Answer all questions   **Time: One hour**

1. (a) Simplify the following:

    i. $\left(\dfrac{27}{8}\right)^{-2/3} \times \dfrac{9}{4} \div \left(\dfrac{121}{256}\right)^{1/2}$;

    ii. $\dfrac{15x^{-2}y^{-4}}{(2y^5)^{-2}x^8}$.

   (b) Factorize the following:

    i. $10x^2 - 17x + 3$;

    ii. $x^3 - 3x^2y + 3xy^2 - y^3$.

   (c) Solve the following equations:

    i. $4^y - 6 \times 2^y - 16 = 0$;

    ii. $3 - x - 2x^2 = 0$.

   (d) If $a^2 + b^2 = 11ab$ then, prove that

$$2\log\left[\frac{a-b}{3}\right] = \log a + \log b.$$

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

    i. $y = e^x \tan x$.

    ii. $y = x \ln x + \ln(x^2 + 1)$.

    iii. $y = x^2 - 3x + 2$.

(b) Evaluate the following:

    i. $\lim\limits_{x \to 0} \left(\dfrac{\sqrt{1+x} - 1}{x} \right)$;

    ii. $\lim\limits_{x \to \infty} \left(\dfrac{12x^4 + 15x^3 + 9}{6x^4 + 9x} \right)$;

    iii. $\lim\limits_{x \to 3} \dfrac{x^2 - 3x}{x^2 - 9}$.

(c) Integrate the following:

    i. $\displaystyle\int \dfrac{2x}{x^2 + 5}\, dx$;

    ii. $\displaystyle\int x\, e^x\, dx$.

(d) Find the turning point of the function $y = x^3 - 3x^2 + 5$, and comment o[...] points.