3. Remy's house has a sensor which detects motion.

The number of times the sensor detects motion in a 15-minute period during every morning is modelled by a Poisson distribution with mean 2.5

(a) Find the probability that during a randomly selected morning the sensor detects motion

(i) at least 4 times in a randomly selected 30-minute period,

(ii) at least 4 times in each of 3 randomly selected non-overlapping 30-minute periods.

(4)

Remy decides to clean the sensor.

After cleaning the sensor, Remy records the number of times the sensor detects motion in a one-hour period in the morning.

Remy will use this data to test, at a 5% significance level, if there is evidence that the mean rate of detecting motion has increased.

(b) Write down suitable null and alternative hypotheses for Remy's test.

(1)

(c) Find the critical region for the test **and** state its associated probability.

(3)

In the one-hour period after the sensor is cleaned, the sensor detects motion 13 times.

Using this observation and your answer to part (c)

(d) state the conclusion to the test, giving a reason for your answer.

(1)

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 3 continued

Question 3 continued

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA
DO NOT WRITE IN THIS AREA

Question 3 continued

(Total for Question 3 is 9 marks)