Statistics 1 Normal Distribution Questions

7   (a)   The weight, X grams, of soup in a carton may be modelled by a normal random
variable with mean 406 and standard deviation 4.2.

Find the probability that the weight of soup in a carton:

(i)   is less than 400 grams;   *(3 marks)*

(ii)   is between 402.5 grams and 407.5 grams.   *(4 marks)*

(b)   The weight, Y grams, of chopped tomatoes in a tin is a normal random variable with
mean μ and standard deviation σ.

(i)   Given that $P(Y<310) = 0.975$, explain why:

$$310 - \mu = 1.96\sigma$$ *(3 marks)*

(ii)   Given that $P(Y<307.5) = 0.86$, find, to two decimal places, values for μ and σ.

2   The heights of sunflowers may be assumed to be normally distributed with a mean of 185 cm
and a standard deviation of 10 cm.

(a)   Determine the probability that the height of a randomly selected sunflower:

(i)   is less than 200 cm;   *(3 marks)*

(ii)   is more than 175 cm;   *(3 marks)*

(iii)   is between 175 cm and 200 cm.   *(2 marks)*

(b)   Determine the probability that the mean height of a random sample of 4 sunflowers is
more than 190 cm.   *(4 marks)*

6   When Monica walks to work from home, she uses either route A or route B.

   (a)   Her journey time, X minutes, by route A may be assumed to be normally distributed with a mean of 37 and a standard deviation of 8.

   Determine:

   (i) $P(X<45)$;   *(3 marks)*

   (ii) $P(30<X<45)$.   *(3 marks)*

   (b)   Her journey time, Y minutes, by route B may be assumed to be normally distributed with a mean of 40 and a standard deviation of σ .

   Given that $P(Y>45) = 0.12$, calculate the value of σ .   *(4 marks)*

   (c)   If Monica leaves home at 8.15 am to walk to work hoping to arrive by 9.00 am, state, with a reason, which route she should take.   *(2 marks)*

(d)   When Monica travels to work from home by car, her journey time, W minutes, has a mean of 18 and a standard deviation of 12.

   Estimate the probability that, for a random sample of 36 journeys to work from home by car, Monica's mean time is more than 20 minutes.   *(4 marks)*

(e)   Indicate where, if anywhere, in this question you needed to make use of the Central Limit Theorem.   *(1 mark)*

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7   (a)   Electra is employed by E & G Ltd to install electricity meters in new houses on an estate. Her time, X minutes, to install a meter may be assumed to be normally distributed with a mean of 48 and a standard deviation of 20.

   Determine:

   (i) $P(X < 60)$;   *(2 marks)*

   (ii) $P(30 < X < 60)$;   *(3 marks)*

   (iii)   the time, k minutes, such that $P(X < k) = 0.9$.   *(4 marks)*

   (b)   Gazali is employed by E & G Ltd to install gas meters in the same new houses. His time, Y minutes, to install a meter has a mean of 37 and a standard deviation of 25.

   (i)   Explain why Y is unlikely to be normally distributed.   *(2 marks)*

   (ii)   State why $\overline{Y}$, the mean of a random sample of 35 gas meter installations, is likely to be approximately normally distributed.   *(1 mark)*

   (iii)   Determine $P(\overline{Y} > 40)$.   *(4 marks)*