

Math 2415

Problem Section #13

This week we will do problems from 16.1-16.2 as well as review for the Final Exam.

Based on past experience, about 50% of the points on the final exam will be on material from 15.3 onwards. In the next problem session, we will post the same set of exam review problems.

16.1: Vector Fields

1. Sketch the vector field $\mathbf{F}(x, y) = -x\mathbf{j}$
2. Sketch the vector field $\mathbf{F}(x, y) = x\mathbf{i} + (x - y)\mathbf{j}$
3. Let $f(x, y) = y - x^2$. Calculate the gradient vector field $F = \nabla f$ and sketch it.

16.2: Line Integrals

1. In this problem you will evaluate $\int_C x^2 ds$, where C is the segment of the curve $y^2 = x^3$ from the origin to $(1, 1)$.
 - (a) Parametrize the curve C in such a way that x and y are both of the form t^k for some integer k . (You will need a different k for y than for x .)
 - (b) This integral is the integral of a function rather than of a vector field. Why?
 - (c) Make a rough sketch of the curve C .
 - (d) Based on your sketch and the values of the integrand along C , do you expect the integral to be positive, negative, or zero?
 - (e) Finally, evaluate the integral.
2. In this problem you will evaluate $\int_C x^2 dy$, where C is the segment of the curve $x = y^3$ from $(0, 0)$ to $(1, 1)$.
 - (a) Parametrize the curve C .
 - (b) This integral is the integral of a vector field rather than of a function. Why?
 - (c) What is the formula for the vector field being integrated?
 - (d) Make a (rough) sketch of this vector field and add the curve C to your sketch.
 - (e) Based on your sketch, do you expect the integral to be positive, negative, or zero?
 - (f) Finally, evaluate the integral.
3. Evaluate $\int_C y^2 dx + x^2 dy$, where C is the arc of the circle $x^2 + y^2 = 9$ from $(0, 3)$ to $(3, 0)$ traversed clockwise. This integral represents the work done by a force on a moving particle. What is the formula for the force? Along what path does the particle move?

Final Exam Review

Here are a long list of problems you could work on, many of which are exam questions from past semesters.

Also see Dr. Makhijani's [Final Exam Practice Problems](#), for which there are solutions [past exams webpage](#).

1. Stewart, 15.6.21
2. Stewart, 15.7.21
3. Stewart, 15.7.25 (a)
4. Stewart, 15.8.23
5. Stewart, 15.Review.30
6. Spring 2014 Final Exam # 8
7. Fall 2009 Exam II # 4
8. Fall 2014 Final Exam # 6
9. Spring 2014 Final Exam # 6
10. Spring 2004 Final: 1
11. Spring 2004 Final: 2
12. Spring 2004 Final: 6
13. Spring 2004 Final: 7 (Part d is on 16.6)
14. Spring 2008 Final: 1
15. Spring 2008 Final: 3
16. Spring 2008 Final: 4
17. Spring 2008 Final: 6
18. Spring 2019 Final: 10 (Based on 16.5)
19. Fall 2009 Final: 4 (Based on 16,.6)
20. Fall 2009 Final: 5
21. Fall 2009 Final: 6
22. Fall 2009 Final: 9