4. A large number of cyclists take part in a cycling time trial.
A random sample of these cyclists are selected and their times, in minutes, are summarised in the following statistics

$$\sum x = 1680 \quad \sum x^2 = 47654.4 \quad n = 60$$

(a) Calculate, for this sample, the value of

    (i) the mean time,

                                                                (1)

    (ii) the standard deviation of the times.

                                                                 (2)

Historically, the mean time for cyclists on this time trial has been 27 minutes and 30 seconds. Lucy is watching the time trial and believes that the mean time of cyclists in this time trial is greater than the mean time of cyclists in previous time trials.

The times of cyclists on this time trial are modelled by a Normal distribution with standard deviation 3 minutes.

(b) Test, at the 5% level of significance, whether or not this sample provides evidence to support Lucy's belief. You should state your hypotheses and show your working clearly.

                                                                 (5)

Speedy Wheels cycling club entered its 5 fastest riders and 5 beginners to take part in the time trial.
The fastest 20% of the cyclists in the time trial are invited to compete in a race the following week.

(c) (i) Explain, with specific reference to the parameter p, why the distribution $B(10, 0.2)$ might not be reasonable to model the number of these *Speedy Wheels* cycling club members who are invited to compete in the race.

                                                                (2)

    (ii) Suggest how to improve the model for the number of these *Speedy Wheels* cycling club members invited to compete in the race.

                                                                 (1)