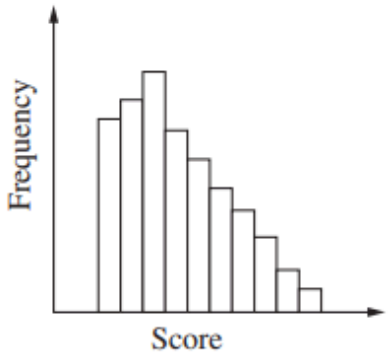
Standard 2 Mathematics Task 2 - Bank of Questions

Part 1 Multiple Choice

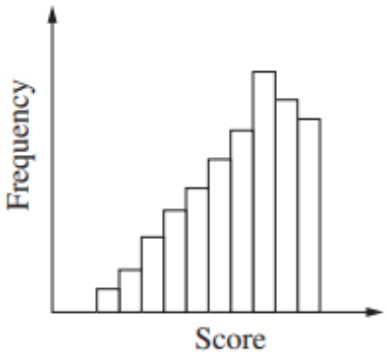
Question 1

Which histogram best represents a dataset that is positively skewed?

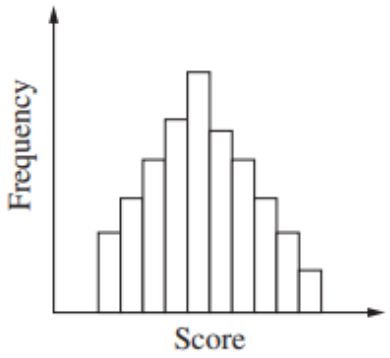
A.



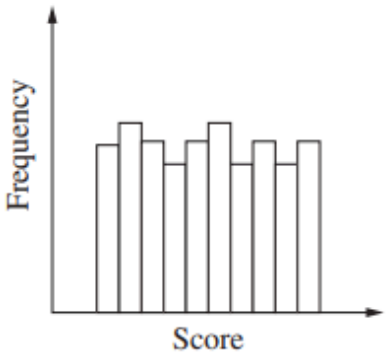
B.



C.



D.



Question 2

John recently did a class test in each of three subjects. The class scores on each test were normally distributed.

The table shows the subjects and John's scores as well as the mean and standard deviation of the class scores on each test.

Subject	*John's score*	*Mean*	*Standard deviation*
French	82	70	8
Commerce	80	65	5
Music	74	50	12

Relative to the rest of the class, which row of the table below shows John's strongest subject and his weakest subject?

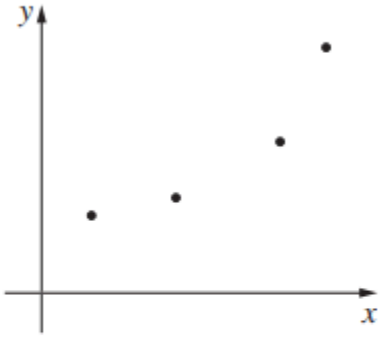
	Strongest subject	*Weakest subject*
A.	Commerce	French
B.	French	Music
C.	Music	French
D.	Commerce	Music

Question 3

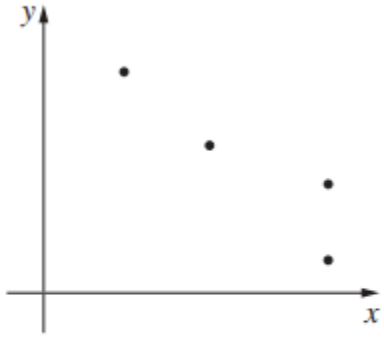
For a set of bivariate data, Pearson's correlation coefficient is –1.

Which graph could best represent this set of bivariate data?

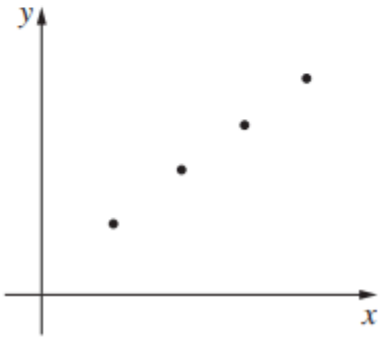
A.



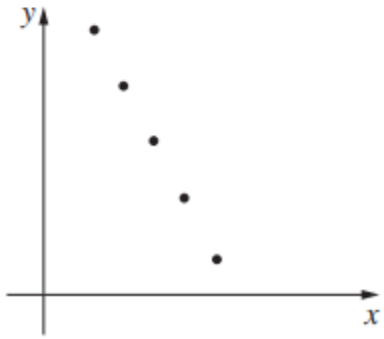
B.



C.



D.



Question 4

On a test, Zac's mark corresponded to a z-score of 2. The test scores had a mean of 63 and a standard deviation of 8.

What was Zac's actual mark on the test?

A. 65

B. 67

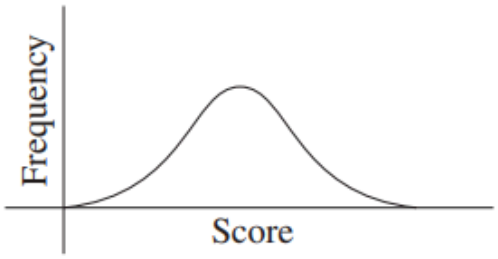
C. 73

D. 79

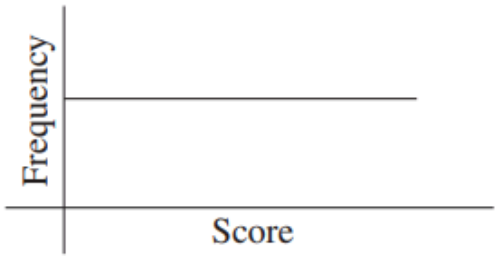
Question 5

Which graph represents a negatively skewed distribution?

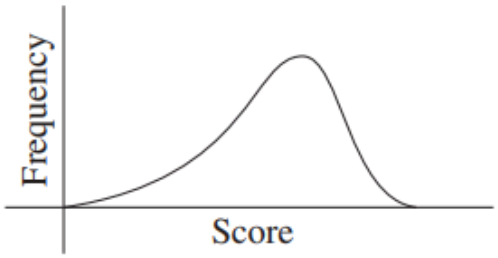
A.



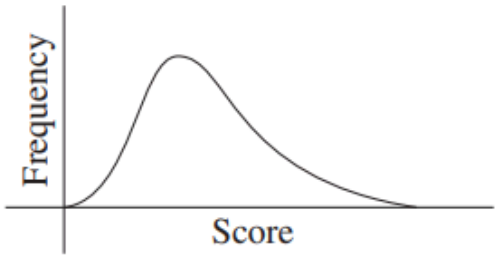
B.



C.



D.



Question 6

For a particular course, the recorded data show a relationship between the number of hours of study per week and the marks achieved out of 100.

A least-squares regression line is fitted to this dataset. The equation of this line is given by

$$M = 20 + 3H,$$

where M is the predicted mark and H is the number of hours of study per week.

Based on this regression equation, which of the following is correct regarding the predicted mark of a student?

A. It will be 3 for zero hours of study per week.

B. It will be 20 for zero hours of study per week.

C. It will increase by 20 for every additional hour of study per week.

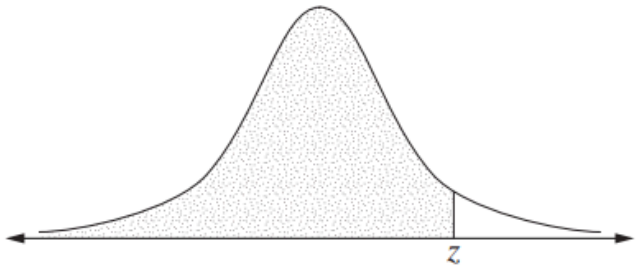
D. It will increase by 1 for every 3 additional hours of study per week.

Question 7

A random variable is normally distributed with mean 0 and standard deviation 1. The table gives the probability that this random variable lies below z for some positive values of z.

z	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99
Probability	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767

The probability values given in the table are represented by the shaded area in the following diagram.



What is the probability that a normally distributed random variable with mean 0 and standard deviation 1 lies between 0 and 1.94?

A. 0.0262

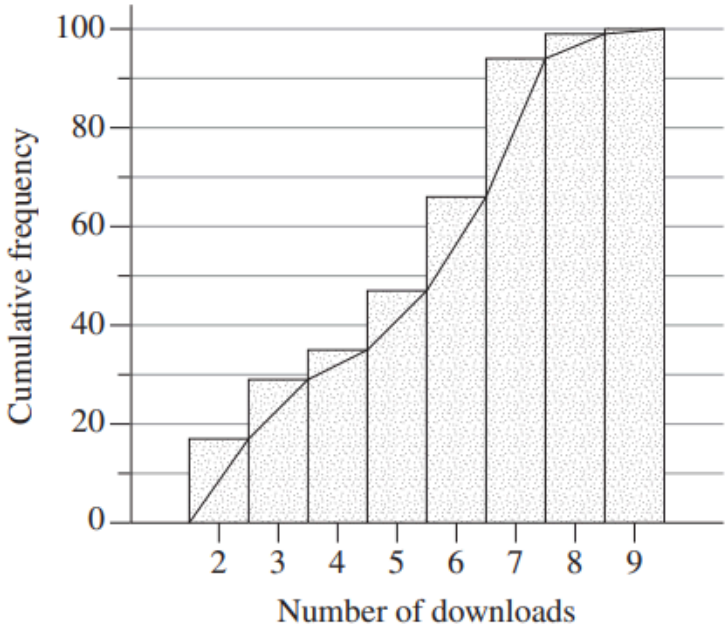
B. 0.4738

C. 0.5262

D. 0.9738

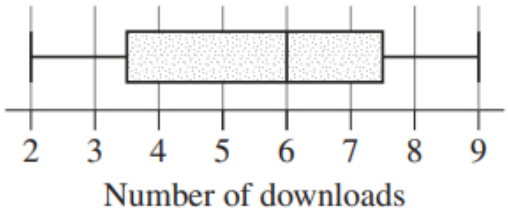
Question 8

The cumulative frequency graph shows the distribution of the number of movie downloads made by 100 people in one month.

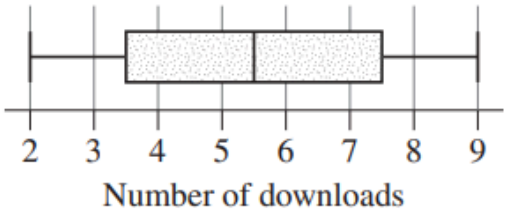


Which box-plot best represents the same data as displayed in the cumulative frequency graph?

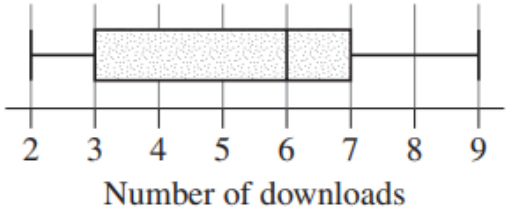
A.



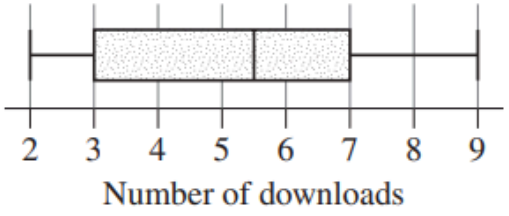
B.



C.



D.



Question 9

In a normal distribution, what is the approximate percentage of scores with a z-score less than 1?

A. 50%

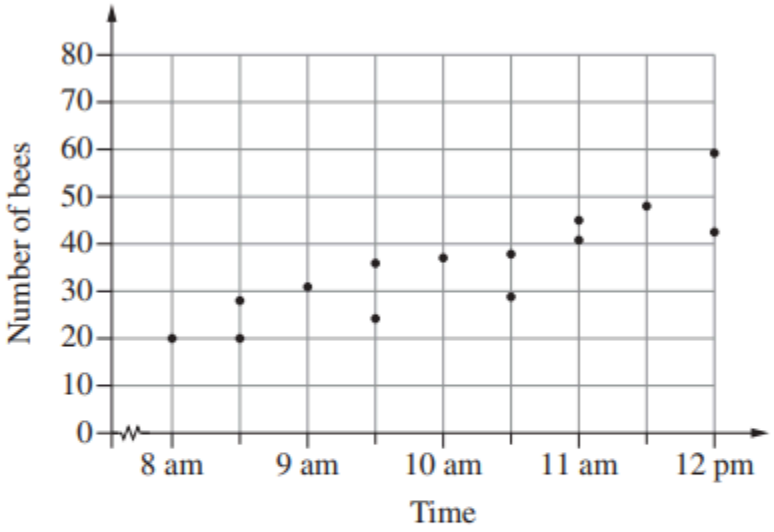
B. 68%

C. 84%

D. 97.5%

Question 10

The number of bees leaving a hive was observed and recorded over 14 days at different times of the day.



Which Pearson's correlation coefficient best describes the observations?

A. −0.8

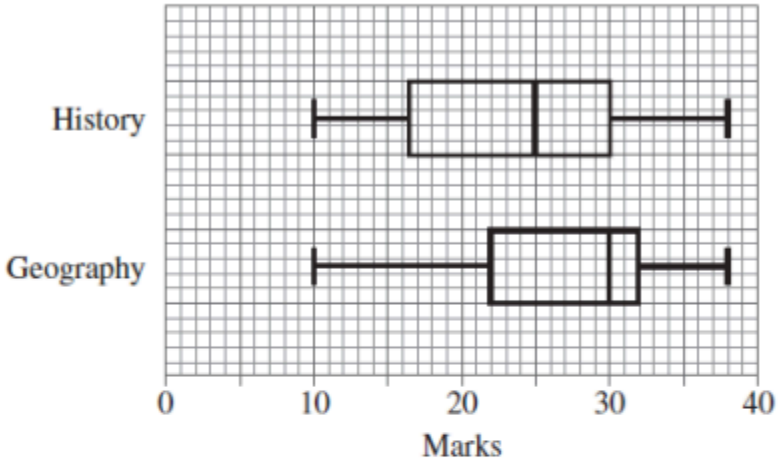
B. −0.2

C. 0.2

D. 0.8

Question 11

The box-and-whisker plots show the results of a History test and a Geography test.



In History, 112 students completed the test. The number of students who scored above 30 marks was the same for the History test and the Geography test.

How many students completed the Geography test?

(A) 8

(B) 50

(C) 56

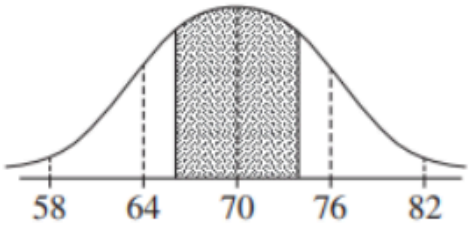
(D) 112

Question 12

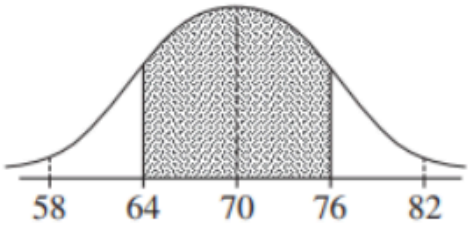
The scores on an examination are normally distributed with a mean of 70 and a standard deviation of 6. Michael received a score on the examination between the lower quartile and the upper quartile of the scores.

Which shaded region most accurately represents where Michael's score lies?

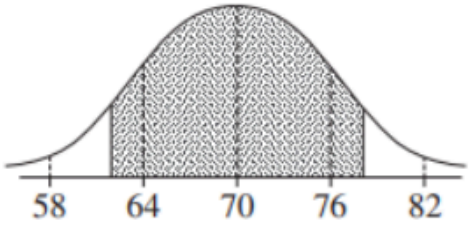
A.



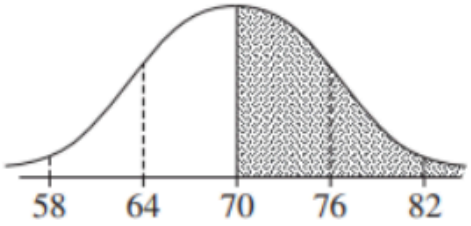
B.



C.



D.



Part 2 Short Answer

Question 1

Consider the following dataset. **4**

1 5 9 10 15

Suppose a new value, x, is added to this dataset, giving the following.

1 5 9 10 15 x

It is known that x is greater than 15. It is also known that the difference between the means of the two datasets is equal to ten times the difference between the medians of the two datasets.

Calculate the value of x.

.....

.....

.....

.....

Question 2

The Intelligence Quotient (IQ) scores for adults in City *A* are normally distributed with a mean of 108 and a standard deviation of 10.

The IQ scores for adults in City *B* are normally distributed with a mean of 112 and a standard deviation of 16.

(a) Yin is an adult who lives in City *A* and has an IQ score of 128. **2**

What percentage of the adults in this city have an IQ score higher than Yin's?

.....

.....

.....

.....

.....

.....

(b) There are 1 000 000 adults living in City *B*. **2**

Calculate the number of adults in City *B* that would be expected to have an IQ score lower than Yin's.

.....

.....

.....

.....

.....

.....

(c) Simon, an adult who lives in City *A*, moves to City *B*. The *z*-score corresponding to his IQ score in City *A* is the same as the *z*-score corresponding to his IQ score in City *B*. **3**

By first forming an equation, calculate Simon's IQ score. Give your answer correct to one decimal place.

.....

.....

.....

.....

.....

.....

.....

.....

Question 3

The five-number summary of a dataset is given. **2**

Lowest score = 1

Lower quartile $(Q_1) = 4$

Median $(Q_2) = 7$

Upper quartile $(Q_3) = 10$

Highest score = 20

Is 20 an outlier? Justify your answer with calculations.

.....

.....

.....

.....

.....

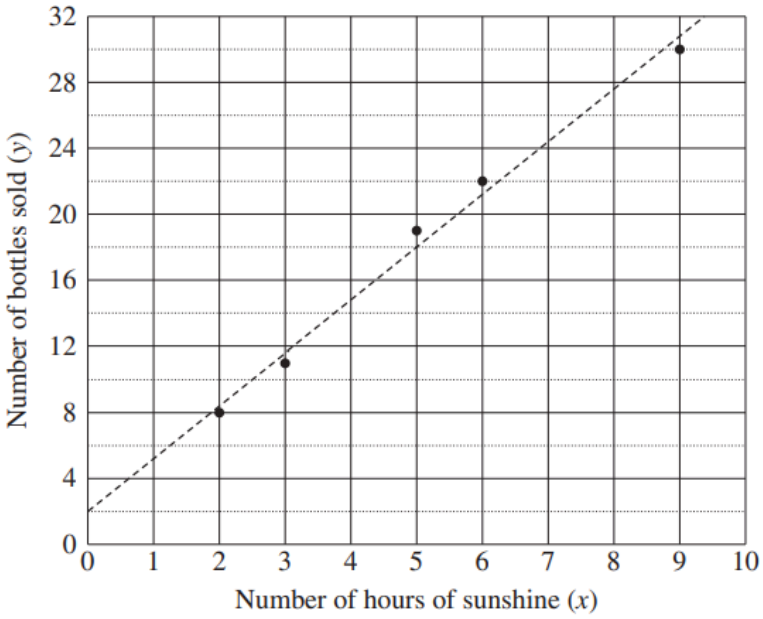
.....

.....

Question 4

A salesperson is interested in the relationship between the number of bottles of lemonade sold per day and the number of hours of sunshine in the day.

The diagram shows the dataset used in the investigation and the least-squares regression line.



(a) Find the equation of the least-squares regression line relating to the dataset. **2**

.....

.....

.....

(b) Suppose a sixth data point was collected on a day which had 10 hours of sunshine. On that day 45 bottles of lemonade were sold. **1**

What would happen to the gradient found in part (a)?

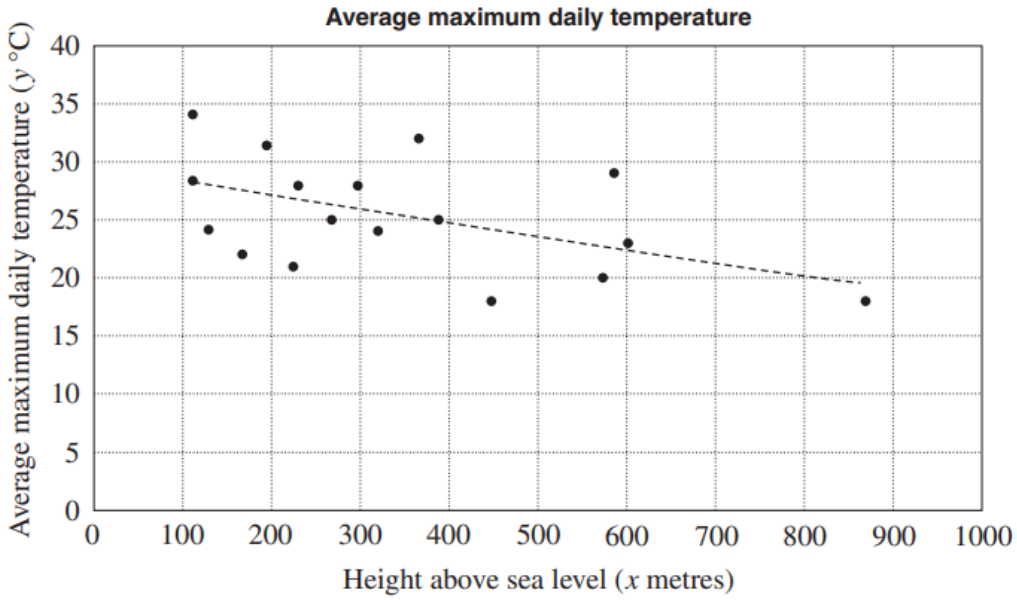
.....

.....

Question 5

For a sample of 17 inland towns in Australia, the height above sea level, x (metres), and the average maximum daily temperature, y (°C), were recorded.

The graph shows the data as well as a regression line.



The equation of the regression line is $y = 29.2 - 0.011x$.

The correlation coefficient is $r = -0.494$.

(a) (i) By using the equation of the regression line, predict the average maximum daily temperature, in degrees Celsius, for a town that is 540 m above sea level. Give your answer correct to one decimal place. **1**

.....

.....

(ii) The gradient of the regression line is −0.011. Interpret the value of this gradient in the given context. **2**

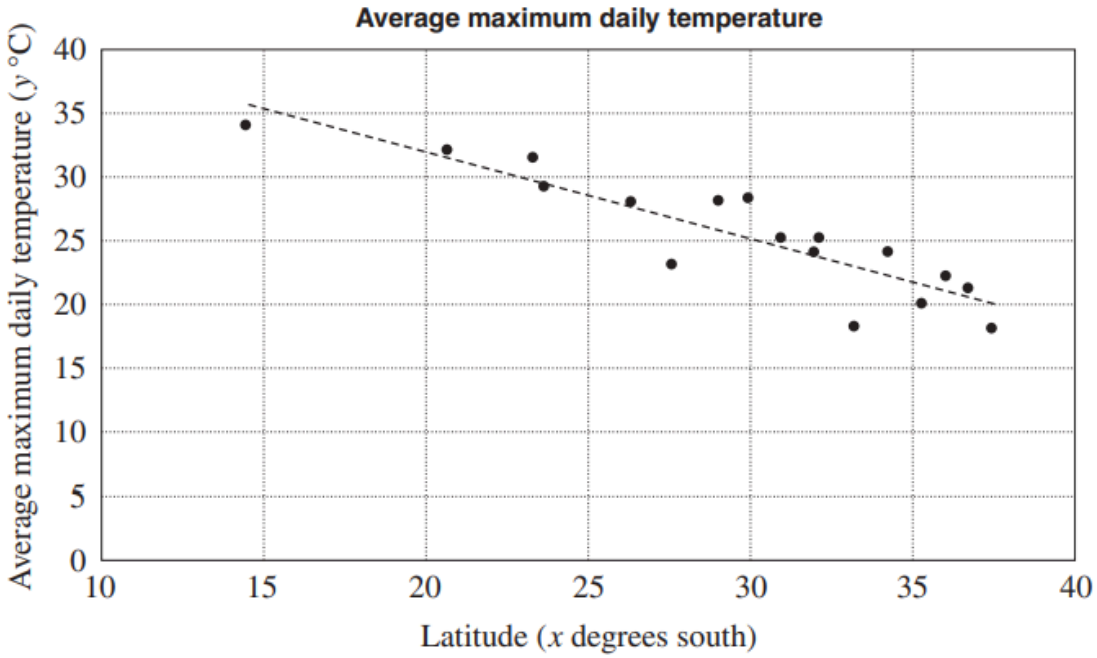
.....

.....

.....

.....

(b) The graph below shows the relationship between the latitude, x (degrees south), and the average maximum daily temperature, y (°C), for the same 17 towns, as well as a regression line. **1**



The equation of the regression line is $y = 45.6 - 0.683x$.

The correlation coefficient is $r = -0.897$.

Another inland town in Australia is 540 m above sea level. Its latitude is 28 degrees south.

Which measurement, height above sea level or latitude, would be better to use to predict this town's average maximum daily temperature? Give a reason for your answer.

.....

.....

.....

.....

Question 6

The marks in a test were normally distributed. The mean mark was 60 and the standard deviation was 15. **2**

What was the percentage of marks higher than 90?

.....

.....

.....

.....

.....

.....

.....

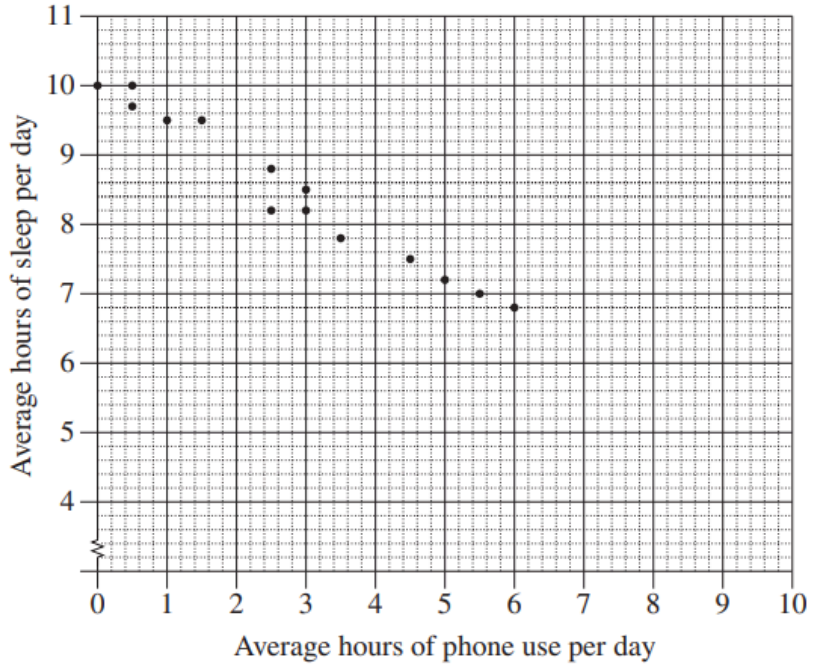
.....

.....

Question 7

A teacher surveyed the students in her Year 8 class to investigate the relationship between the average number of hours of phone use per day and the average number of hours of sleep per day.

The results are shown on the scatterplot below.



(a) The data for two new students, Alinta and Birrani, are shown in the table below. Plot their results on the scatterplot. **2**

	Average hours of phone use per day	*Average hours of sleep per day*
Alinta	4	8
Birrani	0	10.5

(b) By first fitting the line of best fit by eye on the scatterplot, estimate the average number of hours of sleep per day for a student who uses the phone for an average of 2 hours per day. **2**

.....

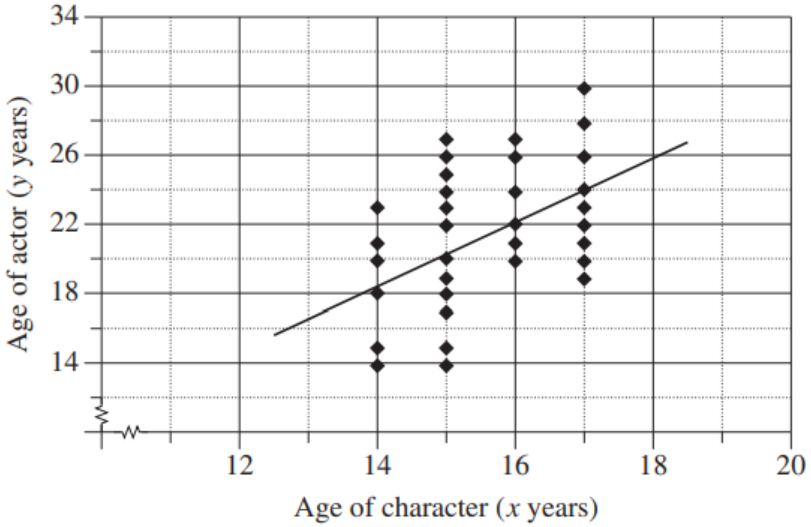
.....

Question 8

Jo is researching the relationship between the ages of teenage characters in television series and the ages of actors playing these characters. **4**

After collecting the data, Jo finds that the correlation coefficient is 0.4564.

A scatterplot showing the data is drawn. The line of best fit with equation $y = -7.51 + 1.85x$, is also drawn.



Describe and interpret the data and other information provided, with reference to the context given.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 9

The life span of batteries from a particular factory is normally distributed with a mean of 840 hours and a standard deviation of 80 hours. **3**

It is known from statistical tables that for this distribution approximately 60% of the batteries have a life span of less than 860 hours.

What is the approximate percentage of batteries with a life span between 820 and 920 hours?

.....

.....

.....

.....

.....

.....

Question 10

A university uses gas to heat its buildings. Over a period of 10 weekdays during winter, the gas used each day was measured in megawatts (MW) and the average outside temperature each day was recorded in degrees Celsius (°C).

Using x as the average daily outside temperature and y as the total daily gas usage, the equation of the least-squares regression line was found.

The equation of the regression line predicts that when the temperature is 0°C, the daily gas usage is 236 MW.

The ten temperatures measured were: 0°, 0°, 0°, 2°, 5°, 7°, 8°, 9°, 9°, 10°.

The total gas usage for the ten weekdays was 1840 MW.

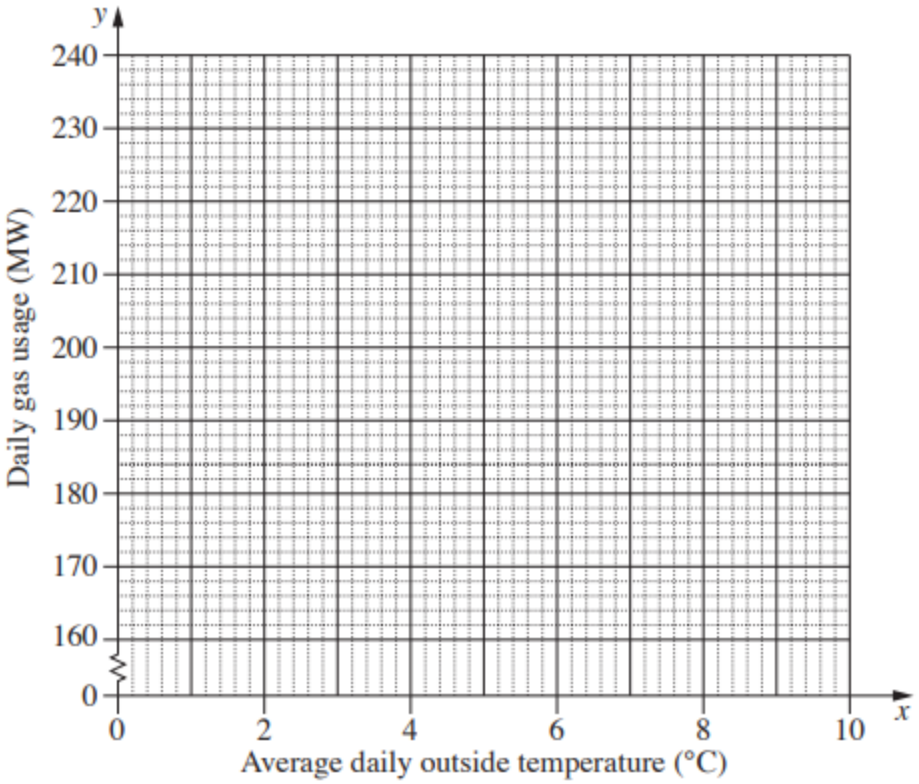
In any bivariate dataset, the least-squares regression line passes through the point $(\bar{x}, \bar{y})$, where $\bar{x}$ is the sample mean of the x-values and $\bar{y}$ is the sample mean of the y-values.

(a) Using the information provided, plot the point $(\bar{x}, \bar{y})$ and the y-intercept of the least-squares regression line on the grid. **3**

.....

.....

.....



(b) What is the equation of the regression line? **2**

.....

.....

.....

.....

.....

.....

(c) In the context of the dataset, identify ONE problem with using the regression line to predict gas usage when the average outside temperature is 23°C. **1**

.....

.....

.....

.....

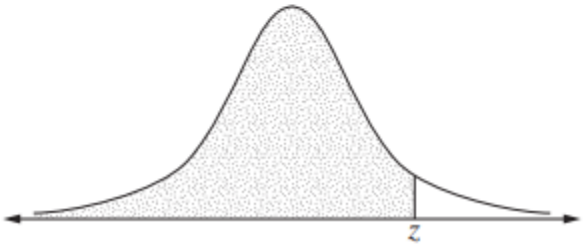
.....

Question 11

A random variable is normally distributed with a mean of 0 and a standard deviation of 1. The table gives the probability that this random variable lies below z for some positive values of z. **4**

z	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39
Probability	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177

The probability values given in the table are represented by the shaded area in the following diagram.



The weights of adult male koalas form a normal distribution with mean $\mu = 10.40$ kg, and standard deviation $\sigma = 1.15$ kg.

In a group of 400 adult male koalas, how many would be expected to weigh more than 11.93 kg?

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

Question 12

The heights, in centimetres, of 10 players on a basketball team are shown. **3**

170, 180, 185, 188, 192, 193, 193, 194, 196, 202

Is the height of the shortest player on the team considered an outlier? Justify your answer with calculations.

.....

.....

.....

.....

.....

.....

.....

.....