Math SL PROBLEM SET 47

Section A (Short Answer)

1. **(F2.4, F2.7 - E) (CA)** Identify the possible integers, k, that allow each quadratic trinomial to be factored over the integers. **(Cirrito 2.4.1, p41)**
   a. $kx^2 + 5x + 2$ b. $9x^2 + kx - 5$ c. $12x^2 - 20x + k$

2. **(C6.2, C6.6 - N) (CI)** The position at t seconds of a particle moving along a straight line is given by $s(t) = 3t^3 - 40.5t^2 + 162t$, where s is measured in meters and $t \geq 0$. **(Cirrito 21.3, p694)**

   a. Find the position at $t = 4$ s.
   b. Is the particle moving forwards or backwards at t = 4? How do you know?
   c. Determine the speed of the particle at $t = 2$ s.
   d. Determine the average speed in the first 3 seconds of travelling.
   e. Determine when the particle's speed is increasing
   f. Determine when the particle's acceleration is 0.

3. **(T3.6 - E) (CA)** Mohamed is taking a weather balloon ride. When the balloon is 900m in the air, he sees a church at S38°E (a bearing of 142°) with an angle of depression of 28° . He continues to rise another 100m and turns to see an art gallery at S71°W (a bearing of 251°) and an angle of depression of 19°. How far is the church from the art gallery? **(Cirrito 9.6, p308)**

4. **(C6.2, C6.3 - N) (CI)** Determine the points of inflection and the intervals of concavity for the graph of $f(x) = 2x^4 - 4x^3$. **(Cirrito 20.3, p672)**

5. **(SP5.8 - E) (CA)** Mr. Smith is playing a game, wherein he is tossing a biased coin. The probability of obtaining heads on this biased coin is ⅓ . **(Cirrito 16.3, p544)**

   a. He tosses the coin five times. Find the probability of getting
      i. at least three heads;
      ii. two heads and three tails.

   b. Mr. Dunham also plays the game and he now tosses the coin 12 times.
      i. Find the expected number of heads.
      ii. Mr. Dunham wins $ 10 for each head obtained, and loses $ 6 for each tail. Find his expected winnings.

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6. **(A1.2, F2.6 - R) (CI)** Let $g(x) = k\log_2(x)$. **(Cirrito 7.4, p219)**

   a. Given that $g^{-1}(1) = 8$, find the value of k.
   b. Hence, find $g^{-1}\left(\frac{2}{3}\right)$.

Section B (Extended Response/Investigation)

7. **(C6.4 - N) (CA)** Use Wolframalpha to help with the following investigation: Working the composite function $g(x) = \sin(f(x))$, find: **(Cirrito 19.3.6, p621)**

   a. The derivative of $y = \sin(x)$
   b. The derivative of $y = \sin(2x + 4)$
   c. The derivative of $y = \sin(4x - 5)$
   d. The derivative of $y = \sin(2x^2 + 5)$
   e. The derivative of $y = \sin(2x^2 - 2x + 5)$
   f. The derivative of $y = \sin(\ln(x))$
   g. Make a general conclusion about the derivative of $g(x) = \sin(f(x))$

8. **(C6.4 - N) (CA)** Use Wolframalpha to help with the following investigation: Working the composite function $g(x) = e^{f(x)}$, find: **(Cirrito 19.3.6, p621)**

   a. The derivative of $y = e^x$
   b. The derivative of $y = e^{½x + 4}$
   c. The derivative of $y = e^{2x - 5}$
   d. The derivative of $y = e^{4x^2 + 5}$
   e. The derivative of $y = e^{3x^2 - 4x + 5}$
   f. The derivative of $y = e^{\sin(x)}$
   g. Make a general conclusion about the derivative of $g(x) = e^{f(x)}$

9. **(C6.4 - N) (CA)** Use Wolframalpha to help with the following investigation: Working the composite function $g(x) = \ln(f(x))$, find: **(Cirrito 19.3.6, p621)**

   a. The derivative of $y = \ln(x)$
   b. The derivative of $y = \ln(½x + 4)$
   c. The derivative of $y = \ln(2x - 5)$
   d. The derivative of $y = \ln(4x^2 + 5)$
   e. The derivative of $y = \ln(3x^2 - 4x + 5)$
   f. The derivative of $y = \ln(\cos(x))$
   g. Make a general conclusion about the derivative of $g(x) = \ln(f(x))$