Math SL PROBLEM SET 35

Section A (Short Answer)

1. **(C6.1 - N) (CA)** Continuing our work with understanding limits, evaluate the following limits (in other words, determine the limiting function value of $f(x)$ in the following scenarios ......)

    a. $\lim\limits_{x \to 2} (3x - 2)$ b. $\lim\limits_{x \to -1} (x^2 - 2x + 3)$ c. $\lim\limits_{x \to \infty} (2 - e^{-x})$

2. **(V4.2 - N) (CA)** Two lines with vector equations of $r_1 = \begin{pmatrix} 0 \\ 6 \\ -1 \end{pmatrix} + \lambda \begin{pmatrix} 7 \\ 3 \\ 1 \end{pmatrix}$ and $r_2 = \begin{pmatrix} 3 \\ 1 \\ 2 \end{pmatrix} + t \begin{pmatrix} 2 \\ 4 \\ -1 \end{pmatrix}$ intersect at the point P. **(Cirrito 12.6.1, p432)**

    a. Find the coordinates of point P.
    b. Find the acute angle between the two lines.

3. **(T3.2, T3.3 - N) (CI)** Given that $\cos(x) = \frac{5}{6}$ and $0 < x < \pi$. Find: **(Oxford 13.1, p448)**

    a. $\sin(2x)$
    b. $\cos(2x)$
    c. $\tan(2x)$
    d. Knowing that $\cos^{-1}\left(\frac{5}{6}\right) = 0.6$ radians, solve the equation $6\cos(x) - 5 = 0$ on the domain of $0 < x < 4\pi$.

4. **(SP5.7, SP5.8 - N) (CA)** Inspired by all you Season 2 athletes (swimmers and ballers) $\Rightarrow$ The random variable, X, refers to an athlete's completion of a daily training program. We are told that X is binomially distributed, where the probability of a successful completion of the training program is 0.78. Mr. Rutherford randomly surveys 8 Season 2 athletes. **(Cirrito 16.1, p527 and Cirrito 16.3.4, p544)**

    a. Determine $P(X = 3)$ and explain what the outcome means.
    b. Determine $P(X > 2)$ and explain what the outcome means.
    c. Hence or otherwise, determine $P(X = 3 \mid X > 2)$

5. **(C6.1 - N) (CA)** Given the function $g(x) = -3x^2 + 5x + 2$, **(Cirrito 18.3, p592)**

   a. determine the value of $g(3)$ as well as determining an expression for $g(3 + h)$
   b. Given your work in Q(a), now let h equal the following values ($h = 1, 0.1, 0.01$ and 0.001) and determine the value of the difference quotient in each case.
   c. What does the difference quotient represent, geometrically?
   d. What does $\lim\limits_{h \to 0} \frac{g(2 + h) - g(2)}{h}$ represent, geometrically?

6. **(T3.5 - E) (CI)** Solve the following trigonometric equations on the domain of $0 < x < 3\pi$. **(Cirrito 10.2.2, p332)**

   a. $\sin(x) - 1 = \cos^2(x)$ b. $\tan(x) = \sin(x)$

Section B (Extended Response/Investigation)

7. **(T3.4 - R,N) (CI)** Given the function $f(x) = \tan(2x + 90°) - \sqrt{3}$, **(Cirrito 16.3.2, p341)**

   a. Find the exact values of the x intercepts, given the domain $0 < x < 360°$.
   b. Find the exact values of the asymptotes of the function.
   c. State the applied transformations of the parent function, $g(x) = \tan(x)$.
   d. Sketch two cycles of $f(x)$.

8. **(V4.2 - N) (CA)** The position of two helicopters X and Y at time t seconds are given by the equations $r_X = \begin{pmatrix} 11 \\ 3 \\ -3 \end{pmatrix} + t \begin{pmatrix} 1 \\ -1 \\ 4 \end{pmatrix}$ and $r_Y = \begin{pmatrix} 1 \\ -7 \\ -2 \end{pmatrix} + t \begin{pmatrix} 2 \\ 1 \\ 9 \end{pmatrix}$. Distances are given in meters. **(Cirrito 12.7.2, p452)**

   a. Find the speed of the two helicopters.
   b. Show that the helicopters do NOT meet.
   c. Find the distance between the helicopters when $t = 10$ seconds.