



Addis Ababa Science and Technology University

Department of Mathematics

Mathematics for Natural Science (Group Assignment 10%)

Submission Date: April 17, 2023

Instruction: Make a group of 5 or 6 students and do the following questions showing all the necessary steps clearly.

1. Use Principle of mathematical induction to prove that

$$\sin \theta + \sin(2\theta) + \sin(3\theta) + \dots + \sin(n\theta) = \sin\left(\left(\frac{n+1}{2}\right)\theta\right) \sin\left(\frac{n\theta}{2}\right) \csc\left(\frac{\theta}{2}\right) \text{ for positive integers } n$$

2. Let us imagine that you and your group members are interning in the office of an elite hedge fund. This fund has decided to do a massive survey of 150 academic economists, and ask them which of three industries (biomedical, software, or telecommunications) is going to be a profitable focus for the fund in the coming year. You were tasked with surveying the economists. After you both carefully collect the results, one of your group members accidentally spills coffee on the data. Luckily, only one datum is obfuscated, marked "(stain)". Despite the loss of one data point, find the number of economists who gave a positive outlook for software or biomedical industries but not telecommunication industry.

Here is the obtained safe data:

- 7 economists gave a positive outlook to none of those three industries.
- 113 economists gave a positive outlook to the software industry.
- 99 economists gave a positive outlook to the biomedical industry.
- 98 economists gave a positive outlook to the telecommunications industry.
- 79 economists gave a positive outlook to both software & biomedical.
- 84 economists gave a positive outlook to both software & telecommunications.
- 82 economists gave a positive outlook to both telecommunications & biomedical.
- (stain) gave a positive outlook to all three industries.

3. Let $z = x + yi$ where x and y are real numbers, be the cube root of a complex number w^{20} where

$$w = \frac{1}{2 + \frac{3}{2}i}. \text{ Find the arithmetic mean of real and imaginary parts of } z ?$$

4. Use truth table to check whether the argument given below is valid or not?

It is not rainy this morning and it is hotter than yesterday.

If we go playing then it is rainy day.

If we do not go playing, then we will celebrate our holyday.

If we celebrate our holyday, then we all wear uniform.

Therefore, we all wear uniform.