

- **Techniques of integration**
 - **Integration by Parts** How do you choose u and v' strategically? When do you have to integrate by parts twice or three times? How do you do it properly? When do you use the “circle trick”? Watch those constants, especially when you integrate by parts twice!
 - **Integration by Partial Fractions** How do you find A and B ? How do you rewrite the integral using them, and once that’s done, how do you actually calculate it?
 - **Powers and combinations of trig functions** If one of the powers is even, you should be able to do conversions based on $\sin^2(x) + \cos^2(x) = 1$. If not, then you’ll have to use double and half angle formulas. Make sure you have those memorized! How do you use double angle formulas to simplify integrals? How can you alternatively use integration by parts and the circle trick to solve integrals of the form $\sin^n(x)$ for n even?
- **Polar Coordinates** What’s up with $r d\theta$? Can you recognize equations for circles (at the origin and away), limacons, flowers, and other similar shapes? How do you find the intersection of curves? What’s “wrong” with polar coordinates? How do you find the area traced out by a curve in polar coordinates? by two curves? How can you use the r and θ graph in rectangular coordinates to infer the rough shape of the proper graph in polar coordinates?
- **Parametric Equations** How do you calculate the distance travelled by an object moving according to certain parametric equations $x(t)$ and $y(t)$? What do $\frac{dx}{dt}$ and $\frac{dy}{dt}$ tell you about the motion? How can you find $\frac{dy}{dx}$? How can you find the equation of motion for an object released from its constraints? Given parametric equations, how do you find an equation involving only x and y describing the path of motion? What if the path (relationship between x and y) is given? How do you find parametric equations?

How do you do all those things if r and θ are given as functions of t instead of x and y ? How can you convert parametric polar to parametric Cartesian?
- **Differential Equations** What is a differential equation? What does it mean to be a solution to a differential equation? How many solutions to a differential equation of order n do you expect? What are initial conditions? How do they help you get a particular solution from a whole family of solutions?

How do you recognize separable differential equations? How do you actually separate variables? What do you do after separating dx ’s from dy ’s? How do you treat the constant of integration that results? What is the order of a separable differential equation?

Are second order linear homogenous differential equations separable? How do you solve them? What assumption about the form of $y (= e^{rx})$ results in the characteristic equation? What does solving the characteristic equation accomplish? If the solutions are complex values of r , how do you convert those complex solutions to real solutions by linear combinations?

Good luck and best wishes!

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