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1. A botanist is studying the distribution of daisies in a field. The field is divided into a number of equal sized squares. The mean number of daisies per square is assumed to be 3. The daisies are distributed randomly throughout the field.

Find the probability that, in a randomly chosen square there will be

- (a) more than 2 daisies, (3)

- (b) either 5 or 6 daisies. (2)

The botanist decides to count the number of daisies,  $x$ , in each of 80 randomly selected squares within the field. The results are summarised below

$$\sum x = 295 \qquad \sum x^2 = 1386$$

- (c) Calculate the mean and the variance of the number of daisies per square for the 80 squares. Give your answers to 2 decimal places. (3)

- (d) Explain how the answers from part (c) support the choice of a Poisson distribution as a model. (1)

- (e) Using your mean from part (c), estimate the probability that exactly 4 daisies will be found in a randomly selected square. (2)

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**Question 1 continued**

Handwriting practice lines for Question 1 continued.



2. The continuous random variable  $X$  is uniformly distributed over the interval  $[-2, 7]$ .
- (a) Write down fully the probability density function  $f(x)$  of  $X$ . (2)
- (b) Sketch the probability density function  $f(x)$  of  $X$ . (2)
- Find
- (c)  $E(X^2)$ , (3)
- (d)  $P(-0.2 < X < 0.6)$ . (2)

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3. A single observation  $x$  is to be taken from a Binomial distribution  $B(20, p)$ .

This observation is used to test  $H_0 : p = 0.3$  against  $H_1 : p \neq 0.3$

(a) Using a 5% level of significance, find the critical region for this test.  
The probability of rejecting either tail should be as close as possible to 2.5%. (3)

(b) State the actual significance level of this test. (2)

The actual value of  $x$  obtained is 3.

(c) State a conclusion that can be drawn based on this value giving a reason for your answer. (2)

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**Question 4 continued**

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