Math 242,   Final Exam,   Fall 2016

Write everything on the blank paper provided. **You should KEEP this piece of paper.** If possible: return the problems in order (use as much paper as necessary), use only one side of each piece of paper, and leave 1 square inch in the upper left hand corner for the staple. If you forget some of these requests, don't worry about it – I will still grade your exam.

The exam is worth 100 points. Please make your work coherent, complete, and correct. Please $\boxed{CIRCLE}$ your answer.

No Calculators or Cell phones.

(1) (14 points) Find $\mathcal{L}^{-1}\left(\ln\left(\frac{s-2}{s+2}\right)\right)$.

(2) (14 points) Find $\mathcal{L}\left(\sin^2(5t)\right)$.

(3) (14 points) Find one non-trivial solution of $tx'' - 2x' + tx = 0$ with $x(0) = 0$.

(4) (14 points) Find the general solution of $3y'' + y' - 2y = 2\cos x$.

(5) (14 points) Solve $2xy\frac{dy}{dx} = 4x^2 + 3y^2$. Express your answer in the form $y = y(x)$.

(6) (15 points) A motor boat is moving at 50 feet per second when its motor suddenly quits and 10 seconds later the boat has slowed to 40 feet/second. The only force acting on the boat is resistance and resistance is proportional to velocity. How far will the boat coast in all?

(7) (15 points) A 120 gal. tank initially contains 90 lbs of salt dissolved in 90 gal. of water. Brine containing 2 lb./gal. of salt flows into the tank at the rate of 4 gal./min., and the well-stirred mixture flows out of the tank at the rate of 3 gal./min. How much salt does the tank contain when it is full?