

**DO NOT TURN OVER UNTIL
INSTRUCTED TO DO SO.**

CALCULATORS ARE NOT PERMITTED

**YOU MAY USE YOUR OWN BLANK
PAPER FOR ROUGH WORK**

**SO AS NOT TO DISTURB OTHER
STUDENTS, EVERYONE MUST STAY
UNTIL THE EXAM IS COMPLETE**

**REMEMBER THIS EXAM IS GRADED BY
A HUMAN BEING. WRITE YOUR
SOLUTIONS NEATLY AND
COHERENTLY, OR THEY RISK NOT
RECEIVING FULL CREDIT**

Name and section: _____

GSI's name: _____

This exam consists of 5 questions. Answer the questions in the spaces provided.

1. Compute the following integrals:

(a) (10 points)

$$\int x \sec^2(3x^2) dx$$

Solution:

(b) (10 points)

$$\int x^2 \ln(x^4) dx.$$

Solution:

2. (25 points) Find a general solution to the following differential equation:

$$xy' + 4y = e^{x^4}$$

Solution:

3. (20 points) The population density at distance t miles from the centre of a city is $1000 \cos(t/2)$ people per square kilometer. How many people live between 1 and 2 km of the city center? You do not need to simplify your answer.

Solution:

4. (a) (10 points) Find a general solution to the following differential equation:

$$y' = te^t(y - 1)$$

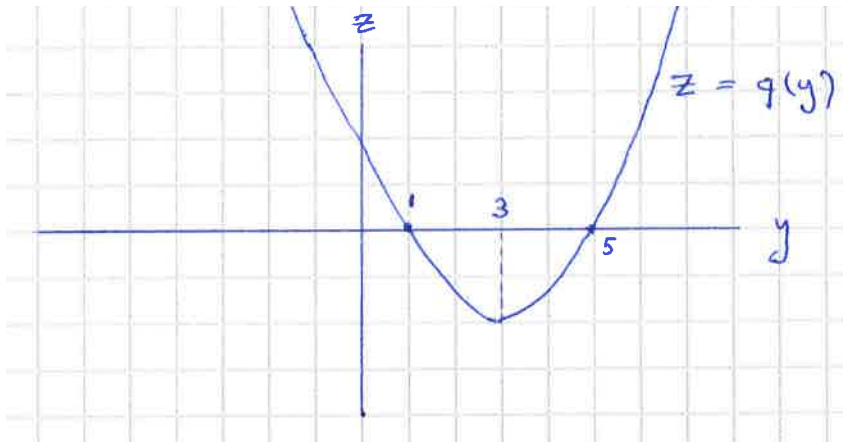
Solution:

- (b) (5 points) Using part(a) find a solution which satisfies the initial condition

$$y(1) = 1.$$

Solution:

5. (20 points) Consider the differential equation of the form $y' = q(y)$, where the graph $z = q(y)$ is as follows:



Sketch a solution for each of the following initial conditions: $y(0) = -2$, $y(0) = 5$ and $y(0) = 4$.

Solution:

