Math SL PROBLEM SET 41

Section A (Skills/Concepts Consolidation)

1. **(C6.3 - N) (CA)** Graph the function $g(x) = e^{-0.25x}\cos(x)$ on the domain of $-\pi < x < 2\pi$ on your TI-84 and hence determine: **(Cirrito 20.2.2, p651)**

   a. the x-coordinate(s) of the extremas.
   b. the domain interval(s) in which the function values are increasing.
   c. the estimated value(s) of the x-coordinates of the inflection point(s).
   d. the domain interval(s) in which the function is concave down.
   e. Include a sketch, labelling the important points from (a) and (c).

2. **(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. and hence, determine an expression for the difference quotient, $\frac{g(3+h)-g(3)}{h}$
   c. Given your work in Q(a) and Q(b), 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.
   d. What does the difference quotient represent, geometrically?
   e. What does $\lim_{h\to 0}\frac{g(3+h)-g(3)}{h}$ represent, geometrically?

3. (**C6.1 - N**) (**CA**) Continuing this work with understanding limits, evaluate the following limits - my suggestion is to graph each function. (in other words, determine the limiting function value of $f(x)$ in the following scenarios ……)

   a. (i) $\lim_{x\to -1}(5)$ (ii) $\lim_{x\to -\frac{5}{2}}(-x+2)$ (iii) $\lim_{x\to 2}(x^3 - x^2 - 4)$

   b. (i) $\lim_{x\to 1}(-\frac{x^2}{2} + 2x + 4)$ (ii) $\lim_{x\to 3}(-\sqrt{x+3})$ (iii) $\lim_{x\to \frac{3}{2}}(-\sqrt{4+2x})$

4. (**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 $f(x)$.

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Section B (Skills/Concepts Practice)

5. **(V4.2 - N) (CA)** You know how to add vectors and subtract vectors and multiply vectors by scalar multiples, but how do you multiply vectors? Here are three video links to something called the dot product (or scalar product) of vectors. Video 1 from *Patrickjmt* and Video 2 from *mathispower4u* will simply show you HOW to do the process but Video 3 from *BetterExplained* will explain the *WHY* behind the *HOW,* and give you a better intuitive understanding of **dot product**. After watching the videos, answer the following questions: **(Cirrito 12.6.1, p432)**

   a. Find the angle between vectors $\boldsymbol{a}$ and $\boldsymbol{b}$ if $\boldsymbol{a} = \boldsymbol{i} + 2\boldsymbol{j} - 4\boldsymbol{k}$ and $\boldsymbol{b} = 4\boldsymbol{i} + 2\boldsymbol{j} + 6\boldsymbol{k}$.

   b. Are the vectors $u = \begin{pmatrix} -8 \\ 2 \\ 2 \end{pmatrix}$ and $v = \begin{pmatrix} -2 \\ 5 \\ -13 \end{pmatrix}$ parallel, perpendicular or neither?

6. **(T3.5 - E) (CA)** Solve the equation $2\sin(x) = \cos(2x)$ on the domain of $-2\pi \leq x \leq \pi$. **(Cirrito 10.2.2, p332)**

7. **(V4.3 - N) (CA)** A boat is initially located at a location defined by $\begin{pmatrix} 5 \\ -10 \end{pmatrix}$ and its motion along a straight line path is defined by $r_1 = \begin{pmatrix} 5 \\ -10 \end{pmatrix} + t\begin{pmatrix} -10 \\ 24 \end{pmatrix}$, where t is time in hours and distances are measured in kilometers. Determine **(Cirrito 12.7.2, p452)**

   a. The position of the boat after 1 hour.
   b. The speed of the boat.
   c. Find the direction that the boat is taking (its bearing) and hence, state its velocity.
   d. How long does it take the boat to reach the position defined by $(x, y) = -65\boldsymbol{i} + 158\boldsymbol{j}$?
   e. Does the boat ever reach the position defined by $\begin{pmatrix} -100 \\ 240 \end{pmatrix}$?
   f. How long does it take for the boat to travel 100km? Where is it located at that moment?

8. **(T3.5 - E) (CI)** Solve the following trig equations on the domain of $0 < x < 2\pi$. **(Cirrito 10.2.2, p332)**

   a. $2\cos^2 x + 3\sin x = 0$
   b. $2\sin^2 x - 3\cos x = 0$
   c. $\cos 2x + 3\sin x - 2 = 0$