Regression models

Gold

A meteorologist believes that there is a relationship between the daily mean wind speed, w km, and the daily mean temperature, t °C. A random sample of 10 consecutive days is taken from past records from a town in the UK in May and the relevant data is given in the table below.

t	10.2	12.4	11.8	14.7	16.2	16.9	18.5	19.4	15.2	16.1
w	10	13	11	8	9	11	13	15	12	13

The meteorologist calculated the product moment correlation coefficient for the 10 days and obtained $r = 0.435$.

   a Explain why a linear regression model based on these data is unreliable on a day when the mean temperature is 28 °C.

   b Stating your hypotheses clearly test, at the 5% significance level, whether or not the product moment correlation coefficient for the population is greater than zero.

Silver

The daily mean air temperature, t °C, and the rainfall, f mm, were recorded for a city on seven consecutive days in March 2013.

Temperature, t (°C)	9.9	8.2	6.9	4.5	6.4	5.4	6.9
Rainfall, f (mm)	17.0	12.0	4.2	3.9	4.5	1.2	2.8

The data are coded using the changes of variable $x = t$ and $y = \log f$. The regression line of y on x is found to be $y = -0.5264 + 0.174x$.

Joss says that the formula for the regression line can't be correct because the constant -0.5264 means that rainfall is negative when the temperature is 0 °C. Explain why Joss is wrong.

Bronze

The following table shows 10 observations from a bivariate data set.

s	38	94	81	83	51	27	78	46	57	63
t	34	99	79	96	34	15	64	75	74	77

a State what is measured by the product moment correlation coefficient and the values it can take.
b Use your calculator to find the value of the product moment correlation coefficient between s and t, correct to 3 significant figures.