3.   (a)   correct working   *(A1)*
         eg $-5+(8-1)(3)$

         $u_8 = 16$ *A1   N2*
                                                                                                 [2 marks]

   (b)   correct substitution into u_n formula   *(A1)*
         eg $-5+3(n-1)$, $3n-8$

         correct equation   *(A1)*
         eg $-5+3(n-1)=67$, $3n-8=67$, $3(n-1)=72$

         correct working   *(A1)*
         eg $3n=75$, $n-1=24$

         $n=25$ *A1   N3*
                                                                                                 [4 marks]

                                                                                                 Total [6 marks]

4.   (a)   correct approach   *(A1)*
         eg $3\log_2 a$

         $\log_2 a^3 = 3b$ *A1   N2*
                                                                                                 [2 marks]

   (b)   correct working   *(A1)*
         eg $\log_2 8 + \log_2 a$, $\log_2 8 = 3$

         $\log_2 8a = 3 + b$ *A1   N2*
                                                                                                 [2 marks]

   (c)   correct working   *(A1)*
         eg $\dfrac{\log_2 a}{\log_2 8}$, $\dfrac{1}{3}\log_2 a$, $b\log_8 2$

         $\log_8 a = \dfrac{b}{3}$ *A1   N2*

                                                                                                 [2 marks]

                                                                                                 Total [6 marks]

Section A

2.   (a)   (i)   evidence of set up   *(M1)*

           eg   correct value for a or b or r (seen in (ii)) or $r^2 (= 0.973)$

           9.91044, -31.3194

           $a = 9.91$, $b = -31.3$, $y = 9.91x - 31.3$ *A1A1*   *N3*

         (ii) 0.986417

                $r = 0.986$ *A1*   *N1*

                                                                 [4 marks]

      (b)   substituting $x = 21.5$ into **their** equation   *(M1)*

           eg $9.91(21.5) - 31.3$

           181.755

           182 (cm)   *A1*   *N2*

                                                                 [2 marks]

                                                               Total [6 marks]

4. (a) attempt to use definition of outlier

$1.5 \times 20 + Q_3$ **(M1)**

$1.5 \times 20 + U \geq 75$ $(\Rightarrow U \geq 45$, accept $U > 45)$ OR $1.5 \times 20 + Q_3 = 75$ **A1**

minimum value of $U = 45$ **A1**

[3 marks]

(b) attempt to use interquartile range **(M1)**

$U - L = 20$ (may be seen in part (a)) OR $L \geq 25$ (accept $L > 25$)

minimum value of $L = 25$ **A1**

[2 marks]
Total [5 marks]

5. correct substitution into formula for infinite geometric series **(A1)**

eg $\quad 33.25 = \dfrac{u_1}{1-r}$

correct substitution into formula for u_n (seen anywhere) **(A1)**

eg $\quad 7.98 = u_1 r$

attempt to express u_1 in terms of r (or vice-versa) **(M1)**

eg $\quad u_1 = \dfrac{7.98}{r}$, $u_1 = 33.25(1-r)$, $r = \dfrac{7.98}{u_1}$, $r = \dfrac{33.25 - u_1}{33.25}$

correct working **(A1)**

eg $\quad \dfrac{\left(\dfrac{7.98}{r}\right)}{1-r} = 33.25$, $33.25(1-r) = \dfrac{7.98}{r}$, $(0.4, 19.95)$, $(0.6, 13.3)$, $\dfrac{u_1}{1-\dfrac{7.98}{u_1}} = 33.25$

$r = 0.4 \ \left(=\dfrac{2}{5}\right)$, $r = 0.6 \ \left(=\dfrac{3}{5}\right)$ **A1A1** **N3**

Total [6 marks]

Section B

7. (a) evidence of median position **(M1)**

40 students

median $=14$ (hours) **A1**

[2 marks]

(b) recognizing there are 8 students in the top 10% **(M1)**

72 students spent less than k hours **(A1)**

$k=18$ (hours) **A1**

[3 marks]

(c) 15 hours is 60 students OR $p=60-4$ **(M1)**

$p=56$ **A1**

21 hours is 76 students OR $q=80-76$ OR $q=80-4-56-16$ **(A1)**

$q=4$ **A1**

[4 marks]

(d) 20 of the 80 students OR $\dfrac{1}{4}$ spend more than 15 hours doing homework **(A1)**

$\dfrac{20}{80}=\dfrac{x}{320}$ OR $\dfrac{1}{4}\times 320$ OR 4×20 **(A1)**

80 (students) **A1**

[3 marks]

(e) (i) only year 12 students surveyed OR amount of homework might be different for different year levels **R1**

(ii) stratified sampling OR survey students in all years **R1**

[2 marks]

Total [14 marks]

Section B

8. (a) valid approach **(M1)**
eg $f(x)=0$, $x^2-4x-5=0$

valid attempt to solve quadratic equation **(M1)**
eg factorizing, formula, completing the square

evidence of correct working **(A1)**

eg $(x-5)(x+1)$, $x=\dfrac{4\pm\sqrt{16-4(-5)}}{2}$

$x=-1$, $x=5$ (accept $(-1,0)$, $(5,0)$) **A1A1** **N3**
[5 marks]

(b) correct working **(A1)**

eg $\dfrac{-(-4)}{2(1)}$, $\dfrac{-1+5}{2}$

$x=2$ (must be an equation with $x=$) **A1** **N2**
[2 marks]

(c) (i) $h=2$ **A1** **N1**

(ii) **METHOD 1**

valid approach **(M1)**
eg $f(2)$

correct substitution **(A1)**
eg $(2)^2-4(2)-5$

$k=-9$ **A1** **N2**

METHOD 2

valid attempt to complete the square **(M1)**
eg x^2-4x+4

correct working **(A1)**
eg $(x^2-4x+4)-4-5$, $(x-2)^2-9$

$k=-9$ **A1** **N2**
[4 marks]

continued…

Question 8 continued

(d) **METHOD 1** (working with vertex)

vertex of f is at $(2, -9)$ **(A1)**

correct horizontal reflection **(A1)**
eg $x = -2$, $(-2, -9)$

valid approach for translation of **their** x **or** y value **(M1)**

eg $x - 3$, $y + 6$, $\begin{pmatrix} -2 \\ -9 \end{pmatrix} + \begin{pmatrix} -3 \\ 6 \end{pmatrix}$, one correct coordinate for vertex

vertex of g is $(-5, -3)$ (accept $x = -5$, $y = -3$) **A1A1** **N1N1**

METHOD 2 (working with function)

correct approach for horizontal reflection **(A1)**

eg $f(-x)$

correct horizontal reflection **(A1)**
eg $(-x)^2 - 4(-x) - 5$, $x^2 + 4x - 5$, $(-x - 2)^2 - 9$

valid approach for translation of **their** x **or** y value **(M1)**
eg $(x + 3)^2 + 4(x + 3) - 5 + 6$, $x^2 + 10x + 22$, $(x + 5)^2 - 3$, one correct coordinate for vertex

vertex of g is $(-5, -3)$ (accept $x = -5$, $y = -3$) **A1A1** **N1N1**

[5 marks]

Total [16 marks]