MAT 17B, Fall 2020
Practice problems for Midterm 2

This practice sheet contains more problems that the actual exam

1. Find the area:
a) Between the parabola $y = x^2$ and the line$y = 3x - 2$
b) Between the lines $x = 0, y = x$ and $y = 3 - 2x$.
c) Between the hyperbola $y = 1/x$ and the line $y = \frac{5}{2} - x$
d) Between the parabolas $y = x^2 - 3$ and $y = 5 - 3x^2$
e) Between the graph of $y = (x^2 - 1)^2$ and the line $y = 0$.

2. Consider the function$f(x) = \frac{1}{2}(e^x + e^{-x})$
a) Let R be the region bounded by the graph of $f(x)$ and the lines $x = 1, x = -1$ and $y = 0$. Find the area of R.
b) Consider the solid obtained by rotation of R about the x-axis. Find its volume.

3. Are the following functions solutions to the differential equation

$$y' = x + y \ ?$$

a) $y(x) = -x - 1$
b) $y(x) = 3e^x$
c) $y(x) = 2e^x - x - 1$
d) $y(x) = e^x - x$

4. Consider the differential equation $y' = y(y - 1)^2(y - 2)$.
a) Find all equilibrium solutions.
b) Sketch the phase plot and determine if the equilibrium solutions are stable or unstable
c) Determine where $y(t)$ is increasing or decreasing
d) Sketch the graphs of solutions for this equation.
e) Find the limit $\lim_{t\to+\infty} y(t)$ depending on the initial condition $y(0)$.

5. Solve the following differential equations:
a) $y' = 7\sqrt{x} + \sin x$
b) $y' = 0.5y,\ y(0) = 100$
c) $y' = y^2,\ y(0) = 1$
d) $y' = \frac{x}{y}$.