Maths A & I

Statistics 2 exam.

Name:
Date:

Remember:
- If nothing else is stated, provide your answers with 3 sf.
- Use sigma for the standard deviation
- When answering questions with the calculator you have to state that the answer was provided by the calculator.
- Drawings are not compulsory but are recommended.

1. The number of hairs per square centimeter of scalp (hair density) follows a normal distribution with mean = 480 and standard deviation = 60

a) What percentage of people have a hair density of between 420 and 540? [2]

b) What percentage of people have a hair density that is NOT between 360 and 600? [3]

c) A company is looking for subjects with incipient alopecia for a study on a hair-strengthening shampoo. The subject is eligible if he/she has a hair density below 340. If 5000 individuals are picked at random, how many of them are expected to have a low enough hair density to be eligible for the study? [3]

d) A young girl has been hired to do a shampoo commercial because, according to the company's specialist, she has such a high hair density that "only one person in a thousand would have a higher hair density than her". Calculate her hair density. [4]

2. For each of these normal distributions, state the meaning of the shaded area, the value of x and, if present, y.
Example: "44% of the population is below the value x, which has to be higher than 60 because it is to the right of the mean"
[1 each]

a)

55   58   0.12

b)

130   0.4   x

c)

80%   200   x

d)

0.7   -x   0   x

e)

0.6   x   6   y

f)

0.05   x   1100
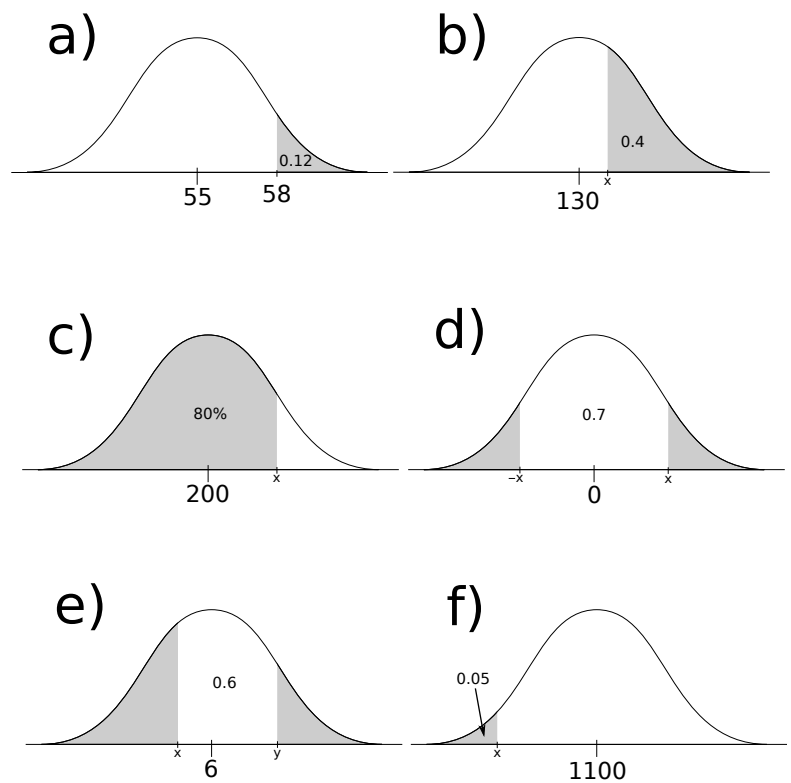
3. In a school, all Mathematical Studies SL students were given a test. The test contained four questions, each one on a different topic from the syllabus. The quality of each response was classified as satisfactory or not satisfactory. Each student answered only three of the four questions, each on a separate answer sheet.
The table below shows the number of satisfactory and not satisfactory responses for each question.

		Topic				
		Calculus	Probability	Geometry	Logic	Total
Quality of response	Satisfactory	10	16	20	14	60
	Not satisfactory	8	6	10	6	30
	Total	18	22	30	20	90

A χ^2 test is carried out at the 5 % significance level for the data in the table.

a) State the null hypothesis for this test. [1]

b) Calculate the expected frequency of satisfactory calculus responses. [2]

c) Write down the number of degrees of freedom for this test. [1]

d) Calculate the value of χ^2 for this test and compare it with the critical value, which is 7.815 [2]

e) What is the conclusion for this test? Explain the reason why. [2]

bonus. What would be the critical value if we want a 8% significance level? What would be the conclusion of the test in that case? [3]

4. A student has had an erratic attendance throughout the year, and the mentor wonders whether the student's attendance has to do with tests or not.
The mentor gathers the following information about the student:
The total number of lessons in the year has been 750, out of which 40 were tests.
Of the 710 lessons that weren't tests, the student attended 670, and out of the 40 that were tests she attended 32.
The mentor runs a χ^2 test on these data.

a) Write the numbers in a table [1]

b) State the null and alternative hypotheses [2]

c) Calculate the value of χ^2 [2]

d) Write down the number of degrees of freedom. [1]

e) The critical values of χ^2 for the significance levels of 10%, 5% and 1% are 2.7055, 3.8414 and 6.6349.

For which of these significance level(s) would we accept the null hypothesis? [2]

5. The following table shows the average body weight, x , and the average weight of the brain, y , of seven species of mammal. Both measured in kilograms (kg).

Species	Average body weight	Average weight of the brain
Cat	3	0.026
Cow	465	0.423
Donkey	187	0.419
Giraffe	529	0.680
Goat	28	0.115
Jaguar	100	0.157
Sheep	56	0.175

a) Find the range of the average body weights for these seven species of mammal. [2]

b) Calculate r (Pearson's) [2]

c) Describe the correlation (if any) [2]

d) Write down the equation of the best fit line in the form y=ax + b [2]

e) According to this correlation, what should be the average weight of the brain of grey wolves, whose average body weight is 36? [2]

f) bonus) The average body weight of mice is 0.023 kg. Would it be appropriate to use this correlation to estimate the weight of the brain of mice? why? [2]