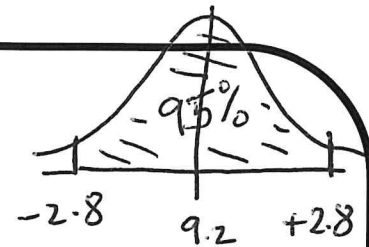
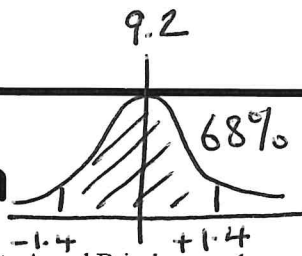


Normal Distribution



Q1

Roisin is a keen gardener and has plants A and B in her garden.

The lengths of the leaves on plant A are normally distributed with mean 9.2 cm and standard deviation 1.4 cm.

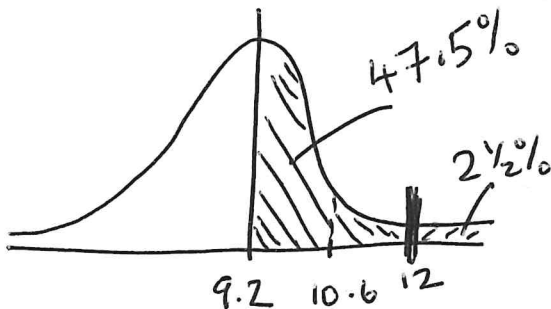
spread outness

(a) Within what range of lengths would you expect about two-thirds of the leaves on plant A to be?

68% lies $9.2 - 1.4$ and $9.2 + 1.4$

Answer 7.8 cm and 10.6 cm [3]

(b) Find the probability that a leaf, selected at random from plant A, is between 9.2 cm and 12 cm long.



Answer 0.475 [3]

The lengths of the leaves on plant B are normally distributed with mean 10.6 cm and standard deviation 2.1 cm.

$$\sigma = 2.1$$

$$\mu = 10.6$$

The standardised score for a leaf, selected at random from plant B, is -0.7

(c) Calculate the actual length of the leaf.

$$z = \frac{x - \mu}{\sigma}$$

LEARN THIS

$$-0.7 = \frac{x - 10.6}{2.1}$$

$$-1.47 = x - 10.6$$

$$9.13 = x$$

Answer 9.13 cm [3]

Roisin takes a leaf at random off the ground, but is unsure which plant it has come from.

The leaf measures 10 cm.

(d) Using standardised scores, determine which plant this leaf is more likely to have come from, giving a reason for your choice.

Find each standardised score

Plant A $z = \frac{10 - 9.2}{1.4}$

Plant B $z = \frac{10 - 10.6}{2.1}$

$$z = 0.571$$

$$z = -0.286$$

$\sigma =$ spread/outiness

In a senior sporting competition, the points scored by the 348 competitors were normally distributed with a mean of 124 and a standard deviation of 7.2

Q2

$\mu = 124$

$\sigma = 7.2$

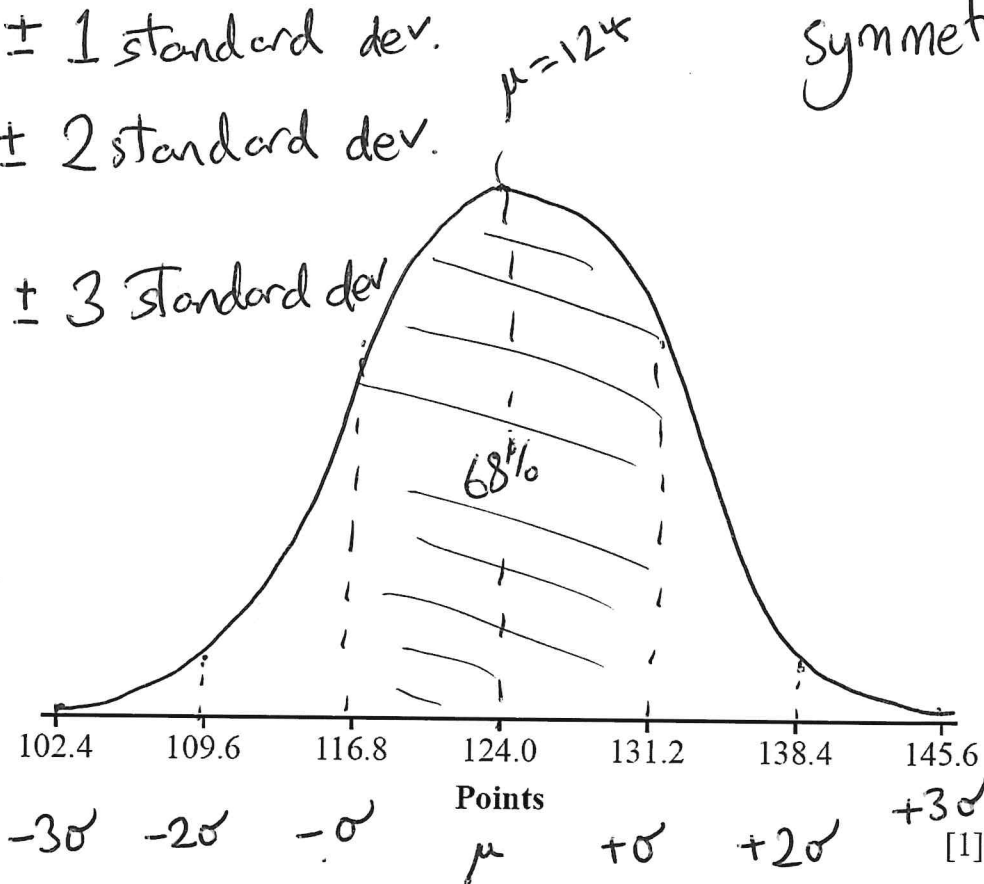
(c) (i) Use the axis below to sketch the distribution of the points in the senior sporting competition.

68% \pm 1 standard dev.

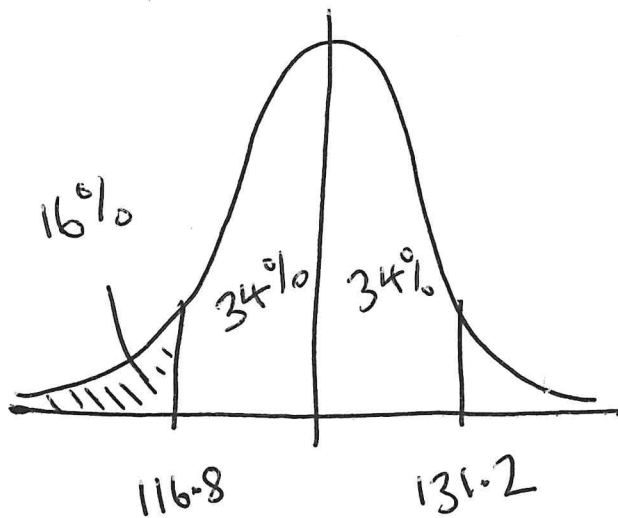
95% \pm 2 standard dev.

99% \pm 3 standard dev.
almost all

symmetrical



(ii) Calculate an estimate of the number of competitors who scored 116.8 points or less in the senior sporting competition.



Approx 56

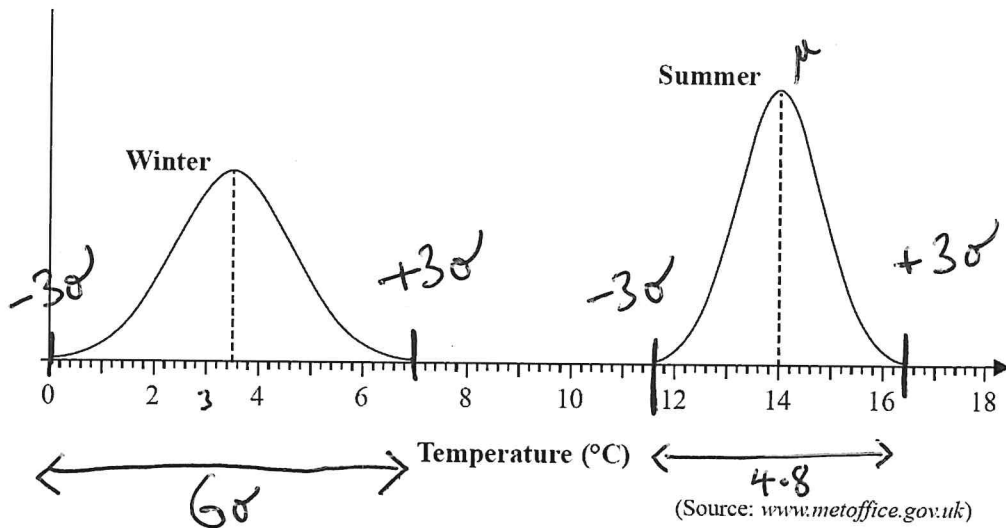
Answer 16% of 348 [2]
 0.16×348

The mean of the daily winter temperatures and the mean of the daily summer temperatures in the UK have been recorded for each year from 1910 to 2018

Q3

This information has been used to model the two distributions of the mean temperatures.

The graphs below give information about these models.



(a) Write down the name of the distribution that is suggested by each of these graphs.

Because the shape
Because symmetrical

Normal Distribution

(1)

(b) Comment on the difference between the means of these two distributions.

Mean of Winter = 3.5

Mean of Summer = 14

Summer mean is greater than Winter mean

(2)

The standard deviation for the distribution of the summer temperatures is 0.8°C , correct to one decimal place.

(c) Using the graph for the winter temperatures, calculate an estimate for the standard deviation of the distribution of the winter temperatures, correct to one decimal place.

Remember
Virtually all is between
 -3σ and $+3\sigma$
so that
Winter is between 0 and 7

(2)

$$6\sigma = 7$$

$$\sigma = 1.16$$

approx.

$$\sigma = 1.2$$

standard deviation

Year 12 students completed tests in Digital Technology, Home Economics and Religious Studies.

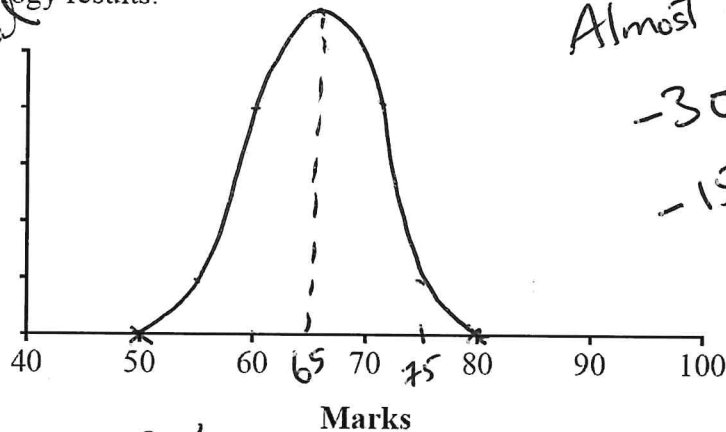
Q4 The results in each test were normally distributed, $\mu = 65$

The mean of the Digital Technology results was 65 and the standard deviation was 5

$$\sigma = 5$$

(a) On the grid below sketch the distribution of the Digital Technology results.

Symmetrical



*Almost all is
-3σ to +3σ
-15 to +15
from mean*

-3σ ← ————— → $+3\sigma$

[2]

Niamh got 71 marks in the Digital Technology test.

(b) Calculate Niamh's standardised score in Digital Technology.

$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{71 - 65}{5}$$

$$z = \frac{6}{5} \quad \text{Answer } \underline{1.2} \quad [2]$$

$$z = 1.2$$

Niamh's standardised score in the Home Economics test was 0.3

(c) (i) Which test did Niamh do better in?

Digital Technology Home Economics [1]

(ii) Give a reason for your answer.

Her standard score in D.T. is further up/away from 0

It is better because it is further away from the mean

Her Home Economics result is closer to mean

Harry, Kyle and Ethan entered a junior sporting competition.

Q5 The points scored by all competitors in the junior sporting competition were normally distributed with a mean of 98 and a standard deviation of 3.2

$$\mu = 98$$

$$\sigma = 3.2$$

(a) Harry scored 102 points in the competition.

(i) Calculate Harry's standardised score.

$$z = \frac{x - \mu}{\sigma}$$

$$z = \frac{102 - 98}{3.2}$$

$$z = 1.25$$

Answer _____ [2]

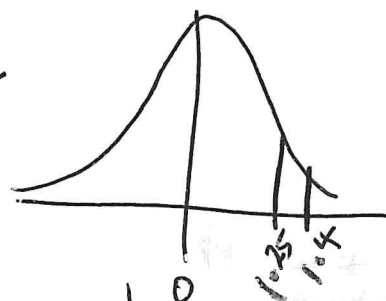
Kyle's standardised score in the competition was 1.4

(ii) Who scored more points in the competition?

Tick one box.

Harry

Kyle



Give a reason for your answer.

His 1.4 standardised score shows
his result is further up away
from the mean [2]

Ethan's standardised score was calculated to be -0.31

(b) Calculate how many points Ethan scored in the competition.

$$z = \frac{x - \mu}{\sigma}$$

$$-0.31 = \frac{x - 98}{3.2}$$

$$-0.992 = x - 98$$

$$x = 98 - 0.992$$

$$x = 97.008$$

Ans 97 points