NORMAL DISTRIBUTION

2013 MI P2 Q10

A fruit stall sells 2 types of durians, XO and D24. For each type of durian, a randomly chosen durian has a mass that is normally distributed with mean and standard deviation, as well as unit price as shown in the following table.

	Mean (kg)	**Standard deviation (kg)**	**Price per kg**
XO	2.5	0.8	\$12
D24	2.0	0.5	\$7

(i) Find the probability that the total mass of 2 randomly chosen XO durians is more than 3 times the mass of a randomly chosen D24 durian. [3]

(ii) Find the probability that the price of a randomly chosen XO durian differs from the price of a randomly chosen D24 durian by less than \$15. [4]

A sample of n XO durians is randomly chosen. Find the least value of n such that the probability that the mean mass is more than 2.25 kg exceeds 0.9. [4]

Answers: (i) 0.297 (ii) 0.460 (iii) 17

CJC P2 Q9

A student reaches the bus-stop outside his house at 7:20 am every morning to take a bus to school and has to reach his school by 7.40 am. Assume that the waiting time for his bus is normally distributed with mean 8 minutes and variance 5 minutes^2, and the journey time is normally distributed with mean 11 minutes and variance 4 minutes^2.

(i) Find the probability that he will take more than 20 minutes to reach school (i.e. late for school) on a randomly chosen day. [2]

(ii) In a month of 30 days, what is the expected number of days he will be late for school? [1]

(iii) Find the latest time he would have to reach the bus-stop outside his house so that the probability of him being late for school is less than 5%. [4]

(iv) Find the probability that the average time taken to travel from the bus stop outside his house (including waiting for the bus) to school in 30 days is between 15 to 20 minutes. [2]

Answer: (i) 0.369 (ii) 11days (iii) 7.16am (iv) 0.966

2010 PJC P2 Q12

The weight, Y, of a Yummy cereal bar is normally distributed with mean $(120-k)$g and standard deviation 10g. The weight, F, of a Fullness cereal bar is normally distributed with mean 180 g and standard deviation 20 g.

(i) Given that $\mathrm{P}(Y<80)=\mathrm{P}(Y>150)$, show that the value of k is 5. [1]

(ii) 5 Yummy cereal bars are randomly chosen. Find the probability that exactly one bar weighs lesser than the lower quartile weight and exactly one bar weighs more than the median weight. [2]

(iii) Find the probability that the weight of 2 randomly chosen Yummy cereal bars differs from one and a half times the weight of a randomly chosen Fullness cereal bar by at most 5g.

State the assumption needed for your working. [4]

The Fullness cereal bars are sold at \$2 per 100g.

(iv) Find the probability that a randomly chosen Fullness cereal bar costs more than \$3.50. [2]

(v) A random sample of 100 Fullness cereal bars is taken. Find the probability that there are at least 55 bars but at most 65 bars with each costing more than \$3.50. [3]

Answers: (i) 5 (ii) 5/128 (iii) 0.0582; The weight of any cereal bar is independent of the weight of other cereal bar. (iv) 0.599 (v) 0.738

2015 VJC P2 Q11

A supermarket sells 2 different types of apples – Granny Smith and Fuji. The masses, in grams, of each type of apples follow normal distributions. The means and standard deviations of these distributions are shown in the following table.

	Mean (g)	Standard deviation (g)
Granny Smith	150	11.7
Fuji	180	15.2

(i) Two Fuji apples are chosen. Find the probability that their masses differs by at least 20 g.

(ii) Granny Smith apples are sold at \$3.50 per kg and Fuji apples at \$5 per kg.

Find the probability that six Granny Smith apples and four Fuji apples cost more than \$6.50.

(iii) State an assumption needed for your calculations in parts **(i)** and **(ii)**.

Answers: (i) 0.352 (ii) 0.915 (iii) We assume that the masses of all the apples are independent of each other.

2019 ASRJC P2 Q6 (I)

Birth weight can be used to predict short and long-term health complications for babies. Studies show that the birth weight of babies born to mothers who do not smoke in a certain hospital can be assumed to follow a normal distribution with mean 3.05 kg and variance $\sigma^2 \text{ kg}^2$.

The hospital classifies babies based on their birth weight as shown as in the table below.

Birth weight	Classification
Less than 1.5 kg	Very low birth weight
1.5 kg to 2.5 kg	Low birth weight
2.5 kg to 4.0 kg	Normal birth weight
More than 4.0 kg	High birth weight

(i) A sample showed that 20.2% of the babies born to mothers who do not smoke have low birth weight. If this is true for the entire population, find two possible values of σ, corrected to 2 decimal places. Explain clearly why one of the values of σ found should be rejected. [4]

Answer: (i) On average, for every 100 babies born, 2.5 babies have a weight less than 0 kg.