Show all work on the following problems – be sure to draw the diagram!

1. The percentage impurity of a chemical can be modelled by a normal distribution with a mean of 5.8 and a standard deviation of 0.5. Obtain the probability that a sample of the chemical has percentage impurity between 5 and 6.

2. Melons sold on a market stall have weights that are normally distributed with a mean of 2.18 kg and a standard deviation of 0.25 kg. For a melon chosen at random, find the probability that its weight lies between 2 kg and 2.5 kg.

3. A teacher travels from home to work by car each weekday by one of two routes, X or Y. For route X, her journey times are normally distributed with a mean of 30.4 minutes and a standard deviation of 3.6 minutes. Calculate the probability that her journey time on a particular day takes between 25 minutes and 35 minutes.

4. Soup is sold in tins which are filled by a machine. The actual weight of soup delivered to a tin by the filling machine is always normally distributed about the mean weight with a standard deviation of 8g. The machine is set originally to deliver a mean weight of 810g.
    (a) Determine the probability that the weight of soup in a tin, selected at random, is less than 800g.

    (b) Determine the probability that the weight of soup in a tin, selected at random, is between 795 g and 820 g.

5. The weight, X grams, of a particular variety of orange is normally distributed with mean 205 and standard deviation 25. A wholesaler decides to grade such oranges by weight. He decides that the smallest 30 per cent should be graded as small, the largest 20 per cent graded as large, and the

remainder graded as medium. Determine, to one decimal place, the maximum weight of an orange graded as:

    (i)   small

    (ii)   medium.

6.   Jars of bolognese sauce, sold by a supermarket, are stated to have contents of weight 500 g. The weights, in grams, of the actual contents of jars in a large batch are normally distributed with mean 506 and standard deviation 5. Find the weight which is exceeded by the contents of 99.9% of the jars in this batch.

7.   The distance, in kilometers, travelled to work by the employees of a city council may be modelled by a normal distribution with mean 7.5 and standard deviation 2.5. Find d such that 10% of the council's employees travel less than d kilometers to work.

8.   An airline operates a service between Manchester and Paris. The flight time may be modelled by a normal distribution with mean 85 minutes and standard deviation 8 minutes. In order to gain publicity for the service, the airline decides to refund fares when a flight time exceeds q minutes. Find the value of q such that the probability of fares being refunded on a particular flight is 0.001.

9. Every December, a large insurance company gives each salesperson a productivity score base on the dollar value of new policies sold during the year, and these scores follow a normal distribution. All salespeople with scores more than 1.5 standard deviations above the mean score are awarded bonuses, and all salespeople with scores that are outliers on the high end are awarded substantial raises in addition to the bonuses. What is the probability that a randomly selected salesperson received the bonus but not the raise?