| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 1 | | | 51.3 | 2 | **B1** for 51.2[5] or $\frac{205}{4}$ or $51\frac{1}{4}$<br>If **0** scored **SC1** for *their* answer to more than 3 figures correctly rounded to 3 s.f. | |
| 2 | | | 25 | 2 | **B1** for 40 : 1000 oe or $\frac{1000}{40}$ oe<br>or 0.025 as the answer<br>or answer with units e.g. 25 with any unit, 1 : 25 with consistent units | oe e.g 0.04 : 1<br>condone as answer 1 : 25 for 1 mark<br><br>**B1** for e.g. 25g, 25kg or 1kg : 25kg |
| 3 | | | 55.7 to 55.71 or 40 + 5π | 4 | **B1** for diameter = 10 cm or radius = 5 cm<br><br>**M1** for $[\frac{1}{2}]$ 2 × π × *their5* oe<br><br>**M1** for 8 + 17 + 8 + 3 + 4 + *their* 15.7 or better | **B1** might be seen on diagram and can be implied by 5 or 10 with π e.g. 5π, 31.4 to 31.42, $5^2$×π<br>**M1** implied by 10π, 5π, 31.4 to 31.42 or 15.7 to 15.71<br>Award M marks even if not used to find final answer as long as it is not contradicted.<br>Note : *their* 5 in the **M1** should be *their* radius of the circle<br>*their* 15.7 should involve π and be an attempt at the circumference of the semicircle, not the area or whole circle |
| 4 | **(a)** | | negative<br>no correlation<br>positive | 2 | **B1** for 2 correct | accept none, neutral, zero or uncorrelated for no correlation<br>ignore embellishments |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | **(b)** | | acceptable ruled line of best fit<br><br>FT *their* straight line, reading from 250 | **B1**<br><br>**B1FT** | | See overlay between (170, 10) and (170, 50) and between (380, 160) and (380, 200) and must reach the vertical lines, ignore beyond overlay<br><br>No line drawn 0 marks<br>Line must have positive gradient.<br><br>Correct reading ± 2 and *their* reading should be within the same grid square where *their* line(lobf) crosses 250 |
| **5** | **(a)** | | Equation<br>Identity<br>Equation | **1** | | |
| | **(b)** | | $y = 3x + 5$ as final answer | **3** | **B2** for final answer $3x + 5$<br>or for a correct equation but not in required form isw<br><br>OR<br><br>**M2** for using (2, 11) correctly in $y = 3x + c$ oe<br>or<br>**M1** for "y = 3*x* + c"<br>or for y = 3*x* + *k* oe where *k* is any numerical value except 0 or 5<br>or for correctly substituting (2, 11) in $y = mx + c$ oe ($m \neq 3$) | **B2** for e.g. $(y – 11) = 3(x – 2)$ or $y – 3x = 5$ or $3x – y + 5 = 0$ as the answer<br>**B2** for $y = 3x + 5$ seen in working and subsequently spoilt (excluding changing to a perpendicular gradient)<br><br>e.g. $11 = 3 \times 2 + c$<br><br>e.g. $11 = \frac{1}{3} \times 2 + c$ |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 6 | | | $\frac{210}{150}$ oe or 1.4 | **M1** | | implied by 1 [h] 24 [m] or 84 [m] |
| | | | $\frac{210}{100}$ oe or 2.1 | **M1** | | implied by 2 [h] 6 [m] or 126 [m] |
| | | | *their1*.4 + *their* 2.1 or 3.5 | **M1** | | *their* 3.5 could be 3½, 3 [h] 30[m] or 210 [m] |
| | | | $\frac{210+210}{their\ 3.5}$ oe<br>or 125 × *their* 3.5 oe<br>or 420 ÷ 125 | **M1** | | use of $\frac{total\ distance}{total\ time}$ and allow total time=3.30 or in mins |
| | | | 120<br>or 420 < 437.5 oe<br>or 3.36 < 3.5 oe | **A1** | **A1** dep. on **M4** | see appendix<br>e.g. 420 is less distance than 437.5<br>e.g. 3.36 is faster than 3.5 |
| 7 | **(a)** | | 360 ÷ 5 [= 72] oe<br>180 – 72 [= 108] | **M1**<br>**M1** | | Accept any correct method but they must not start with 108 e.g 108 × 5 = 540 scores **M0** |
| | | | OR | OR | | |
| | | | (5 – 2) × 180 [= 540] oe | **M1** | allow to split into 3 triangles or into a quadrilateral and a triangle so 360 + 180 [= 540] | condone missing brackets<br>Note : $\frac{(5-2)\times 180}{5}$ scores **M1 M1** |
| | | | 540 ÷ 5 [= 108] | **M1** | condone 540 ÷ 108 = 5 with 5 is the number of sides [of a pentagon] | |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | **(b)** | | 18 | **4** | **M1** for 360 – 108 – 92 or 160 oe<br><br>**M2** for $\frac{360}{180-their160}$ oe<br>or **M1** for 180 – *their*160 may be implied by 20 | Angles may be on diagram<br><br>Alternative method 1: **M1** for 160 as before<br>**M2** for 180*n* – *their*160*n* = 360<br>or **M1** for $\frac{(n-2)180}{n}$ = *their*160 oe<br>Alternative method 2:<br>**M2** for 92 – 72 or 20<br>**M1dep** for $\frac{360}{their20}$ dep. on **M2**<br>Trials:<br>**M1** for 360 – 108 – 92 or 160<br>**M1** for each different value for the number of sides and the correct internal angle calculated to a maximum of **M2**<br><br>see appendix for values |
| **8** | | | Three correct and different criticisms or suggestions for improvement | **3** | We need three statements, only one from each category (in guidance) for 3 marks.<br>**B2** for two correct<br>or<br>**B1** for one correct<br><br>Different means different category<br>Note : the same criticism and suggestion e.g. standing by station will only get people using trains and they should stand in the middle of town is only 1 mark | Categories:<br>• Larger sample size<br>• Vary the time (hour or day)<br>• Vary the location e.g biased towards railway users<br>• No control over numbers of genders<br>• No control over numbers in age groups<br><br>see appendix for exemplars and treat stratified sample as one category (usually age or gender) |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 9 | (a) | | $3.7 \times 10^{-3}$ | 1 | | Condone trailing zeros |
| | (b) | | 20 or $2 \times 10^{1}$ or $2 \times 10$ nfww | 4 | **M1** for $1.2 \times 10^{6} + 4[.0] \times 10^{6}$ or $5.2 \times 10^{6}$ oe<br>**M1** for $1.5 \times 10^{5} + 1.1 \times 10^{5}$ or $2.6 \times 10^{5}$ oe<br><br>**M1** for $\frac{a\ population\ value}{an\ area\ value}$ | may be implied by figs 52<br>may be implied by figs 26<br><br>Award M marks even if not used to find final answer as long as it is not contradicted.<br><br>Population and area values must be consistent eg both south island, both north island or *their* summed population and area e.g. **M1** implied by 8 or 36.36 to 36.4 or 44.36 or 44.4 |
| 10 | | | 7 | 3 | **M2** for $3k + 2 - 4 = 19$ oe or $5^{21}$<br><br>or<br><br>**M1** for $5^{2}$ or $5^{3k}$ or $5^{-2}$ or $5^{23}$<br>or forming equation in $k$ with one error or omission e.g. $3k - 4 = 19$ | e.g. $3k + 2 = 23$<br><br>condone $5^{3\times k}$ for **M1** |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| **11** | | | [$a$ =] 9<br>[$b$ =] 7 | **5** | **B2** for $a(11 - 5) = 3(11 + b)$ oe and<br>$a(29 - 5) = 2\times3(29 + b)$ oe<br><br>or **B1** for any two of the expressions below $a(11 - 5)$, $3(11 + b)$, $a(29 - 5)$, $3(29 + b)$ oe<br><br>**M1** for equating coefficients of one variable in *their* original linear equations or making $a$ or $b$ the subject of one of *their* original equations e.g. $24a = 12(11 + b)$ and $24a = 6(29 + b)$ or $b = 2a - 11$<br><br>**M1** for correctly eliminating one variable in *their* linear equations with one coefficient of one variable equal e.g. $6(29 + b) = 12(11 + b)$ oe or $24a = 6(29 + 2a - 11)$<br><br>If **0** scored **SC1** for $a(x - 5)$ or $3(x + b)$ allowing any letter for $x$ | e.g. $6a = 3(11 + b)$ or better<br>e.g. $24a = 6(29 + b)$ or better<br><br>e.g $6a$, $24a$, $33 + 3b$, $87 + 3b$<br><br>Note : if they write two correct equations and manipulate them incorrectly e.g. expanding brackets incorrectly then they can score **B2 M0 M1**<br><br>**B2 M2** for a correct linear equation in $a$ or $b$ e.g. $2a - 11 = 4a - 29$ oe or better<br><br>Allow one arithmetical error in one of the processes<br>For substitution award second **M1** at the point of substitution<br><br>Trials :<br>**M1** for each attempt using values for $a$ and $b$ and checking both functions with 11 and 29 to a maximum of **M2** |

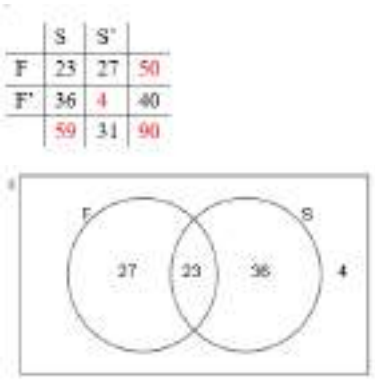
| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| **12** | | | 119.8[4] with correct working | **5** | **M1** for $\frac{25.6-17.2}{2}$ oe or 4.2<br><br>**M2** for $\sqrt{7^2-(their 4.2)^2}$ or better or 5.6<br>or **M1** for [*h*]$^2$ + (*their*4.2)$^2$ = 7$^2$ or 31.36<br><br>**M1** for $\frac{25.6+17.2}{2} \times their\ height$ oe<br><br>If **0** or **1** scored, instead **SC3** for answer 119.8[4] with no or insufficient working | Correct working requires evidence of at least **M2** or **M1M1**<br><br>*their* 4.2 must be an attempt at $\frac{25.6-17.2}{2}$ and must be less than 7<br><br>for *their* height do not allow 7 but condone e.g. 31.36<br><br>Longer methods must be complete and correct : e.g.<br>**M1** for 4.2 as before<br>**M1** for e.g. cos$^{-1}$(4.2÷7) = 53.13…<br>**M1** for e.g. 7sin(53.13) = 5.59… or 5.6<br>**M1** for area as before |
| **13** | **(a)** | | O is not on the circumference oe | **1** | | see appendix |
| | **(b)** | | 140 | **2** | **M1** for reflex angle AOC = 220<br>or for 360 – 2 × 110 | May be on diagram<br><br>Award **M1** for other valid method reaching the equivalent of a correct equation in *x*<br>e.g. Point D added on major arc, ADC indicated as $\frac{x}{2}$ and then 110 + $\frac{x}{2}$ = 180 oe<br><br>or marking angle ADC as 70 |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 14 | (a) | | any evidence of reading (median) from cf = 60 or reading cf for score 34<br><br>No and a correct statement with [34 and] 35 – 37 or with 51 – 57 and 60 | **M1**<br><br>**A1** | | For **M1** we need to see a line or mark on the graph or a figure allowing an error of ± ½ small square so<br>for 60 allow reading from 59 – 61 giving 35 – 37<br>for 34 allow reading from 33 – 35 gives a reading of 51 – 57<br>figures may be in working, see appendix for some **A1** statements |
| | (b) | | 58 | **3** | **M2** for $\frac{100-10}{100} \times 120$ oe or 108<br>or **M1** for $\frac{10}{100} \times 120$ oe or 12 | may be on the diagram |
| 15 | | | $y = \frac{180}{x^2}$ oe | **3** | **M1** for $y = \frac{k}{x^2}$ oe<br>**B1** for [$k$ =] 180<br>If **0** or **1** scored instead **SC2** for answer $y \propto \frac{180}{x^2}$ or if **0** scored instead **SC1** for $y \propto \frac{1}{x^2}$ | equivalents include $5 = \frac{k}{6^2}$ and $yx^2 = k$ |
| 16 | (a) | | 640 | **1** | | |
| | (b) | | 2.5 | **1** | | |
| | (c) | (i) | 998 to 999<br>and<br>1023 to 1024 | **3** | **M2** for one of these correct<br>or **M1** for substitution of any number between 18 and 19 into the formula | e.g. $640 \times 1.025^{18}$ and $640 \times 1.025^{19}$ or *their* 998 ×1.025<br>If they use other values, one value must be 18 and instead of 19 they can use :<br>18.08 ≤ other value ≤ 19 and ignore extras |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | (c) | (ii) | Any reason suggesting that the rate will not continue | 1 | | see appendix, if more than one statement mark the best unless one is contradictory |
| 17 | (a) | | $x^2 + y^2 = 4^2$ oe final answer | 2 | **B1** for $x^2 + y^2 = k$ ($k \neq 0$ or 16)<br>or answer $a^2 + b^2 = 4^2$ oe | $k$ could be $r^2$ |
| | (b) | | $2.3^2 + 3.3^2$<br>16.18 or 16.2 or 4.02[…]<br><br>a correct decision e.g. outside **and** (16.18 or 16.2) and 16 or 4.02[…] and 4 | **M1**<br>**B1**<br><br>**A1FT** | <br><br><br>**A1** is **dependent** on awarding **M1** and is a correct decision based on *their* figure | If they have the correct working, produce an incorrect figure they can earn **M1 B0 A1FT** providing *their* decision is correct for *their* figure<br>allow the reasoning to be in the working and condone 'above' for 'outside'<br>see appendix for some comments |
| 18 | (a) | | 4.5 or $4\frac{1}{2}$ or $\frac{9}{2}$ oe nfww | 3 | **M2** for $\frac{29.5+2}{7}$<br>or **M1** for $29.5 = k \times 7 - 2$ oe<br>Trials :<br>**M1** for each correct trial with value of $k$ in $k \times 7 - 2$ with the result to a maximum of **2** marks | |
| | (b) | (i) | 1.75 or $1\frac{3}{4}$ or $\frac{7}{4}$ oe | 2 | **M1** for $2u_1 = 6u_1 - 7$ oe or better<br>Trials :<br>**M1** for one correct trial with input and output for $u_1$ | accept any letter for $u_1$ |
| | (b) | (ii) | Always get 1.4 oe | 1 | | see appendix |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 19 | | | $\sqrt{75}\,[-\sqrt{15}+\sqrt{15}]-\sqrt{3}$<br>or $\sqrt{5}\,\sqrt{15}\,[-\sqrt{5}\sqrt{3}+\sqrt{15}\,]-\sqrt{3}$<br>or $5\sqrt{3}\,[-\sqrt{15}+\sqrt{15}]-\sqrt{3}$<br><br>$5\sqrt{3}-\sqrt{3}=4\sqrt{3}$ | **M2**<br><br><br><br><br>**A1** | **M1** for correct expansion with one error or omission or $\sqrt{75}=5\sqrt{3}$<br>Alternative 1<br>**M2** for $\sqrt{3}\,(\sqrt{5}-1)(\sqrt{5}+1)$ or better<br>or **M1** for $\sqrt{15}$ - $\sqrt{3}$ =$\sqrt{3}\,(\sqrt{5}-1)$<br><br>for **A1** allow $5\sqrt{3}-\sqrt{3}$ to be seen in the **M2** expression | Working must be in surds, working can be in tables e.g<br>**M2** for<br>$\begin{array}{\|c\|c\|c\|}\hline & \sqrt{15} & -\sqrt{3} \\ \hline \sqrt{5} & \sqrt{75} & -\sqrt{15} \\ \hline +1 & \sqrt{15} & -\sqrt{3} \\ \hline \end{array}$ |
| 20 | | | 9.09 to 9.1 | **3** | **M2** for [BC =] $\frac{12\times\sin 40}{\sin 58}$ oe<br>or<br>**M1** for $\frac{12}{\sin 58}=\frac{BC}{\sin 40}$ oe | Allow any complete and correct alternative method |
| 21 | **(a)** | | 3.8 − 4.2 nfww | **2** | **M1** for $\frac{their15-their7}{3-1}$ oe | condone 6.8 ≤ *their*7 ≤ 7.2<br>and 14.8 ≤ *their*15 ≤ 15.2 e.g $\frac{14.8-7.2}{3-1}=3.8$<br>This part cannot be answered with a tangent at $x = 2$. |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | **(b)** | | Ruled tangent drawn at $x$ = 2.5 | **B1** | | Tangent should not cross the curve, should touch at $x$ = 2.5 (condone slight daylight between tangent and curve) and condone running along the curve slightly. Ignore any tangent at $x$ = 2 for this part.<br><br>The remaining 3 marks depend on a reasonable ruled attempt at a tangent clearly at $x$ = 2.5 so **B0 M1 M1 A1FT** is possible.<br><br>**M1** for attempting to divide vertical distance by horizontal distance on *their* tangent at $x$ = 2.5 even if the readings are inaccurate<br>The final mark (**A1**) is easily checked for accuracy by using the 'ruler' which is lined up on the tangent and extended as far as possible, calculate the gradient, or translate the ruler to put one end on the origin, and use a tolerance of ± 0.2 and if *their* figure is within range award **A1** |
| | | | using two points on *their* tangent at $x$ = 2.5 | **M1** | this might be in the form of a triangle or two points clearly identified or in a calculation | |
| | | | use of $\frac{difference\ in\ y}{difference\ in\ x}$ | **M1** | | |
| | | | accurate calculation from *their* tangent | **A1FT** | | |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 22 | | | $\frac{23}{59}$ | 5 | **B4** for answer $\frac{23}{n}$ where $24 \leq n \leq 90$<br>or<br>**B3** for (F and S) = 23<br>or<br>**M3** for a correct Venn diagram or correct table showing these figures in black<br>or<br>**B2** for (S and not F) = 36<br>or for (F and not S) = 27<br>or for answer $\frac{k}{59}$ where $1 \leq k \leq 58$<br>or<br>**M2** for a Venn diagram or table with **two** of n(F)=50, n(S)=59 and n( ξ)=90 correct<br>or<br>**B1** for (not F) = 40 or (not S) = 31<br>or<br>**M1** for a Venn diagram or table with **one** of n(F)=50, n(S)=59 and n( ξ)=90 correct | If $\frac{23}{59}$ in working isw conversion to another form and accept 0.3898… or 0.39[0] or 38.98% or 39[.0]% for **5** marks<br><br>Award B marks if correctly shown on a labelled grid or implied on a Venn diagram<br><br> |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 23 | (a) | | $(x – 8)^2$ or $(x – 8)(x – 8)$ final answer<br>with correct working | 6 | **B5** for answer $x^2 – 16x + 64$ with correct working<br><br>OR<br><br>**B4** for answer $−9x^2 – 16x + 64$ with correct working<br><br>OR<br><br>**M3** for correctly expanding the triple bracket e.g. $x^3 − 4x^2 – 16x + 64$ oe<br>or<br>**M2** for correctly expanding any two brackets from the triple bracket e.g. $x^2 [– 4x + 4x] – 16$ or $x^2 – 4x – 4x + 16$ oe or $(x^2 − 8x + 16)(x + 4)$<br>or<br>**M1** for attempting to expand any two brackets e.g. $x^2 + 4x – 4x – 16$ oe with at most one error<br>AND<br>**M1** for correctly expanding final bracket e.g. $−x^3 + 5x^2$ oe<br>AND<br>**M1** for correctly simplifying *their* final expression by collecting like terms e.g. $x^2 – 16x + 64$<br><br>If **0**,**1** or **2** scored instead **SC3** for answer $(x – 8)^2$ or $(x – 8)(x – 8)$ | correct working requires at least **M3** or **M1 M1 M1** or **M2 M1**<br><br>If you award B marks do not award any extra M marks<br><br>e.g. $x^3 − 8x^2 + 16x + 4x^2 – 32x + 64$ oe<br><br>e.g. $x^2 – 16$ or $x^2 − 8x + 16$<br><br>condone one error in the previous step e.g $(x^2 − 8x + 8)(x + 4) = x^3 + 4x^2 – 8x^2 - 32x + 8x + 32$ or better scores **M2**<br><br>e.g. $x^2 – 8$<br><br>Note : brackets must be removed and $(−x^3 + 5x^2)$ must not be used for multiplication<br><br>Note : once mark(s) are awarded they are not lost for subsequent incorrect working |

| Question | | | Answer | Mark | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | **(b)** | | 8 | **1FT** | Note : correct answer 8 scores 1<br>**FT** *their* ($ax^2 + bx + c$) where $a > 0$ and *their* answer should be $-\frac{b}{2a}$. | If the quadratic expression is factorised, expand the brackets first. |