1. First-order equations $dy/dt = f(t, y)$

1. What is a solution to a differential equation? How do I verify that a something is a solution?
2. How do I solve a separable ODE?
3. How do I solve a linear ODE?
4. What is an autonomous ODE?
5. What is an equilibrium?
6. What types of equilibria of $dy/dt = f(y)$ are there and how are they characterized?
7. What is the phase line? How do I draw it?
8. How does the Euler method work?
9. What is the statement of the Existence and Uniqueness Theorem? What is its geometric meaning?
10. How does one change variables in an ODE?

2. Planar systems $dY/dt = F(Y)$

1. What is a solution to a system of ODEs?
2. What is an equilibrium of a system of ODEs? How do I find the equilibria?
3. What is the vector field? What is the direction field? How do I draw them?
4. What is the relation between the vector field and solutions?
5. What is an eigenvalue of a $2 \times 2$ matrix $A$?
6. What is an eigenvector?
7. What is the characteristic polynomial $A$? How does it depend on the trace and determinant of $A$?
8. How many equilibria can a linear system $dY/dt = AY$ have?
9. How do I find the straight line solutions to a linear system?
10. How do I find the general solution when the eigenvalues are: real and distinct, real and repeated, complex? How do I solve an initial value problem?
11. What is the phase portrait and how do I draw it?
12. If $\det A \neq 0$, what are all the possible types of equilibria of $dY/dt = AY$? How does the type of an equilibrium depend on the eigenvalues of $A$?
13. What is the trace-determinant plane?
14. How do I solve a second-order homogeneous linear ODE with constant coefficients?
15. What is a (simple, unforced) harmonic oscillator?
16. What types of harmonic oscillators are there?
17. What are the possible types of qualitative behavior of harmonic oscillators?

3. The Laplace transform

1. What is the definition of the Laplace transform?
2. What are the main properties of the Laplace transform?
3. What is the Laplace transform of $1, e^{at}, t^n, \sin \omega t, \cos \omega t$?
4. What is the Laplace transform of $dy/dt$ in terms of the Laplace transform of $y$?
5. What is the Laplace transform of $u_a(t)f(t-a)$ in terms of the Laplace transform of $f$?
6. What is the Laplace transform of $e^{at}f(t)$ in terms of the Laplace transform of $f$?
7. What is the definition of the inverse Laplace transform?
8. Rephrase and answer questions 3.–6. for the inverse Laplace transform.
9. How do I solve a linear (first- or second-order) ODE using the Laplace transform?
10. How do I model and analyze a harmonic oscillator with discontinuous forcing?