

Cambridge International AS & A Level

Mathematics

9709/52

Paper 5 Probability & Statistics 1

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Question No (3)

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The weights of oranges can be modelled by a normal distribution with mean 131 grams and standard deviation 54 grams. Oranges are classified as small, medium or large. A large orange weighs at least 184 grams and 20% of oranges are classified as small.

- (a) Find the percentage of oranges that are classified as large.
 (b) Find the greatest possible weight of a small orange.

Solution:**(a)**

By the given data
 let x be the variable of normal distribution

$$\Rightarrow x \sim N(131, 54) = N(\mu, \sigma)$$

According to given condition

Large orange $x \geq 184$

we shall calculate $P(X \geq 184)$

By standardize

$$z = \frac{x - \mu}{\sigma} = \frac{184 - 131}{54} = \frac{53}{54}$$

$$z \approx 0.9815$$

$$\Rightarrow P(X \geq 184) = P(Z \geq 0.9815)$$

$$= 1 - \Phi(0.9815)$$

$$= 1 - 0.8369$$

$$= 0.1631$$

From
 standard
 N table

percentage of orange that are classified
 as large

$$= 0.1631 \times 100$$

$$= 16.3 \%$$

(b)

As 20% of the oranges are small.
That means

$$P(X \leq w) = 20\%$$

$$P(X \leq w) = 0.2$$

By doing standardize

$$\begin{aligned} P(X \leq w) &= P\left(\frac{X - \mu}{\sigma} \leq \frac{w - \mu}{\sigma}\right) \\ &= P\left(Z < \frac{w - 131}{54}\right) = 0.2 \end{aligned}$$

$$\Phi\left(\frac{w - 131}{54}\right) = 0.2$$

$$\frac{w - 131}{54} = \begin{matrix} -0.842 \\ \text{z-value for 20th percentile} \end{matrix}$$

$$\begin{aligned} w &= 131 + 54 \times -0.842 \\ &= 131 - 45.468 \end{aligned}$$

$$w = 85.53$$

