

King Fahd Univ. of Petroleum and Minerals
Faculty of Sciences
Department of Mathematical Sciences

MAJOR No. 1
(MATH. 260-053 Sections 2 and 3)

Name:

ID:

Important instructions:

- Use an HB pencil or a pen (do not use red color)
- Solve the problems completely
- Write down your answers in a clear manner
- Justify all your steps
- Use the back of the page (verso) only for scratching

Prob. 1

Write a differential equation having the function g as its solution where g is such that its graph is normal to every curve of the form $y = \frac{1}{3}x^2 + k$ (k is a constant) where they meet and then solve it.

Prob. 2

The brakes of a car are applied when it is moving at 145 km/h and provide a constant deceleration of 16 meters per second square (m/s^2). How far does the car travel before coming to a stop?

Prob. 3

Just before midday the body of an apparent homicide victim is found in a room that is kept at a constant temperature of 55° F. At 7 am the temperature of the body is 70° F and at 9 am it is 56° F. Assume that the temperature of the body at the time of death was 92.8° F and that it has cooled in accord with Newton's law. What was the time of death?

Prob. 4

Solve the initial value problem

$$\begin{cases} (v^2 + 1)\frac{du}{dv} - 6v \exp(-\frac{3}{2}v^2) = -3v^3u \\ u(0) = 2. \end{cases}$$

Prob. 5

Solve by Gauss elimination method

$$\begin{cases} x + 5y + 6z = 3 \\ 5x + 2y - 10z = 1 \\ 8x + 17y + 8z = 5 \end{cases}$$

Prob. 6

Under what condition on the constants a , b and c does the system

$$\begin{cases} 3x + 5y + z = a \\ -x + 2y - 7z = b \\ 5x + 7y + 4z = c \end{cases}$$

have a unique solution? No solution? Infinitely many solutions?

Prob. 7

Show (prove and not only check) that the solution curves of the differential equation

$$-\frac{t}{x} \frac{dx}{dt} = \frac{2t^3 - x^3}{2x^3 - t^3}$$

are of the form $t^3 + x^3 = 3Ct$.