1. 100 students are asked what they had for breakfast on a particular morning. There were three choices: cereal (*X*), bread (*Y*) and fruit (*Z*). It is found that

<div align="center">

10 students had all three
17 students had bread and fruit only
15 students had cereal and fruit only
12 students had cereal and bread only
13 students had only bread
8 students had only cereal
9 students had only fruit

</div>

(a) Represent this information on a Venn diagram.

**(4)**

(b) Find the number of students who had none of the three choices for breakfast.

**(2)**

(c) Write down the percentage of students who had fruit for breakfast.

**(2)**

(d) Describe in words what the students in the set $X \cap Y'$ had for breakfast.

**(2)**

(e) Find the probability that a student had **at least** two of the three choices for breakfast.

**(2)**

(f) Two students are chosen at random. Find the probability that both students had all three choices for breakfast.

**(3)**
**(Total 15 marks)**

2. **Give all your numerical answers correct to two decimal places.**

On 1 January 2005, Daniel invested 30 000 AUD at an annual **simple** interest rate in a *Regular Saver* account. On 1 January 2007, Daniel had 31 650 AUD in the account.

(a) Calculate the rate of interest.

**(3)**

On 1 January 2005, Rebecca invested 30 000 AUD in a *Supersaver* account at a nominal annual rate of 2.5 % **compounded annually**.

(b) Calculate the amount in the *Supersaver* account after two years.

**(3)**

(c) Find the number of complete years since 1 January 2005 it will take for the amount in Rebecca's account to exceed the amount in Daniel's account.

**(3)**

On 1 January 2007, Daniel reinvested 80 % of the money from the *Regular Saver* account in an

*Extra Saver* account at a nominal annual rate of 3 % **compounded quarterly**.

(d)　(i)　Calculate the amount of money reinvested by Daniel on the 1 January 2007.

　　(ii)　Find the number of complete years it will take for the amount in Daniel's *Extra Saver* account to exceed 30 000 AUD.

**(5)**
**(Total 14 marks)**

**3.** In an environmental study of plant diversity around a lake, a biologist collected data about the number of different plant species (*y*) that were growing at different distances (*x*) in metres from the lake shore.

| Distance (*x*) | 2 | 5 | 8 | 10 | 13 | 17 | 23 | 35 | 40 |
|---|---|---|---|---|---|---|---|---|---|
| Plant species (*y*) | 35 | 34 | 30 | 29 | 24 | 19 | 15 | 13 | 8 |

(a)　Draw a scatter diagram to show the data. Use a scale of 2 cm to represent 10 metres on the *x*-axis and 2 cm to represent 10 plant species on the *y*-axis.

**(4)**

(b)　Using your scatter diagram, describe the correlation between the number of different plant species and the distance from the lake shore.

**(1)**

(c)　Use your graphic display calculator to write down

　　(i)　$\bar{x}$, the mean of the distances from the lake shore;

　　(ii)　$\bar{y}$, the mean number of plant species.

**(2)**

(d)　Plot the point $(\bar{x}, \bar{y})$ on your scatter diagram. **Label this point M.**

**(2)**

(e)　Write down the equation of the regression line *y* on *x* for the above data.

**(2)**

(f)　Draw the regression line *y* on *x* on your scatter diagram.

**(2)**

(g)　Estimate the number of plant species growing 30 metres from the lake shore.

**(2)**
**(Total 15 marks)**

**4.** An arithmetic sequence is defined as

$$u_n = 135 + 7n, \qquad n = 1, 2, 3, \ldots$$

(a) Calculate $u_1$, the first term in the sequence.

**(2)**

(b) Show that the common difference is 7.

**(2)**

$S_n$ is the sum of the first $n$ terms of the sequence.

(c) Find an expression for $S_n$. Give your answer in the form $S_n = An^2 + Bn$, where $A$ and $B$ are constants.

**(3)**

The first term, $v_1$, of a geometric sequence is 20 and its fourth term $v_4$ is 67.5.

(d) Show that the common ratio, $r$, of the geometric sequence is 1.5.

**(2)**

$T_n$ is the sum of the first $n$ terms of the geometric sequence.

(e) Calculate $T_7$, the sum of the first seven terms of the geometric sequence.

**(2)**

(f) Use your graphic display calculator to find the smallest value of $n$ for which $T_n > S_n$.

**(2)**
**(Total 13 marks)**

**5.** (a) Phoebe chooses a biscuit from a blue tin on a shelf. The tin contains one chocolate biscuit and four plain biscuits. She eats the biscuit and chooses another one from the tin. The tree diagram below represents the situation with the four possible outcomes where *A* stands for chocolate biscuit and *B* for plain biscuit.
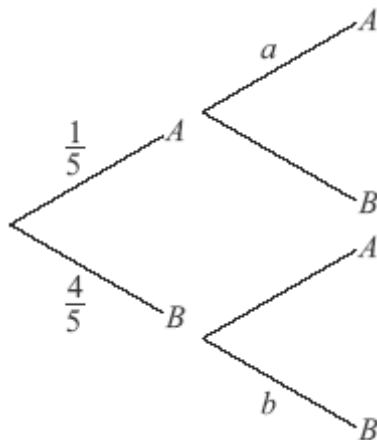


(i) Write down the value of *a*.

(ii) Write down the value of *b*.

(iii) Find the probability that both biscuits are plain.

**(6)**

On another shelf there are two tins, one red and one green. The red tin contains three chocolate biscuits and seven plain biscuits and the green tin contains one chocolate biscuit and four plain biscuits. Andrew randomly chooses either the red or the green tin and randomly selects a biscuit.
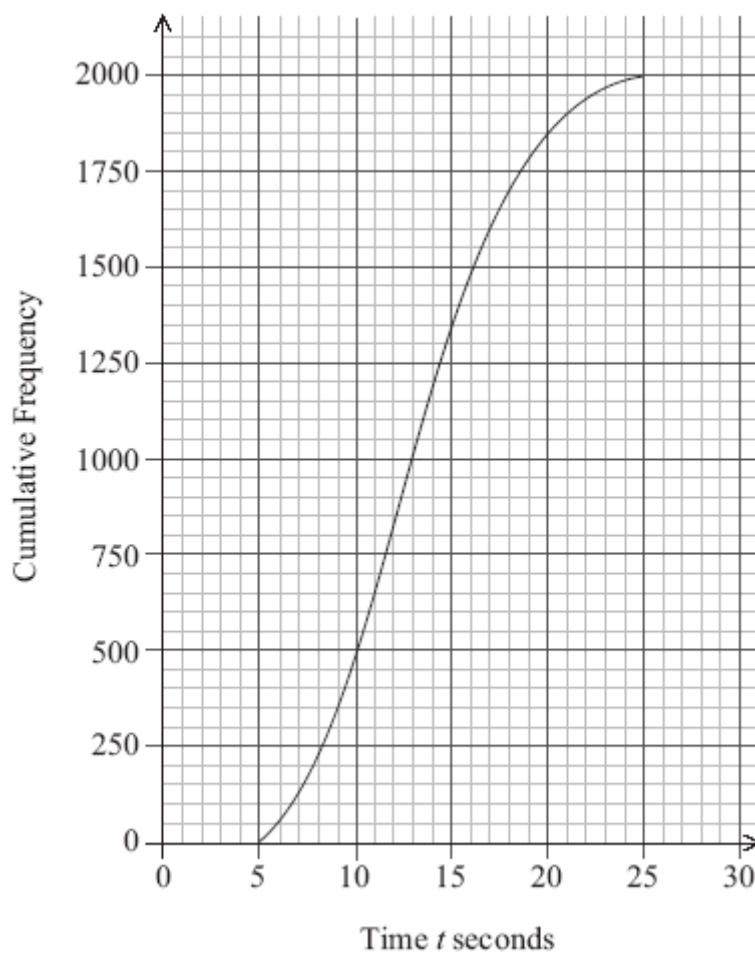
(b) **Copy and complete** the tree diagram below.
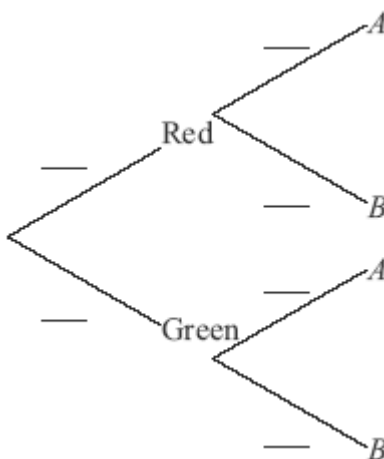


**(3)**

(c)    Find the probability that

     (i)     he chooses a chocolate biscuit;

     (ii)    he chooses a biscuit from the red tin given that it is a chocolate biscuit.

**(6)**
**(Total 15 marks)**

**6.**    The diagram shows the cumulative frequency graph for the time $t$ taken to perform a certain task by 2000 men.



Time $t$ seconds

(a)    Use the diagram to estimate

     (i)     the median time;

     (ii)    the upper quartile and the lower quartile;

     (iii)   the interquartile range.

**(4)**

(b)     Find the number of men who take **more than** 11 seconds to perform the task.

**(3)**

(c)     55 % of the men took less than $p$ seconds to perform the task. Find $p$.

**(2)**

The times taken for the 2000 men were grouped as shown in the table below.

| Time | Frequency |
|------|-----------|
| $5 \le t < 10$ | 500 |
| $10 \le t < 15$ | 850 |
| $15 \le t < 20$ | $a$ |
| $20 \le t < 25$ | $b$ |

(d)     Write down the value of

(i)     $a$;

(ii)    $b$.

**(2)**

(e)     Use your graphic display calculator to find an estimate of

(i)     the mean time;

(ii)    the standard deviation of the time.

**(3)**

Everyone who performs the task in **less than** one standard deviation **below** the mean will receive a bonus. Pedro takes 9.5 seconds to perform the task.

(f)     Does Pedro receive the bonus? Justify your answer.

**(3)**
**(Total 17 marks)**