RYERSON UNIVERSITY Winter 2018

Differential Equations and Vector Calculus MTH312

Final Exam (SAMPLE) Time: 120 minutes

Last Name (Print) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

First Name (Print) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Student Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Circle your section:

Section 011 (Lab: Wednesday 12-1pm) Section 021 (Lab: Wednesday4-5pm)

**Instructions:**

1. This test contains six questions on 8 pages, including this cover page.
2. Write neatly and legibly. If you need extra space, use the back of sheets, indicating clearly where your answer continues.
3. In each question, show all your work. The correct answer alone may worth little or nothing.
4. Delete all irrelevant and incorrect work because marks may be deducted for work which is misleading.
5. Do not remove any pages from this test package.

**For instructor’s use only**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Total | |
| Value |  |  |  |  |  |  |  | 50 |
| Marks |  |  |  |  |  |  |  |  |

**GOOD LUCK**

**Question** Find

**Question** Solve the following differential equation by the Laplace transform.



**Question** Solve the system of linear differential equations:

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**Question** Find the Fourier series of the function defined by for , and for with for all x.



**Question**  Evaluate the following surface integral

where S is the part of the plane in the first octant.



**Question** Evaluate the following double integral:

where R is the region bounded by the circle centered at the origin with a radius r=4.

**Solution**: We use polar coordinates and get

**Question** Find the volume of the region bounded above by the sphere , and below by the cone ***Hint***: Use cylindrical coordinates.

**Solution**: When and we have

.

So, the cone and the sphere intersect at . For the region in this problem, they intersect on the plane .

Now we can describe the region Q using the cylindrical coordinates:

So, the volume of this region is

NOTE: This can be solved using spherical coordinates. Read the solution to Example 8 in my notes or Exercise 78 on the text