Answer all questions
Time: One hour

1. (a) Find the equation of a straight line passing through the point (4, -1) and perpendicular to the line of $2x - 3y = 9$.

(b)

i. Let $A = \begin{pmatrix} 1 & -2 & 0 \\ 8 & 7 & -5 \\ 6 & -2 & 3 \end{pmatrix}$ $B = \begin{pmatrix} 8 & 4 & -1 \\ 4 & -3 & -2 \\ 6 & 4 & 1 \end{pmatrix}$ and $C = \begin{pmatrix} 2 & 0 & -5 \\ 1 & 4 & 2 \\ -1 & 0 & -1 \end{pmatrix}$.

Find the matrix $A + 2B - 3C$.

ii. Find the matrix AB if

$$A = \begin{pmatrix} 7 & 3 \\ 2 & 5 \\ 6 & 8 \\ 9 & 0 \end{pmatrix} \text{ and } B = \begin{pmatrix} 7 & 4 & 9 \\ 8 & 1 & 5 \end{pmatrix}.$$

(c) Evaluate the following limits:

i. $\displaystyle\lim_{x \to 4} \frac{x^2 - \sqrt{x}}{4 - x}$;

ii. $\displaystyle\lim_{x \to \alpha} \frac{3x + 5}{x - 9}$;

2. (a) Differentiate the following functions with respect to the variable x:

    i. $y = x^7 (7x^4 + 3)$;

    ii. $y = \dfrac{(x + 3)}{(x^2 + 6x + 2)}$;

    iii. $y = \dfrac{(x^2 + 2x)^4}{(x^3 + 3x^2 + 7)^3}$;

    iv. $y = \log \sqrt{5x^4 + 4x}$.

(b) Integrate the following with respect to x:

    i. $(x + 3)^2$;

    ii. $\dfrac{x^3}{(x^4 + 8)}$;

    iii. e^{8x} ;

    iv. $(3x + 2)(x - 2)$.