

Year 2 Applied Chapter 1: Regression Correlation Hypothesis Testing
Exam Questions (Answers)

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
1a	$\log_{10} c = 1.89 - 0.0131t$ $c = 10^{1.89-0.0131t}$ $c = 77.6 \times 0.970^t$ (3 s.f.)	M1 M1 A1	1.1a 1.1b 1.1b	6th Understand exponential models in bivariate data.
		(3)		
1b	b is the proportional rate at which the temperature changes per minute.	A1	3.2a	6th Understand exponential models in bivariate data.
		(1)		
1c	Extrapolation/out of the range of the data.	A1	2.4	4th Understand the concepts of interpolation and extrapolation.
		(1)		
(5 marks)				
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
2a	The data seems to follow an exponential distribution.	B1	2.4	6th Understand exponential models in bivariate data.
		(1)		
2b	$r = 0.9735$ is close to 1	B1	2.2a	2nd Know and understand the language of correlation and regression.
	which gives a strong positive correlation.	B1	2.4	
		(2)		
2c	Model is a good fit with a reason. For example, Very strong positive linear correlation between t and $\log_{10} p$. The transformed data points lie close (enough) to a straight line.	B2	3.2a	6th Understand exponential models in bivariate data.
		(2)		
(5 marks)				
Notes 2c B0 for just stating the model is a good fit with no reason.				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
3a	A critical value is the point (or points) on the scale of the test statistic beyond which we reject the null hypothesis.	B1	1.2	5th Understand the language of hypothesis testing.
		(1)		
3b	$H_0 : \rho = 0$, $H_1 : \rho > 0$ Critical value = 0.5494 $0.714 > 0.5494$ (test statistic in critical region) There is evidence to reject H_0 There is evidence that there is a positive correlation between the number of vehicles and road traffic accidents.	B1 M1 A1	2.5 1.1b 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
3c	$r = -7.0 + 0.02v$	B1	1.2	4th Make predictions using the regression line within the range of the data.
		(1)		
3d	Road fatalities per 100 000 population.	B1	1.2	2nd Know and understand the language of correlation and regression.
		(1)		
3e	Outside the range of the data used in the model. or This would require extrapolation.	B1	3.5b	4th Understand the concepts of interpolation and extrapolation.
		(1)		
(7 marks)				
Notes				

Q	Scheme	Marks	AOs	Pearson Progression Step and Progress descriptor
4a	A statistic that is calculated from sample data in order to test a hypothesis about a population.	B1	1.2	5th Understand the language of hypothesis testing.
		(1)		
4b	$H_0 : \rho = 0, H_1 : \rho \neq 0$ $p\text{-value} < 0.05$ There is evidence to reject H_0 There is evidence (at 5% level) of a correlation between the daily mean temperature and daily mean pressure.	B1 M1 A1	2.5 1.1b 2.2b	6th Carry out a hypothesis test for zero correlation.
		(3)		
4c	Two sensible interpretations or observations. For example, Two distinct distributions Similar gradients of regression line. Similar correlations for each season. Lower temperature in autumn. More spread for the daily mean pressure in autumn.	B2	3.2a	4th Use the principles of bivariate data analysis in the context of the large data set.
		(2)		
(6 marks)				
Notes				

5)

$$\begin{aligned} a/ \quad H_0 : \quad p &= 0 \\ H_1 : \quad p &\neq 0 \end{aligned}$$

b/ critical value: 0.4409

critical regions $x < -0.4409$ and $x > 0.4409$

0.37 is in the acceptable region $\therefore$ we accept H_0 . There is not enough evidence to suggest there is a correlation between temperature and rainfall.

6)

$$\begin{aligned} H_0 : \quad p &= 0 \\ H_1 : \quad p &> 0 \end{aligned}$$

critical value 0.6581

critical region $x > 0.6581$

$0.636 < 0.6581$ we accept H_0 .

There is not enough evidence to suggest a positive correlation between temperature and hours of sunshine

7)

$$y = 1.99 - 0.031x$$

$$\log_{10} w = 1.99 - 0.031t$$

$$w = 10^{1.99 - 0.031t}$$

$$w = 10^{1.99} \cdot 10^{-0.031t}$$

$$w = 97.7 \cdot 0.931^t$$

$$\underline{a = 97.7} \quad \underline{b = 0.931} \quad (3 \text{ s.t.})$$

b/ Immediately after the kettle boiled the temperature was 97.7°C .

c/ The temperature will not continue to decrease once it reaches room temperature it will remain the same.

8)

a/ There is a very strong positive correlation.
The coding is appropriate and there is
This suggests a non linear relationship
between x and y .

b/ $s = 2.60 + 0.127r$

$$\log_{10} y = 2.60 + 0.127x$$

$$y = 10^{2.60 + 0.127x}$$

$$y = (10^{2.60}) (10^{0.127})^x$$

$$y = (398) (1.34)^x$$

$$\underline{a = 398} \quad \underline{b = 1.34} \quad (35f)$$