

Math SL PROBLEM SET 7

1. **(F2.6, F2.7, F2.8 - R) (CA)** Mr. Santowski is taking medicine for MATHITIS. Once he has taken the medicine, it gets used up by his body and the amount of medicine that remains in his body is modelled by the equation $A(t) = 50(0.7)^{0.2t}$, where A is measured in milligrams and t is measured in hours. **(Cirrito 7.2, p209)**
- Determine the initial dose of medicine.
 - Evaluate $A(12)$ and interpret the meaning of the result.
 - Every 12 hours, Mr. S takes **another dose**. Prepare a SKETCH of the graph looks like, on the domain of $0 \leq t \leq 48$.
 - How much medicine does he have in his body **after** taking the: (i) second dose? (ii) third dose?
 - At what time(s) in the first 36 hours does Mr. S have at least 40 mg of medicine in his body?
2. **(SP5.2 - R) (CA)** Roeland has prepared a frequency table distribution for a data set shown in the table below. **(Oxford 8.3, p260)**

x	1	2	3	4
frequency	32	20	41	16

- Find the mean and median of this data set.
 - For the frequency row, re-express each frequency as a relative frequency (or rather as a probability). Find the mean and median now. What observations do you make about the mean and median and the total relative frequency now?
3. **(F2.1, 2.3 - R) (CI)** Two functions are defined as follows: $f(x) = 2x^2 - 6$ and then $g(x) = x - 5$. Both functions are limited to a domain of $\{-4 \leq x \leq 4\}$. **(Cirrito 5.4.1, p148; Cirrito 5.4.2, p157)**
- State the range of both functions, $f(x)$ and $g(x)$.
 - A new function, $h(x)$ is defined as the composite of $f(x)$ with $g(x)$ (as in $h(x) = f \circ g(x)$). Write the equation of $h(x)$.
 - The new function, $h(x)$, represents a transformed version of $f(x)$. Describe what transformations have been applied to $f(x)$ to create the function of $h(x)$.
 - Mr. S asks if the order of composition makes a difference. Determine the equation for the composite of g with f i.e. $g \circ f(x)$ and hence, answer Mr. S's question.
 - Determine the equation of the inverse of $h(x)$.
 - (CA)** Find the intersection point(s) of $h(x)$ and its inverse.

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4. **(C6.1, 6.3; F2.1 - N,R) (CA)** Given the cubic polynomial defined by $P(x) = (x - 3)(x + 1)(x + 4)$, answer the following questions about this function. *(Cirrito 5.2.1, p115; Cirrito 18.1.3, p582)*
- Evaluate $P(-2)$.
 - Solve $P(x) = -2$.
 - In which domain interval are the function values of $P(x)$ increasing?
 - An average rate of change is determined by finding the slope between two points of a function. Find the average rate of change of $P(x)$ between the values of $x = 2$ and $x = 3$.

Your calculator has the ability to draw tangent lines on the graphs of your functions (to find the DRAW menu, go to $2\text{nd} \Rightarrow \text{PRGM} \Rightarrow 5 \Rightarrow$ now input your x value, for example, $x = -3$).

- Draw the line that is tangent to $P(x)$ at $x = -3$ and write down its equation.
 - At which x -values would you expect the tangent lines to be horizontal? Why?
 - Explain the significance of the slope of the tangent line.
5. **(F2.1, 2.7, T3.6 - R) (CI)** Given the functions $f(x) = 2x - 5$ and $g(x) = \sqrt{9 - x}$, *(Cirrito 5.2.1, p115, Cirrito 5.4.2, p157)*
- State the domain and range of $y = g(x)$.
 - Determine the equation of $y = g^{-1}(x)$.
 - Solve the equation $f(x) = g(x)$ and state the meaning of the solution.
 - Given your work in Q(c), state the solution set for $f(x) > g(x)$.
 - Determine the measure of the angle that the line $y = 2x - 5$ makes with the positive x axis.
6. **(SP5.5 - R) (CI)** A bag contains 4 green marbles and 6 yellow marbles. Sam selects one marble from the bag and then **without** replacement, he selects a second marble. **(Oxford 3.5, p89)**
- Write down the probability that the first marble Sam selects is green.
 - Find the probability that Sam selects two green marbles.
 - Find the probability that Sam selects two marbles of different colour.