Math SL PROBLEM SET 40

Section A (Short Answer)

1. **(A1.2 - N)** **(CI)** Here is the Tamara "special question" ⇒ Use the properties of logarithms to write each logarithmic expression as a sum, difference or constant multiple of single logarithms (i.e. logarithms without products, quotients or exponents) **(Cirrito 7.4, p221)**

    a. $\log_2(2m)$ b. $\ln \sqrt[5]{x}$ c. $\log_3(a^2b^3)$ d. $\log_{10}[10x(1+r)^t]$ e. $\ln\left(\frac{m^3}{n}\right)$

2. **(F2.4, F2.8, C6.3 - R,N)** **(CI)** Zeinab throws a stone vertically upwards from the top of a building 250 m high. The height of the stone, $h(t)$ meters above the ground t seconds after being thrown is modeled by the equation $h(t) = 250 + 100t - 10t^2$, $t \geq 0$. **(Cirrito 3.1.2, p65)**

    a. How long does it take for the stone to reach a height of 50 m above the top of the building?
    b. How long does it take for the stone to reach a height of 50 m above the ground?
    c. What is the maximum height of the stone?
    d. How long does it take for the stone to reach the ground?
    e. What is the speed of the stone when it hits the ground?

3. **(T3.6 - E)** **(CA)** For the ΔTAM, side AT = 12 cm and side TM = 10.5 cm and $\angle$TAM = 21°. Determine the measure of side MA and hence the area of the triangle. **(Cirrito 9.5.2, p297)**

4. **(A1.3 - N)** **(CA)** Consider the expression $\left(\frac{3}{x} - 2x^2\right)^{12}$, ***(Cirrito 4.1.2, p100)***

    a. Find the first three terms of this expansion.
    b. Find the coefficient of the x^{12} term OR justify that it does not exist.
    c. Find the constant term of this expansion OR justify that it does not exist.

5. **(SP5.7 - N)** **(CA)** The discrete random variable X has a distribution defined by the equation $P(X = x) = k(25 - x^2)$ for $k \in \{1, 2, 3, 4, 5\}$. **(Cirrito 16.1, p527)**

    a. Prepare a frequency table to help organize the information and to solve this problem.
    b. Find the value of k.
    c. Find P($1 < x \leq 3$)
    d. Prepare a histogram and a frequency polygon for X.
    e. Find E(X) and Var(X).
    f. Find E($3X + 2$)

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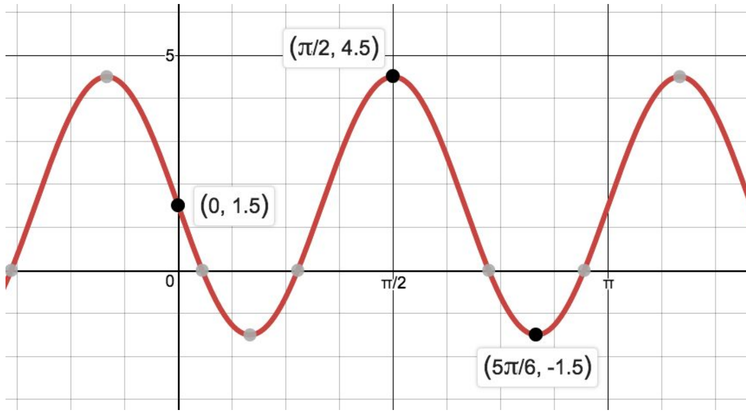
6. **(T3.4 - R)** **(CI)** Given the function, $y = f(x)$, pictured here, determine: **(Cirrito 10.3, p337)**

   a. the amplitude,
   b. the period,
   c. the equation of the axis of the curve (or sinusoidal axis),
   d. an appropriate equation for the function.
   e. the intervals of increase on the domain of $0 \le x \le \pi$.
   f. the exact values of the zeroes on the domain of $0 \le x \le \pi$.
   g. where is $\frac{d}{dx} f(x) = 0$?



Section B (Extended Response/Investigation)

7. **(F2.1, F2.3, C6.1 - R,N)** **(CI)** Consider the function $g(x) = \sqrt{x+4}$, **(Cirrito 6.1, 6.2)**
   a. Determine the domain and range of $y = g(x)$.
   b. The function $y = g(x)$ is now translated 6 units to the left and then horizontally compressed by a factor of 3. Write down the new equation of this transformed function.
   c. Determine the equation of $y = g^{-1}(x)$.
   d. What is the domain of $y = g^{-1}(x)$?
   e. **(IB 7/HL)** Determine the simplified equation that results from the $\lim_{h \to 0} \frac{g(x+h) - g(x)}{h}$ calculation.
   f. Hence or otherwise, determine the rate of change of $y = g(x)$ at the point where $x = 12$.

8. **(C6.3 - N)** **(CA)** We will now make connections involving graphs of functions and the graphs of their derivatives. Working with the cubic function $f(x) = x^3 - 3x^2 - 9x$: **(Cirrito 20.2, p649)**
   a. Graph the function $f(x) = x^3 - 3x^2 - 9x$. Sketch the function in your notebook and label the extrema
   b. Find the x-values of the **extrema** (max/min points).
   c. Determine the interval in which the function is **increasing** and determine the interval in which the function is **decreasing**.
   d. Now determine the equation of the derivative of $f(x) = x^3 - 3x^2 - 9x$
   e. Graph the derivative on the SAME grid as Q(a).
   f. Determine the interval in which the derivative has positive values (i.e. $\frac{d}{dx}f(x) > 0$) and then determine the interval in which the derivative has negative values (i.e. $\frac{d}{dx}f(x) < 0$).
   g. What do you notice about your answers to Q(c) and Q(f). Write a general conclusion.
   h. Solve the equation $\frac{d}{dx}f(x) = 0$ and compare this answer to your answer to Q(b)