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| **Topic 4: Statistics and Probability** | **Chi-Square** |
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| 1. A study was done to determine whether the amount of sleep a student gets affects their GPA. A random sample of high school seniors was taken in the Unites States. The results are in the following table.
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|  | **GPA < 2.0** | **2.0 ≤ GPA < 3.0** | **3.0 ≤ GPA ≤ 4.0** |
| **Hours of Sleep < 7** | 10 | 12 | 6 |
| **7 ≤ Hours of Sleep < 8** | 7 | 14 | 18 |
| **8 ≤ Hours of Sleep** | 9 | 12 | 25 |

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| A $χ^{2}$ test was performed at the 1% significance level. The critical value for this test is 13.77.1. State the null hypothesis.
2. Write down the degrees of freedom.
3. Write down:
	1. The $χ^{2}$ statistic.
	2. The associated p-value.
4. State, giving a reason, whether the null hypothesis should be accepted.

Mark scheme:1. Ho: The GPA of a high school senior is independent of the number of hours of sleep they receive.
2. Degrees of Freedom: $\left(3-1\right)\left(3-1\right)=4$
	1. $χ^{2}=8.63912$
3. p-value $=0.070781$
4. Method 1: $χ^{2}<critical value$ $8.64<13.277$ Fail to reject the null hypothesis

Method 2: p-value $>$ significance level $0.070781>0.01$ Enough evidence to support null hypothesis | (1 mark)(1 mark)(1 mark)(1 mark)(2 marks)(A1)(A1)(A1)(A1) (R1) (A1)(R1)(A1) |
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