5. (a) The discrete random variable $X \sim B(40, 0.27)$

   Find $P(X \geqslant 16)$

   (2)

   Past records suggest that 30% of customers who buy baked beans from a large supermarket buy them in single tins. A new manager suspects that there has been a change in the proportion of customers who buy baked beans in single tins. A random sample of 20 customers who had bought baked beans was taken.

   (b) Write down the hypotheses that should be used to test the manager's suspicion.

   (1)

   (c) Using a 10% level of significance, find the critical region for a two-tailed test to answer the manager's suspicion. You should state the probability of rejection in each tail, which should be less than 0.05

   (3)

   (d) Find the actual significance level of a test based on your critical region from part (c).

   (1)

   One afternoon the manager observes that 12 of the 20 customers who bought baked beans, bought their beans in single tins.

   (e) Comment on the manager's suspicion in the light of this observation.

   (1)

   Later it was discovered that the local scout group visited the supermarket that afternoon to buy food for their camping trip.

   (f) Comment on the validity of the model used to obtain the answer to part (e), giving a reason for your answer.

   (1)