(t) = 4t3e-4t

16) Find the inverse LaPlace Transform of the given function.

 F(s) = 

17) Expand the LaPlace transform of the given expression in terms of x and L(t).

Do not solve.

 7y’’ – 2y’ + 3y , f(0) = 1 and f’(0) = 0

18) Solve the following differential equation using LaPlace Transforms.

 12y’’ + 12y’ + 111y = 0 , y(0) = 1 and y’(0) = - ½

19) Solve the following differential equation using LaPlace Transforms.

 3y’’ + 12y = 3 sin(4t) , given y(0) = 0 and y’(0) = 0