MATH 100: GENERAL MATHEMATICS (LAW)

QUESTION ONE

(a) Express the following as a single fraction: $\frac{2}{x+3}-\frac{x-4}{x-1}$ (2mks)

(b) Find $f(-2)$ for the following piece-wise defined function

$$f(x)=\begin{cases}1-5x, & \text{if } x<-2\\ x^2-2x, & \text{if } -2\leq x\leq 1\\ -1+2x, & \text{if } x>1\end{cases}$$ (2mks)

(c) (i)Find the quotient when $4x^4+4x^3-x^2+7x-4$ is divided by $(2x-1)$. (2mks)

(ii) Use long division method to find the remainder when $5x^5+x^3+10x^2+9$ is divided by the factor $(x+1)$. (3mks)

(d) Make x the subject of the formula $F=\sqrt{\frac{ax+b}{cx+d}}$ (3mks)

(e) (i) An open rectangular box measures externally 30 cm long, 25 cm wide and 13 cm deep. If the box is made of wood 1 cm thick, what volume of wood is used? (4mks)

(ii) Find the area of a circle of radius 42 cm. If a sector of angle 80^o is removed from the circle, what area is left? (4mks)

(f) Evaluate $\frac{(-7+\sqrt{16})(-3^2)}{(-6-3)|-2-3|\div 5}$ (4mks)

(g) Let p be the proposition '' He likes shouting'' and q the proposition '' she likes shouting''.

(i) Write in symbolic form the statement '' It is not true that both dislike shouting''. (2mks)

(ii) Construct the truth-table for (a) above. (2mks)

(iii) Write in symbolic form: '' He dislikes shouting or it is not true that she does not dislike shouting'' (2mks)

QUESTION TWO

(a) A legal practitioner goes to work either by matatu or by bus. If he goes by matatu,the probability that he will be late is $\frac{1}{20}$, while if he goes by bus the probability is $\frac{1}{8}$.

(i) Suppose he tosses a coin to decide whether to go by matatu or by bus. What is the probability that he will be late? (3mks)

(ii) If he travels by matatu for 4 successive days, what is the probability that he will be late every day (3mks)

(b) The average number of court cases, C, a law firm handles each year can be modeled by $C = 8\log_4(2 + 6t)$ where t denotes the number of years since the firm's launch. Find the average number of cases handled by the firm each year for the first five years of its operations. (4mks)

(c) The time taken by a committee meeting is partly constant and partly varies as the square of the number of members present. If there are twelve members present the meeting lasts only 56 minutes but with twenty it takes exactly two hours. How long will it last if sixteen members attend? (4mks)

(d) (i) Solve the equation $9x^2 + 12x - 3 = 0$ by completing the square method. (3mks)

(ii) Factorize the following expressions (i) $25x^2 + 40x + 16$ (ii) $x^3 - 2x^2 - 4x + 8$ (3mks)

QUESTION THREE

(a) A particle starts from rest at a point A and moves along a straight line, coming to rest at another point B. During the motion its velocity, v metres per second after t seconds, is given by $v = 9t^2 - 2t^3$. Calculate

(i) the time taken for the particle to reach B (2mks)

(ii) the distance travelled during the first two seconds (2mks)

(iii) the time taken for the particle to attain its maximum velocity (2mks)

(iv) the maximum velocity attained (2mks)

(v) the maximum acceleration during the motion (2mks)

(b) If a curve passes through the point $(-1,4)$ and its gradient at any point is $2x - 1$, find the coordinates of the point on the curve at which the gradient is -7. (2mks)

(c) Find the area lying between the curve $y = 2x^2 - 5x + 6$ and the x-axis, for values of x from 1 to 3. (4mks)

(d) Find the following indefinite integrals

(i) $\int \frac{7}{1+6x} dx$ (2mks)

(ii) $\int \sqrt{1 + 5x^3}\, dx$ (2mks)

QUESTION FOUR

The table below shows the frequency distribution of diameters for 40 tins in millimeters.

Diameter	130-139	140-149	150-159	160-169	170-179	180-189

(mm)						
No. of tins	1	3	7	13	10	6

calculate

(a) the mean for the grouped lengths (4mks)

(b) the median (3mks)

(c) the upper quartile and the lower quartile (4mks)

(d) the 60^{th} percentile (3mks)

(b) the standard deviation of the distribution (6mks)

QUESTION FIVE

(a) The linear model $P = -1200x + 450{,}000$ is used to predict the depreciation of the value of a machine as time ogresses where x is how old the machine is in years and P is the current value of the machine. Find the value of the machine after 11 years. (3mks)

(b) Solve the following equations

(i) $4^x = 3^x$ (3mks)

(ii) $(\log_2 y)^2 - \frac{1}{3}\log_7 y = \frac{2}{3}$ (3mks)

(iii) $2\log x = \sqrt{\log x}$ (3mks)

(c) Find the precise value of $\log_4 \frac{1}{32}$ (2mks)

(d) Simplify $x^2y^{-1} \div [(x^{-1} + y^{-1})^{-1}]^{-1}$ (3mks)

(e) Let $f(x) = -2x^2 + 1$ and $g(x) = 4x - 3$. Find $(f\ o\ g)(x)$
(3mks)

(f) Express the following in scientific notation: 1796×0.0001796 (2mks)

(g) Differentiate the function $y = (4x^2 - 3x + 2)^4$ (2mks)