A#43 CORRELATION - THE PMCC

TAILORED TUTORS
A LEVEL MATHS

AEM questions are taken from past exam papers - they have been carefully chosen to represent a typical exam question at each level of difficulty. If you can do these questions, you're ready to move onto past papers for this topic.

APPRENTICE

Fourteen candidates each sat two test papers, Paper 1 and Paper 2, on the same day. The marks, out of a total of 50, achieved by the students on each paper are shown in the table. Calculate the value of of the product moment correlation coefficient, r, between the marks on Paper 1 and those on Paper 2.

Candidate	A	B	C	D	E	F	G	H	I	J	K	L	M	N
Mark on Paper 1 (x)	36	29	33	17	42	26	45	12	25	19	26	15	28	11
Mark on Paper 2 (y)	46	18	34	24	45	21	37	15	35	17	38	11	44	21

EXPERT

The table shows the heights, x cm, and the arm spans, y cm, of a random sample of 12 men aged between 21 years and 40 years.

x	152	166	154	159	179	167	155	168	174	182	161	163
y	143	154	151	153	168	160	146	163	170	175	155	158

a. Calculate the value of the product moment correlation coefficient between x and y.

b. Interpret, in context, your value calculated in part (a).

c. The regression line for this data is used to estimate the arm span of men who are160cm tall.
Give tWO reasons why this estimate would be reliable and one reason why it might not be.

MASTER

Each of 10 cows was given an additive (x) every day for four weeks to see if it would improve the milk yield $((y)$. At the beginning, the average milk yield per day was 4 gallons. The milk yield of each cow was measured on the last day of the four weeks. The data collected is shown in the table.

Cow	A	B	C	D	E	F	G	H	I	J
Additive, x (25gm units)	1	2	3	4	5	6	7	8	9	10
Yield, y (gallons)	4.0	4.2	4.3	4.5	4.5	4.7	5.2	5.2	5.1	5.1

a. Use your calculator to find the value of the product moment correlation coefficient for the first seven cows.

b. State which is the response variable and which is the explanatory variable

c. Without further calculation, write down, with a reason, how the product moment correlation coefficient for all 10 cows would differ from your answer to b.

A#50 HYPOTHESIS TESTING - PMCC

TAILORED TUTORS
A LEVEL MATHS

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APPRENTICE

The ages (months) and weights (kg), of a random sample of nine babies are shown in the table below.

Baby	A	B	C	D	E	F	G	H	I
Age, x	1	2	2	3	3	3	4	4	5
Weight, y	4.4	5.2	5.8	6.4	6.7	7.2	7.6	7.9	8.4

The product moment correlation coefficient between age and weight for these babies was found to be 0.972. Interpret this value by testing for a positive correlation at the $5\,\%$ significance level.

EXPERT

The data below show the height above sea level (x metres) and the temperature ($y°\text{C}$) at 7.00am, on the same day in summer at nine places in Europe.

Height, x (m)	1400	400	280	790	390	590	540	1250	680
Temperature, $y(°\text{C})$	6	15	18	10	16	14	13	7	13

The product moment correlation coefficient between height above sea level and temperature for these places is -0.975. Using this value, test for negative correlation at the $5\,\%$ significance level. Interpret your result in context.

MASTER

Ffion, as part of her research project, measured the stem length and the cap diameter of each of a random sample of 24 matsutake mushrooms. Using these measurements she calculated the value of the product moment correlation coefficient to be 0.336, correct to three significant figures.

Assuming that her measurements came from a bivariate normal distribution, test, at the $5\,\%$ level of significance, the hypothesis that there is no correlation between the stem length and the cap diameter of matsutake mushrooms.

Product Moment Coefficient					
Level					Sample size, n
0.10	0.05	0.025	0.01	0.005	
0.8000	0.9000	0.9500	0.9800	0.9900	4
0.6870	0.8054	0.8783	0.9343	0.9587	5
0.6084	0.7293	0.8114	0.8822	0.9172	6
0.5509	0.6694	0.7545	0.8329	0.8745	7
0.5067	0.6215	0.7067	0.7887	0.8343	8
0.4716	0.5822	0.6664	0.7498	0.7977	9
0.4428	0.5494	0.6319	0.7155	0.7646	10
0.4187	0.5214	0.6021	0.6851	0.7348	11
0.3981	0.4973	0.5760	0.6581	0.7079	12
0.3802	0.4762	0.5529	0.6339	0.6835	13
0.3646	0.4575	0.5324	0.6120	0.6614	14
0.3507	0.4409	0.5140	0.5923	0.6411	15
0.3383	0.4259	0.4973	0.5742	0.6226	16
0.3271	0.4124	0.4821	0.5577	0.6055	17
0.3170	0.4000	0.4683	0.5425	0.5897	18
0.3077	0.3887	0.4555	0.5285	0.5751	19
0.2992	0.3783	0.4438	0.5155	0.5614	20
0.2914	0.3687	0.4329	0.5034	0.5487	21
0.2841	0.3598	0.4227	0.4921	0.5368	22
0.2774	0.3515	0.4133	0.4815	0.5256	23
0.2711	0.3438	0.4044	0.4716	0.5151	24
0.2653	0.3365	0.3961	0.4622	0.5052	25
0.2598	0.3297	0.3882	0.4534	0.4958	26
0.2546	0.3233	0.3809	0.4451	0.4869	27
0.2497	0.3172	0.3739	0.4372	0.4785	28
0.2451	0.3115	0.3673	0.4297	0.4705	29
0.2407	0.3061	0.3610	0.4226	0.4629	30
0.2070	0.2638	0.3120	0.3665	0.4026	40
0.1843	0.2353	0.2787	0.3281	0.3610	50
0.1678	0.2144	0.2542	0.2997	0.3301	60
0.1550	0.1982	0.2352	0.2776	0.3060	70
0.1448	0.1852	0.2199	0.2597	0.2864	80
0.1364	0.1745	0.2072	0.2449	0.2702	90
0.1292	0.1654	0.1966	0.2324	0.2565	100