10 Club 65–80 Holidays fly jets between Liverpool and Magaluf. Over a long period of time records show that half of the flights from Liverpool to Magaluf take less than 153 minutes and 5% of the flights take more than 183 minutes.

An operations manager believes that flight times from Liverpool to Magaluf may be modelled by the Normal distribution.

(a) Use the information above to write down the mean time the operations manager will use in his Normal model for flight times from Liverpool to Magaluf. **[1]**

(b) Use the information above to find the standard deviation the operations manager will use in his Normal model for flight times from Liverpool to Magaluf, giving your answer correct to 1 decimal place. **[3]**

(c) Data is available for 452 flights. A flight time of under 2 hours was recorded in 16 of these flights. Use your answers to parts **(a)** and **(b)** to determine whether the model is consistent with this data. **[3]**

The operations manager suspects that the mean time for the journey from Magaluf to Liverpool is less than from Liverpool to Magaluf. He collects a random sample of 24 flight times from Magaluf to Liverpool. He finds that the mean flight time is 143.6 minutes.

(d) Use the Normal model used in part **(c)** to conduct a hypothesis test to determine whether there is evidence at the 1% level to suggest that the mean flight time from Magaluf to Liverpool is less than the mean flight time from Liverpool to Magaluf. **[7]**

(e) Identify two ways in which the Normal model for flight times from Liverpool to Magaluf might be adapted to provide a better model for the flight times from Magaluf to Liverpool. **[2]**