Topic 6 Part 5 *[189 marks]*

1a. *[2 marks]*

Markscheme

$4a + 2b = 20$

$a + b = 8$ ***(A1)***

$a - b = -4$ ***(A1)*** ***(C2)***

Note: Award ***(A1)(A1)*** for any two of the given or equivalent equations.

[2 marks]

Examiners report

Most candidates attempted this question but very few of them completed it entirely. A number of students wrote incorrect equations in part (a), which shows that the mapping diagram was poorly understood and read. Part (c) proved to be difficult for many who didn't know how to find the x-coordinate of the vertex of the graph of the function. Some students gave the two coordinates instead of the x-coordinate only.

1b. *[1 mark]*

Markscheme

$a = 2$ ***(A1)*****(ft)**

[1 mark]

Examiners report

Most candidates attempted this question but very few of them completed it entirely. A number of students wrote incorrect equations in part (a), which shows that the mapping diagram was poorly understood and read. Part (c) proved to be difficult for many who didn't know how to find the x-coordinate of the vertex of the graph of the function. Some students gave the two coordinates instead of the x-coordinate only.

1c. *[1 mark]*

Markscheme

$b = 6$ ***(A1)*****(ft)** ***(C2)***

Note: Follow through from their (a).

[1 mark]

Examiners report

Most candidates attempted this question but very few of them completed it entirely. A numberof students wrote incorrect equations in part (a), which shows that the mapping diagram was poorly understood and read. Part (c) proved to be difficult for many who didn't know how to find the x-coordinate of the vertex of the graph of the function. Some students gave the two coordinates instead of the x-coordinate only.

1d. *[2 marks]*

Markscheme

$x = -\frac{6}{2(2)}$ ***(M1)***

Note: Award ***(M1)*** for correct substitution in correct formula.

$= -1.5$ ***(A1)*(ft)** ***(C2)***

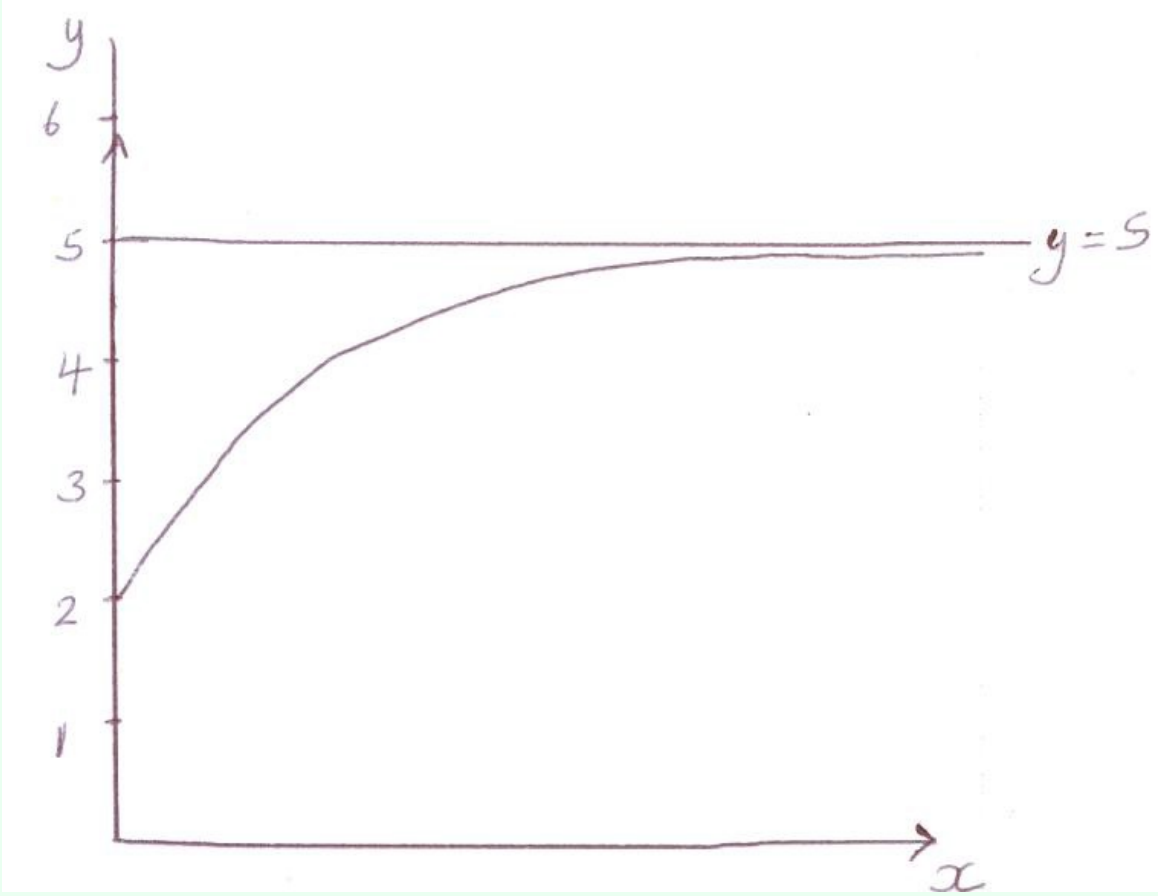
[2 marks]

Examiners report

Most candidates attempted this question but very few of them completed it entirely. A number of students wrote incorrect equations in part (a), which shows that the mapping diagram was poorly understood and read. Part (c) proved to be difficult for many who didn't know how to find the *x*-coordinate of the vertex of the graph of the function. Some students gave the two coordinates instead of the *x*-coordinate only.

2a. *[3 marks]*

Markscheme



(A1)(A1)(A1)

Notes: Award ***(A1)*** for labels and scale on *y*-axis.
Award ***(A1)*** for smooth increasing curve in the given domain.
Award ***(A1)*** for asymptote implied (
gradient $\rightarrow 0$).

[3 marks]

Examiners report

Most candidates attempted this question and many gained 3 or 4 marks. All made an attempt at sketching the graph which demanded that students used their GDC. Many candidates failed to label their graphs and to give an indication of scale, and lost one mark in part (a). Some did not pay attention to the domain and sketched the graph in a different region. A significant number could also write down the coordinates of the y-intercept, although some wrote only $y = 2$ instead of giving the two coordinates. Almost all could draw the line $y = 5$ on the sketch but many could not find the answer for the number of solutions to the equation given in part c). Some candidates lost time in an attempt to draw this graph accurately on graph paper, which was not the intended task. Most candidates attempted this question, which clearly indicated that the time given for the paper was sufficient.

2b. *[1 mark]*

Markscheme

(0, 2) *accept* $x = 0$, $y = 2$ ***(A1)*** ***(C4)***

Note: If incorrect domain used and both (0, 2) and (
−0.737, 0) seen award ***(A1)*(ft)**.

[1 mark]

Examiners report

Most candidates attempted this question and many gained 3 or 4 marks. All made an attemptat sketching the graph which demanded that students used their GDC. Many candidates failed to label their graphs and to give an indication of scale, and lost one mark in part (a). Some did not pay attention to the domain and sketched the graph in a different region. A significant number could also write down the coordinates of the y-intercept, although some wrote only$y = 2$ instead of giving the two coordinates. Almost all could draw the line $y = 5$ on thesketch but many could not find the answer for the number of solutions to the equation given in part c). Some candidates lost time in an attempt to draw this graph accurately on graphpaper, which was not the intended task. Most candidates attempted this question, which clearly indicated that the time given for the paper was sufficient.

2c. *[1 mark]*

Markscheme

line passing through (0, 5), parallel to x axis and not intersecting their graph. ***(A1)*** ***(C1)***

[1 mark]

Examiners report

Most candidates attempted this question and many gained 3 or 4 marks. All made an attemptat sketching the graph which demanded that students used their GDC. Many candidates failed to label their graphs and to give an indication of scale, and lost one mark in part (a). Some did not pay attention to the domain and sketched the graph in a different region. A significant number could also write down the coordinates of the y-intercept, although some wrote only$y = 2$ instead of giving the two coordinates. Almost all could draw the line $y = 5$ on thesketch but many could not find the answer for the number of solutions to the equation given in part c). Some candidates lost time in an attempt to draw this graph accurately on graphpaper, which was not the intended task. Most candidates attempted this question, which clearly indicated that the time given for the paper was sufficient.

2d. *[1 mark]*

Markscheme

zero ***(A1)*** ***(C1)***

[1 mark]

Examiners report

Most candidates attempted this question and many gained 3 or 4 marks. All made an attemptat sketching the graph which demanded that students used their GDC. Many candidates failed to label their graphs and to give an indication of scale, and lost one mark in part (a). Some did not pay attention to the domain and sketched the graph in a different region. A significant number could also write down the coordinates of the y-intercept, although some wrote only $y = 2$ instead of giving the two coordinates. Almost all could draw the line $y = 5$ on thesketch but many could not find the answer for the number of solutions to the equation given in part c). Some candidates lost time in an attempt to draw this graph accurately on graphpaper, which was not the intended task. Most candidates attempted this question, which clearly indicated that the time given for the paper was sufficient.

3a. *[2 marks]*

Markscheme

$N = 2 \times (1.81)^{0.7\times0}$ ***(M1)***

$N = 2$ ***(A1)*** ***(C2)***

Notes: Award ***(M1)*** for correct substitution of $t = 0$.
Award ***(A1)*** for correct answer.

[2 marks]

Examiners report

Parts (a) and (b) were confidently answered with many candidates correctly finding the number who started the rumour and also the number involved after 5 hours. A common mistake was to let $t = 0$ but not evaluate the expression correctly.

3b. *[1 mark]*

Markscheme

16.0 (3 s.f) ***(A1)*** ***(C1)***

Note: Accept 16 and 15.

[1 mark]

Examiners report

Parts (a) and (b) were confidently answered with many candidates correctly finding the number who started the rumour and also the number involved after 5 hours. A common mistake was to let $t = 0$ but not evaluate the expression correctly.

3c. *[3 marks]*

Markscheme

$150 = 2 \times (1.81)^{0.7t}$ ***(M1)***

$t = 10.39...$ h ***(A1)***

$t = 624$ minutes ***(A1)*****(ft)** ***(C3)***

Notes: Accept 10 hours 24 minutes. Accept alternative methods.

Award last ***(A1)*****(ft)** for correct rounding to the nearest minute of their answer.

Unrounded answer must be seen so that the follow through can be awarded.

[3 marks]

Examiners report

Very few candidates could answer part (c). With the working shown, it was obvious candidates could correctly state the equation, but could not use their calculators to find the value of t.

4a. *[1 mark]*

Markscheme

$q = 4$ ***(A1)*** ***(C1)***

[1 mark]

Examiners report

This question was not well answered with few candidates gaining full marks. Many candidates could find the value of q but not r. Although many found the minimum value of y, they could not find the maximum value of the function or express the range correctly.

4b. *[2 marks]*

Markscheme

$2.5 = \frac{r}{4}$ ***(M1)***

$r = 10$ ***(A1)*** ***(C2)***

[2 marks]

Examiners report

This question was not well answered with few candidates gaining full marks. Many candidates could find the value of q but not r. Although many found the minimum value of y, they could not find the maximum value of the function or express the range correctly.

4c. *[1 mark]*

Markscheme

-8.5 ***(A1)*****(ft)** ***(C1)***

[1 mark]

4d. *[2 marks]*

Markscheme

$-8.5 \leqslant y \leqslant 104$ ***(A1)*(ft)*(A1)*(ft)** ***(C2)***

Notes: Award ***(A1)*(ft)** for their answer to part (c) with correct inequality signs, ***(A1)*(ft)** for 104. Follow through from their values of q and r.

Accept 104 ±2 if read from graph.

[2 marks]

Examiners report

This question was not well answered with few candidates gaining full marks. Many candidates could find the value of q but not r. Although many found the minimum value of y, they could not find the maximum value of the function or express the range correctly.

5a. *[3 marks]*

Markscheme

–1.10, 0.218, 3.13 ***(A1)(A1)(A1)***

[3 marks]

Examiners report

This question was either very well done – by the majority – or very poor and incomplete attempts were seen. This would perhaps indicate a lack of preparation in this area of the syllabus from some centres, though it is recognised that the differential calculus is one of the more problematic topics for the candidature.

It was however disappointing to note the number of candidates who do not use the GDC to good effect; in part (a) for example, the zeros were not found accurately due to "trace" being used; this is not a suitable approach – there is a built-in zero finder which should be used. Much of the question was accessible via a GDC approach, a sketch was given that could have been verified on the GDC; this was lost on many.

5b. *[3 marks]*

Markscheme

$f'(x) = 12x^2 - 18x - 12$ ***(A1)(A1)(A1)***

Note: Award ***(A1)*** for each correct term and award maximum of ***(A1)(A1)*** if other terms seen.

[3 marks]

Examiners report

This question was either very well done – by the majority – or very poor and incomplete attempts were seen. This would perhaps indicate a lack of preparation in this area of the syllabus from some centres, though it is recognised that the differential calculus is one of the more problematic topics for the candidature.

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5c. *[4 marks]*

Markscheme

$f'(x) = 0$ ***(M1)***
$x = -0.5, 2$
$x = -0.5$ ***(A1)***

Note: If $x = -0.5$ not stated, can be inferred from working below.

$y = 4(-0.5)^3 - 9(-0.5)^2 - 12(-0.5) + 3$ ***(M1)***
$y = 6.25$ ***(A1)(G3)***

Note: Award ***(M1)*** for their value of x substituted into $f(x)$.

Award ***(M1)(G2)*** if sketch shown as method. If coordinate pair given then award ***(M1)(A1)(M1)(A0)***. If coordinate pair given with no working award ***(G2)***.

[4 marks]

Examiners report

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5d. *[1 mark]*

Markscheme

(0, 3) ***(A1)***

Note: Accept $x = 0$, $y = 3$.

[1 mark]

Examiners report

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5e. *[2 marks]*

Markscheme

$f'(0) = -12$ ***(M1)(A1)*****(ft)*****(G2)***

Note: Award ***(M1)*** for substituting $x = 0$ into their derivative.

[2 marks]

Examiners report

This question was either very well done – by the majority – or very poor and incomplete attempts were seen. This would perhaps indicate a lack of preparation in this area of the syllabus from some centres, though it is recognised that the differential calculus is one of the more problematic topics for the candidature.

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5f. *[2 marks]*

Markscheme

Tangent: $y = -12x + 3$ ***(A1)*****(ft)*****(A1)(G2)***

Note: Award ***(A1)*****(ft)** for their gradient, ***(A1)*** for intercept = 3.

Award ***(A1)(A0)*** if $y =$ not seen.

[2 marks]

Examiners report

This question was either very well done – by the majority – or very poor and incomplete attempts were seen. This would perhaps indicate a lack of preparation in this area of the syllabus from some centres, though it is recognised that the differential calculus is one of the more problematic topics for the candidature.

It was however disappointing to note the number of candidates who do not use the GDC to good effect; in part (a) for example, the zeros were not found accurately due to "trace" being used; this is not a suitable approach – there is a built-in zero finder which should be used. Much of the question was accessible via a GDC approach, a sketch was given that could have been verified on the GDC; this was lost on many.

5g. *[1 mark]*

Markscheme

-12 ***(A1)*****(ft)**

Note: Follow through from their part (e).

[1 mark]

Examiners report

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It was however disappointing to note the number of candidates who do not use the GDC to good effect; in part (a) for example, the zeros were not found accurately due to "trace" being used; this is not a suitable approach – there is a built-in zero finder which should be used. Much of the question was accessible via a GDC approach, a sketch was given that could have been verified on the GDC; this was lost on many.

5h. *[3 marks]*

Markscheme

$12x^2 - 18x - 12 = -12$ ***(M1)***

$12x^2 - 18x = 0$ ***(M1)***

$x = 1.5, 0$

At Q $x = 1.5$ ***(A1)*****(ft)*****(G2)***

Note: Award ***(M1)(G2)*** for $12x^2 - 18x - 12 = -12$ followed by $x = 1.5$.

Follow through from their part (g).

[3 marks]

Examiners report

This question was either very well done – by the majority – or very poor and incomplete attempts were seen. This would perhaps indicate a lack of preparation in this area of the syllabus from some centres, though it is recognised that the differential calculus is one of the more problematic topics for the candidature.

It was however disappointing to note the number of candidates who do not use the GDC to good effect; in part (a) for example, the zeros were not found accurately due to "trace" being used; this is not a suitable approach – there is a built-in zero finder which should be used. Much of the question was accessible via a GDC approach, a sketch was given that could have been verified on the GDC; this was lost on many.

6a. *[8 marks]*

Markscheme

Option 1: Amount

$= 25\,000\left(1 + \frac{5}{100}\right)^3$ ***(M1)(A1)***

=

$28\,940.63$ ***(A1)(G2)***

Note: Award ***(M1)*** for substitution in compound interest formula, ***(A1)*** for correct substitution. Give full credit for use of lists.

Option 2: Amount

$= 25\,000\left(1 + \frac{4.8}{12(100)}\right)^{3\times 12}$ ***(M1)***

=

$28\,863.81$ ***(A1)(G2)***

Note: Award ***(M1)*** for correct substitution in the compound interest formula. Give full credit for use of lists.

[8 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common error was to make all the comparisons using interest alone; though much credit was given for doing this, candidates should be aware of what is being asked for in the question.

Many did not understand the notion of monthly compounding periods.

6b. *[1 mark]*

Markscheme

Option 1 is the best investment option. ***(A1)*****(ft)**

[1 mark]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common error was to make all the comparisons using interest alone; though much credit was given for doing this, candidates should be aware of what is being asked for in the question.

Many did not understand the notion of monthly compounding periods.

6c. *[2 marks]*

Markscheme

$u_1 = 135 + 7(1)$ ***(M1)***

$= 142$ ***(A1)(G2)***

[2 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common weakness was seen in the “show that” parts of the question where, despite a lenient approach to method, many were unable to communicate their thoughts on paper.

For many, finding an expression for S_n in (c) was problematical.

The final part was challenging to the great majority, with a large number not attempting it at all; only the highly competent reached the correct answer.

6d. *[2 marks]*

Markscheme

$u_2 = 135 + 7(2) = 149$ ***(M1)***

$d = 149 - 142$ **OR** *alternatives* ***(M1)*****(ft)**

$d = 7$ ***(AG)***

[2 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common weakness was seen in the "show that" parts of the question where, despite a lenient approach to method, many were unable to communicate their thoughts on paper.

For many, finding an expression for S_n in (c) was problematical.

The final part was challenging to the great majority, with a large number not attempting it at all; only the highly competent reached the correct answer.

6e. *[3 marks]*

Markscheme

$S_n = \frac{n[2(142)+7(n-1)]}{2}$ ***(M1)*****(ft)**

Note: Award ***(M1)*** for correct substitution in correct formula.

$= \frac{n[277+7n]}{2}$ **OR** *equivalent* ***(A1)***

$= \frac{7n^2}{2} + \frac{277n}{2}$ $(= 3.5n^2 + 138.5n)$ ***(A1)(G3)***

[3 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common weakness was seen in the "show that" parts of the question where, despite a lenient approach to method, many were unable to communicate their thoughts on paper.

For many, finding an expression for S_n in (c) was problematical.

The final part was challenging to the great majority, with a large number not attempting it at all; only the highly competent reached the correct answer.

6f. *[2 marks]*

Markscheme

$20r^3 = 67.5$ ***(M1)***

$r^3 = 3.375$ **OR**
$r = \sqrt[3]{3.375}$ ***(A1)***

$r = 1.5$ ***(AG)***

[2 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common weakness was seen in the "show that" parts of the question where, despite a lenient approach to method, many were unable to communicate their thoughts on paper.

For many, finding an expression for S_n in (c) was problematical.

The final part was challenging to the great majority, with a large number not attempting it at all; only the highly competent reached the correct answer.

6g. *[2 marks]*

Markscheme

$T_7 = \frac{20(1.5^7-1)}{(1.5-1)}$ ***(M1)***

Note: Award ***(M1)*** for correct substitution in correct formula.

= 643 *(accept 643.4375)* ***(A1)(G2)***

[2 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common weakness was seen in the "show that" parts of the question where, despite a lenient approach to method, many were unable to communicate their thoughts on paper.

For many, finding an expression for S_n in (c) was problematical.

The final part was challenging to the great majority, with a large number not attempting it at all; only the highly competent reached the correct answer.

6h. *[2 marks]*

Markscheme

$\frac{20(1.5^n-1)}{(1.5-1)} > \frac{7n^2}{2} + \frac{277n}{2}$ ***(M1)***

Note: Award ***(M1)*** for an attempt using lists or for relevant graph.

$n = 10$ ***(A1)*****(ft)*****(G2)***

Note: Follow through from their (c).

[2 marks]

Examiners report

For many, this question came as a welcome relief following the previous two questions. For those with a sound grasp of the topic, there were many very successful attempts.

A common weakness was seen in the "show that" parts of the question where, despite a lenient approach to method, many were unable to communicate their thoughts on paper.

For many, finding an expression for S_n in (c) was problematical.

The final part was challenging to the great majority, with a large number not attempting it at all; only the highly competent reached the correct answer.

7a. *[2 marks]*

Markscheme

$x = 0, x = 4$ ***(A1)(A1)*** ***(C2)***

Notes: Accept 0 and 4.

[2 marks]

Examiners report

A number of candidates left out this question which indicated that this topic was either entirely unfamiliar, that this topic of the syllabus had perhaps not been taught, or was barely familiar. A few candidates wrote down coordinate pairs when asked for a solution to the equation. A number of candidates wrote down the formula for the equation of the axis of symmetry without being able to substitute values for a and b. When given the minimum value of the graph a small number of candidates could identify the range of the function correctly. Overall this question proved to be difficult with its demands for reading and interpreting the graph, and dealing with additional information about the quadratic function given in the different parts.

7b. *[2 marks]*

Markscheme

$x = 2$ ***(A1)(A1)*** ***(C2)***

Note: Award ***(A1)*** for $x =$ constant, ***(A1)*** for 2.

[2 marks]

Examiners report

A number of candidates left out this question which indicated that this topic was either entirely unfamiliar, that this topic of the syllabus had perhaps not been taught, or was barely familiar. A few candidates wrote down coordinate pairs when asked for a solution to the equation. A number of candidates wrote down the formula for the equation of the axis of symmetry without being able to substitute values for a and b. When given the minimum value of the graph a small number of candidates could identify the range of the function correctly. Overall this question proved to be difficult with its demands for reading and interpreting the graph, and dealing with additional information about the quadratic function given in the different parts.

7c. *[1 mark]*

Markscheme

$x = -2$ ***(A1)*** ***(C1)***

Note: Accept –2.

[1 mark]

Examiners report

A number of candidates left out this question which indicated that this topic was either entirely unfamiliar, that this topic of the syllabus had perhaps not been taught, or was barely familiar. A few candidates wrote down coordinate pairs when asked for a solution to the equation. A number of candidates wrote down the formula for the equation of the axis of symmetry without being able to substitute values for a and b. When given the minimum value of the graph a small number of candidates could identify the range of the function correctly. Overall this question proved to be difficult with its demands for reading and interpreting the graph, and dealing with additional information about the quadratic function given in the different parts.

7d. *[1 mark]*

Markscheme

$y \geqslant -4$ $(f(x) \geqslant -4)$ ***(A1)*** ***(C1)***

Notes: Accept alternative notations.

Award ***(A0)*** for use of strict inequality.

[1 mark]

Examiners report

A number of candidates left out this question which indicated that this topic was either entirely unfamiliar, that this topic of the syllabus had perhaps not been taught, or was barely familiar. A few candidates wrote down coordinate pairs when asked for a solution to the equation. A number of candidates wrote down the formula for the equation of the axis of symmetry without being able to substitute values for a and b. When given the minimum value of the graph a small number of candidates could identify the range of the function correctly. Overall this question proved to be difficult with its demands for reading and interpreting the graph, and dealing with additional information about the quadratic function given in the different parts.

8a. *[2 marks]*

Markscheme

$p + q = 6$ ***(A1)***

$0.5p + q = 4$ ***(A1)*** ***(C2)***

Note: Accept correct equivalent forms of the equations.

[2 marks]

Examiners report

A significant number of candidates found it difficult to identify and write two equations that relate p and q. Many of those who wrote the equations were unable to solve them or use their GDC to find the values of p and q in part b). Although the question in part c) was quite standard, there were many errors in the responses. Many students wrote $x = 2$ or only 2 instead of $y = 2$.

8b. *[2 marks]*

Markscheme

$p = 4, q = 2$ ***(A1)(A1)*****(ft)** ***(C2)***

Notes: If both answers are incorrect, award ***(M1)*** for attempt at solving simultaneous equations.

[2 marks]

Examiners report

A significant number of candidates found it difficult to identify and write two equations that relate p and q. Many of those who wrote the equations were unable to solve them or use their GDC to find the values of p and q in part b). Although the question in part c) was quite standard, there were many errors in the responses. Many students wrote $x = 2$ or only 2 instead of $y = 2$.

8c. *[2 marks]*

Markscheme

$y = 2$ ***(A1)(A1)*****(ft)** ***(C2)***

Notes: Award ***(A1)*** for "y = a constant", ***(A1)*****(ft)** for 2. Follow through from their value for q as long as their constant is greater than 2 and less than 6.

An equation must be seen for any marks to be awarded.

[2 marks]

Examiners report

A significant number of candidates found it difficult to identify and write two equations that relate p and q. Many of those who wrote the equations were unable to solve them or use their GDC to find the values of p and q in part b). Although the question in part c) was quite standard, there were many errors in the responses. Many students wrote $x = 2$ or only 2 instead of $y = 2$.

9a. *[1 mark]*

Markscheme

30 ***(A1)***

[1 mark]

Examiners report

The value of $f(0)$ and the derivative function, $f'(x)$ were well done in parts (a) and (b). In part (c) many candidates found $f(1)$ instead of $f'(1)$. In part (d) many students did not use their $f(x)$ to find the x-coordinates of M and N and instead used their GDC. The sketch was generally well done although some students forgot to label M and N or did not use the specified window. The last part of the question was a clear discriminator. Examiners were pleased to see how this challenging question was solved using alternative methods.

9b. *[3 marks]*

Markscheme

$f'(x) = 3x^2 - 6x - 24$ ***(A1)(A1)(A1)***

Note: Award ***(A1)*** for each term. Award at most ***(A1)(A1)*** if extra terms present.

[3 marks]

Examiners report

The value of $f(0)$ and the derivative function, $f'(x)$ were well done in parts (a) and (b). In part (c) many candidates found $f(1)$ instead of $f'(1)$. In part (d) many students did not use their $f(x)$ to find the x-coordinates of M and N and instead used their GDC. The sketch was generally well done although some students forgot to label M and N or did not use the specified window. The last part of the question was a clear discriminator. Examiners were pleased to see how this challenging question was solved using alternative methods.

9c. *[2 marks]*

Markscheme

$f'(1) = -27$ ***(M1)(A1)*****(ft)*****(G2)***

Note: Award ***(M1)*** for substituting $x = 1$ into their derivative.

[2 marks]

Examiners report

The value of $f(0)$ and the derivative function, $f'(x)$ were well done in parts (a) and (b). In part (c) many candidates found $f(1)$ instead of $f'(1)$. In part (d) many students did not use their $f(x)$ to find the x-coordinates of M and N and instead used their GDC. The sketch was generally well done although some students forgot to label M and N or did not use the specified window. The last part of the question was a clear discriminator. Examiners were pleased to see how this challenging question was solved using alternative methods.

9d. *[5 marks]*

Markscheme

(i) $f'(x) = 0$

$3x^2 - 6x - 24 = 0$ ***(M1)***

$x = 4; x = -2$ ***(A1)*****(ft)*****(A1)*****(ft)***

Notes: Award ***(M1)*** for either $f'(x) = 0$ or $3x^2 - 6x - 24 = 0$ seen. Follow through from their derivative. Do not award the two answer marks if derivative not used.

(ii) M(–2, 58) accept $x = -2$, $y = 58$ ***(A1)*****(ft)**

N(4, – 50) accept $x = 4$, $y = -50$ ***(A1)*****(ft)**

Note: Follow through from their answer to part (d) (i).

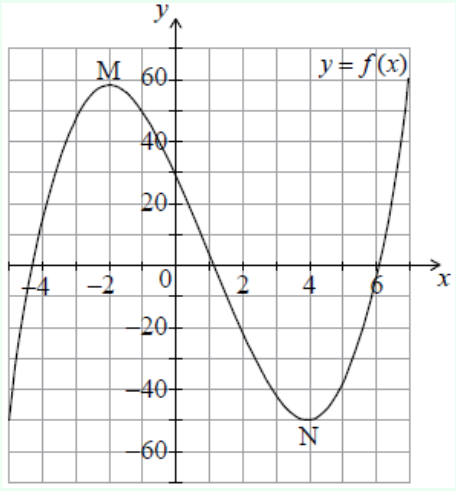
[5 marks]

Examiners report

The value of $f(0)$ and the derivative function, $f'(x)$ were well done in parts (a) and (b). In part (c) many candidates found $f(1)$ instead of $f'(1)$. In part (d) many students did not use their $f(x)$ to find the x-coordinates of M and N and instead used their GDC. The sketch was generally well done although some students forgot to label M and N or did not use the specified window. The last part of the question was a clear discriminator. Examiners were pleased to see how this challenging question was solved using alternative methods.

9e. *[4 marks]*

Markscheme



(A1) for window

(A1) for a smooth curve with the correct shape

(A1) for axes intercepts in approximately the correct positions

(A1) for M and N marked on diagram and in approximately correct position ***(A4)***

Note: If window is not indicated award at most ***(A0)(A1)(A0)(A1)*****(ft)**.

[4 marks]

Examiners report

The value of $f(0)$ and the derivative function, $f'(x)$ were well done in parts (a) and (b). In part (c) many candidates found $f(1)$ instead of $f'(1)$. In part (d) many students did not use their $f(x)$ to find the x-coordinates of M and N and instead used their GDC. The sketch was generally well done although some students forgot to label M and N or did not use the specified window. The last part of the question was a clear discriminator. Examiners were pleased to see how this challenging question was solved using alternative methods.

9f. *[6 marks]*

Markscheme

(i) $3x^2 - 6x - 24 = 21$ ***(M1)***

$3x^2 - 6x - 45 = 0$ ***(M1)***

$x = 5; x = -3$ ***(A1)*****(ft)*****(A1)*****(ft)*****(G3)***

Note: Follow through from their derivative.

OR

Award ***(A1)*** for L_1 drawn tangent to the graph of f on their sketch in approximately the correct position ($x = -3$), ***(A1)*** for a second tangent parallel to their L_1, ***(A1)*** for $x = -3$, ***(A1)*** for $x = 5$. ***(A1)*****(ft)*****(A1)*****(ft)*****(A1)*****(A1)***

Note: If only $x = -3$ is shown without working award ***(G2)*****.** If both answers are shown irrespective of workingaward ***(G3)***.

(ii) $f(5) = -40$ ***(M1)*****(A1)*****(ft)*****(G2)***

Notes: Award ***(M1)*** for attempting to find the image of their $x = 5$. Award ***(A1)*** only for (5, –40). Follow through from their x-coordinate of B only if it has **been clearly identified** in (f) (i).

[6 marks]

Examiners report

The value of $f(0)$ and the derivative function, $f'(x)$ were well done in parts (a) and (b). In part (c) many candidates found $f(1)$ instead of $f'(1)$. In part (d) many students did not use their $f(x)$ to find the x-coordinates of M and N and instead used their GDC. The sketch was generally well done although some students forgot to label M and N or did not use the specified window. The last part of the question was a clear discriminator. Examiners were pleased to see how this challenging question was solved using alternative methods.

10a. *[2 marks]*

Markscheme

$5000 + 3 \times 230 = 5690$ ***(M1)(A1)(G2)***

Note: Accept alternative method.

[2 marks]

Examiners report

Most of the students read carefully the instruction written in the heading of the question and therefore gave their answers with the accuracy stated but some did not.

Simple interest was well done as well as compound interest with only a small minority of candidates making no progress. A number of students lost the answer mark in (b) for not showing the unrounded answer before writing the answer given. It is also important to mention that calculator commands are not accepted as correct working and therefore full marks are not awarded. Also, some candidates wrote their answers without showing any working leading to a number of marks being lost.

10b. *[3 marks]*

Markscheme

$A = 5000\left(1 + \frac{4.2}{100}\right)^{10}$ *or equivalent* ***(M1)(A1)***

$= 7544.79\ldots$ ***(A1)***

$= 7545$ USD ***(AG)***

Note: Award ***(M1)*** for correct substituted compound interest formula, ***(A1)*** for correct substitutions, ***(A1)*** for unrounded answer seen.

If final line not seen award at most ***(M1)(A1)(A0)***.

[3 marks]

Examiners report

Most of the students read carefully the instruction written in the heading of the question and therefore gave their answers with the accuracy stated but some did not.

Simple interest was well done as well as compound interest with only a small minority of candidates making no progress. A number of students lost the answer mark in (b) for not showing the unrounded answer before writing the answer given. It is also important to mention that calculator commands are not accepted as correct working and therefore full marks are not awarded. Also, some candidates wrote their answers without showing any working leading to a number of marks being lost.

10c. *[3 marks]*

Markscheme

$5000(1.042)^n > 6500$ ***(M1)(A1)***

Notes: Award ***(M1)*** for setting up correct equation/inequality, ***(A1)*** for correct values.

Follow through from their formula in part (b).

OR

List of values seen with at least 2 terms ***(M1)***

Lists of values including at least the terms with $n = 6$ and $n = 7$ ***(A1)***

Note: Follow through from their formula in part (b).

OR

Sketch showing 2 graphs, one exponential, the other a horizontal line ***(M1)***

Point of intersection identified or vertical line ***(M1)***

Note: Follow through from their formula in part (b).

$n = 7$ ***(A1)*****(ft)*****(G2)***

[3 marks]

Examiners report

Most of the students read carefully the instruction written in the heading of the question and therefore gave their answers with the accuracy stated but some did not.

Simple interest was well done as well as compound interest with only a small minority of candidates making no progress. A number of students lost the answer mark in (b) for not showing the unrounded answer before writing the answer given. It is also important to mention that calculator commands are not accepted as correct working and therefore full marks are not awarded. Also, some candidates wrote their answers without showing any working leading to a number of marks being lost.

10d. *[3 marks]*

Markscheme

$5000(1.042)^n > 5000 + 230n$ ***(M1)(A1)***

Note: Award ***(M1)*** for setting up correct equation/inequality, ***(A1)*** for correct values.

OR

2 lists of values seen (at least 2 terms per list) ***(M1)***

Lists of values including at least the terms with $n = 5$ and $n = 6$ ***(A1)***

Note: One of the lists may be written under (c).

OR

Sketch showing 2 graphs of correct shape ***(M1)***

Point of intersection identified or vertical line ***(M1)***

$n = 6$ ***(A1)*****(ft)*****(G2)***

Note: Follow through from their formulae used in parts (a) and (b).

[3 marks]

Examiners report

Most of the students read carefully the instruction written in the heading of the question and therefore gave their answers with the accuracy stated but some did not.

Simple interest was well done as well as compound interest with only a small minority of candidates making no progress. A number of students lost the answer mark in (b) for not showing the unrounded answer before writing the answer given. It is also important to mention that calculator commands are not accepted as correct working and therefore full marks are not awarded. Also, some candidates wrote their answers without showing any working leading to a number of marks being lost.

It was nice to see many students recovering after part (d) and to gain full marks in the last two parts of the question.

10e. *[4 marks]*

Markscheme

6610×0.735 ***(M1)***

$= 4858.35$ ***(A1)***

$4858.35 \times 0.982 (= 4770.8997...)$ ***(M1)***

$= 4771$ Euros ***(A1)*****(ft)*****(G3)***

Note: Accept alternative method.

[4 marks]

Examiners report

Most of the students read carefully the instruction written in the heading of the question and therefore gave their answers with the accuracy stated but some did not.

Simple interest was well done as well as compound interest with only a small minority of candidates making no progress. A number of students lost the answer mark in (b) for not showing the unrounded answer before writing the answer given. It is also important to mention that calculator commands are not accepted as correct working and therefore full marks are not awarded. Also, some candidates wrote their answers without showing any working leading to a number of marks being lost.

It was nice to see many students recovering after part (d) and to gain full marks in the last two parts of the question.

10f. *[5 marks]*

Markscheme

800×1.29 (= 1032 USD) ***(M1)(A1)***

Note: Award ***(M1)*** for multiplying by 1.29, ***(A1)*** for 1032. Award ***(G2)*** for 1032 if product not seen.

(1032 – 1006.20 = 25.8)

$25.8 \times \frac{100}{1032}\%$ ***(A1)(M1)***

Note: Award ***(A1)*** for 25.8 seen, ***(M1)*** for multiplying by $\frac{100}{1032}$.

OR

$\frac{1006.20}{1032} = 0.975$ ***(M1)(A1)***

OR

$\frac{1006.20}{1032} \times 100 = 97.5$ ***(M1)(A1)***

$= 2.5\,\%$ ***(A1)(G3)***

Notes: If working not shown award ***(G3)*** for 2.5.

Accept alternative method.

[5 marks]

Examiners report

Most of the students read carefully the instruction written in the heading of the question and therefore gave their answers with the accuracy stated but some did not.

Simple interest was well done as well as compound interest with only a small minority of candidates making no progress. A number of students lost the answer mark in (b) for not showing the unrounded answer before writing the answer given. It is also important to mention that calculator commands are not accepted as correct working and therefore full marks are not awarded. Also, some candidates wrote their answers without showing any working leading to a number of marks being lost.

It was nice to see many students recovering after part (d) and to gain full marks in the last two parts of the question.

11a. *[4 marks]*

Markscheme

$f(-2) = 2 \times 3^{-2}$ ***(M1)***

$= \frac{2}{9}(0.222)$ ***(A1)***

$f(5) = 2 \times 3^5$

$= 486$ ***(A1)***

Range $\frac{2}{9} \leqslant f(x) \leqslant 486$ **OR**
$\left[\frac{2}{9}, 486\right]$ ***(A1)*** ***(C4)***

Note: Award ***(M1)*** for correct substitution of –2 or 5 into $f(x)$, ***(A1)(A1)*** for each correct end point.

[4 marks]

Examiners report

Part (a) proved to be difficult to gain the maximum marks as, although candidates could find the end points, they did not seem to be able to identify the range of the function. Many students gave a list of values for the range, which indicates that this concept was not understood well.

11b. *[2 marks]*

Markscheme

$2 \times 3^x = 162$ ***(M1)***

$x = 4$ ***(A1)*** ***(C2)***

[2 marks]

Examiners report

This question was generally answered well in part (b).

12a. *[2 marks]*

Markscheme

$\frac{(p+6)}{2} = 0.5$ ***(M1)***

$p = -5$ ***(A1)*** ***(C2)***

[2 marks]

Examiners report

This question was one of the most difficult in this paper. Many students left this question blank, showed incorrect working or gave answers without any preceding working.

12b. *[4 marks]*

Markscheme

$\frac{-b}{2(-1)} = 0.5$ ***(M1)***

$b = 1$ ***(A1)***

$-0.5^2 + 0.5 + c = 30.25$ ***(M1)***

$c = 30$ ***(A1)*****(ft)**

Note: Follow through from their value of b.

OR

$y = (6 - x)(5 + x)$ ***(M1)***

$= 30 + x - x^2$ ***(A1)***

$b = 1,\ c = 30$ ***(A1)(A1)*****(ft)** ***(C4)***

Note: Follow through from their value of p in part (a).

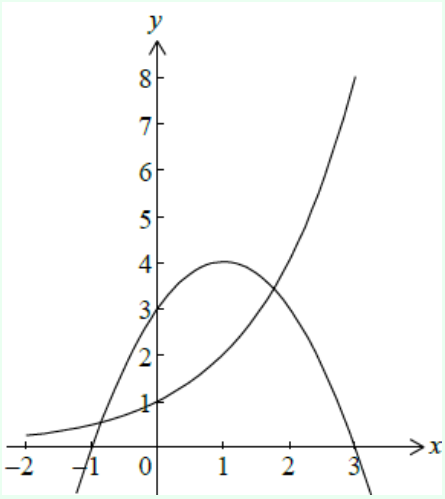
[4 marks]

Examiners report

This question was one of the most difficult in this paper. Many students left this question blank, showed incorrect working or gave answers without any preceding working.

13a. *[3 marks]*

Markscheme



(A1)(A1)(A1)

Note: Award ***(A1)*** for correct domain, ***(A1)*** for smooth curve, ***(A1)*** for y-intercept clearly indicated.

[3 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

The most common error was using the incorrect domain.

13b. *[2 marks]*

Markscheme

$y = 0$ ***(A1)(A1)***

Note: Award ***(A1)*** for y = constant, ***(A1)*** for 0.

[2 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

Many had little idea of asymptotes. Others did not write their answer as an equation.

13c. *[3 marks]*

Markscheme

Note: Award ***(A1)*** for smooth parabola,

(A1) for vertex (maximum) in correct quadrant.

(A1) for all clearly indicated intercepts $x = -1$, $x = 3$ and $y = 3$.

The final mark is to be applied very strictly. ***(A1)(A1)(A1)***

[3 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

The intercepts being inexact or unlabelled was the most frequent cause of loss of marks.

13d. *[2 marks]*

Markscheme

$x = -0.857$ $x = 1.77$ ***(G1)(G1)***

Note: Award a maximum of ***(G1)*** if x and y coordinates are both given.

[2 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

Often, only one solution to the equation was given. Elsewhere, a lack of appreciation that the solutions were the x coordinates was a common mistake.

13e. *[1 mark]*

Markscheme

4 ***(G1)***

Note: Award ***(G0)*** for (1, 4).

[1 mark]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

The maximum is the *y* coordinate only; again a common misapprehension was the answer "(1, 4)".

13f. *[5 marks]*

Markscheme

$f'(x) = 2 - 2x$ ***(A1)(A1)***

Note: Award ***(A1)*** for each correct term.

Award at most ***(A1)(A0)*** if any extra terms seen.

$2 - 2x = 0$ ***(M1)***

Note: Award ***(M1)*** for equating their gradient function to zero.

$x = 1$ ***(A1)*****(ft)**

$f(1) = 3 + 2(1) - (1)^2 = 4$ ***(A1)***

Note: The final ***(A1)*** is for substitution of $x = 1$ into
$f(x)$ and subsequent correct answer. Working must be seen for final ***(A1)*** to be awarded.

[5 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

This was a major discriminator in the paper. Many candidates were unable to follow the analytic approach to finding a maximum point.

13g. *[2 marks]*

Markscheme

$2^2 \times p + 2q - 4 = -10$ ***(M1)***

Note: Award ***(M1)*** for correct substitution in the equation.

$4p + 2q = -6$ or $2p + q = -3$ ***(A1)***

Note: Accept equivalent simplified forms.

[2 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

This part was challenging to the majority, with a large number not attempting the question at all. However, there were a pleasing number of correct attempts that showed a fine understanding of the calculus.

13h. *[2 marks]*

Markscheme

$\frac{dy}{dx} = 2px + q$ ***(A1)(A1)***

Note: Award ***(A1)*** for each correct term.

Award at most ***(A1)(A0)*** if any extra terms seen.

[2 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

This part was challenging to the majority, with a large number not attempting the question at all. However, there were a pleasing number of correct attempts that showed a fine understanding of the calculus.

13i. *[1 mark]*

Markscheme

$4p + q = 1$ ***(A1)*****(ft)**

[1 mark]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

This part was challenging to the majority, with a large number not attempting the question at all. However, there were a pleasing number of correct attempts that showed a fine understanding of the calculus.

13j. *[3 marks]*

Markscheme

$4p + 2q = -6$

$4p + q = 1$ ***(M1)***

Note: Award ***(M1)*** for sensible attempt to solve the equations.

$p = 2, q = -7$ ***(A1)(A1)*****(ft)*****(G3)***

[3 marks]

Examiners report

Undoubtedly, this question caused the most difficulty in terms of its content. Where there was no alternative to using the calculus, the majority of candidates struggled. However, for those with a sound grasp of the topic, there were many very successful attempts.

This part was challenging to the majority, with a large number not attempting the question at all. However, there were a pleasing number of correct attempts that showed a fine understanding of the calculus.

14a. *[1 mark]*

Markscheme

Unit penalty ***(UP)*** *is applicable in part (i)(a)(c)(d)(e) and (f)*

(UP) 90°C ***(A1)***

[1 mark]

Examiners report

Many candidates who had not lost a UP in question 2 lost one here. Parts (a), (c) and (d) were reasonably well tackled. Almost everybody had difficulty with the equation of the horizontal asymptote, a common answer being $y = 20$. Most of the candidates realised that 30 seconds was 0.5 minutes and calculated part (e) correctly. Part (f), solving an exponential equation, was a good discriminator. Trial and error was expected but many students did not think of doing this.

14b. *[1 mark]*

Markscheme

$y = 16$ ***(A1)***

[1 mark]

Examiners report

Many candidates who had not lost a UP in question 2 lost one here. Parts (a), (c) and (d) were reasonably well tackled. Almost everybody had difficulty with the equation of the horizontal asymptote, a common answer being $y = 20$. Most of the candidates realised that 30 seconds was 0.5 minutes and calculated part (e) correctly. Part (f), solving an exponential equation, was a good discriminator. Trial and error was expected but many students did not think of doing this.

14c. *[1 mark]*

Markscheme

*Unit penalty **(UP)** is applicable in part (i)(a)(c)(d)(e) and (f)*

(UP) 16°C **(ft)** *from answer to part (b)* ***(A1)*****(ft)**

[1 mark]

Examiners report

Many candidates who had not lost a UP in question 2 lost one here. Parts (a), (c) and (d) were reasonably well tackled. Almost everybody had difficulty with the equation of the horizontal asymptote, a common answer being $y = 20$. Most of the candidates realised that 30 seconds was 0.5 minutes and calculated part (e) correctly. Part (f), solving an exponential equation, was a good discriminator. Trial and error was expected but many students did not think of doing this.

14d. *[1 mark]*

Markscheme

*Unit penalty **(UP)** is applicable in part (i)(a)(c)(d)(e) and (f)*

(UP) 25.4°C ***(A1)***

[1 mark]

Examiners report

Many candidates who had not lost a UP in question 2 lost one here. Parts (a), (c) and (d) were reasonably well tackled. Almost everybody had difficulty with the equation of the horizontal asymptote, a common answer being $y = 20$. Most of the candidates realised that 30 seconds was 0.5 minutes and calculated part (e) correctly. Part (f), solving an exponential equation, was a good discriminator. Trial and error was expected but many students did not think of doing this.

14e. *[3 marks]*

Markscheme

*Unit penalty **(UP)** is applicable in part (i)(a)(c)(d)(e) and (f)*

for seeing $2^{0.75}$ or equivalent ***(A1)***

for multiplying their (d) by their $2^{0.75}$ ***(M1)***

(UP) 42.8°C ***(A1)*****(ft)*****(G2)***

[3 marks]

Examiners report

Many candidates who had not lost a UP in question 2 lost one here. Parts (a), (c) and (d) were reasonably well tackled. Almost everybody had difficulty with the equation of the horizontal asymptote, a common answer being $y = 20$. Most of the candidates realised that 30 seconds was 0.5 minutes and calculated part (e) correctly. Part (f), solving an exponential equation, was a good discriminator. Trial and error was expected but many students did not think of doing this.

14f. *[4 marks]*

Markscheme

*Unit penalty **(UP)** is applicable in part (i)(a)(c)(d)(e) and (f)*

for seeing
$20 \times 2^{1.5t} = 100$ ***(A1)***

for seeing a value of t between 1.54 *and* 1.56 *inclusive* ***(M1)(A1)***

(UP) 1.55 minutes or 92.9 seconds ***(A1)(G3)***

[4 marks]

Examiners report

Many candidates who had not lost a UP in question 2 lost one here. Parts (a), (c) and (d) were reasonably well tackled. Almost everybody had difficulty with the equation of the horizontal asymptote, a common answer being $y = 20$. Most of the candidates realised that 30 seconds was 0.5 minutes and calculated part (e) correctly. Part (f), solving an exponential equation, was a good discriminator. Trial and error was expected but many students did not think of doing this.

14g. *[3 marks]*

Markscheme

*Financial accuracy penalty **(FP)** is applicable in part (ii) **only**.*

$120 - 3 = 117$

(FP)
117×1.37 ***(A1)***

= 160.29 euros *(correct answer only)* ***(M1)***

*first **(A1)** for 117 seen, **(M1)** for multiplying by 1.37* ***(A1)(G2)***

[3 marks]

Examiners report

The financial part was the best done question in the paper and a large majority of candidates gained full marks here.

14h. *[3 marks]*

Markscheme

*Financial accuracy penalty **(FP)** is applicable in part (ii) **only**.*

(FP)
$\frac{13.5}{1.37}$ ***(A1)(M1)***

9.85 GBP *(answer correct to 2dp only)*

*first **(A1)** is for 13.5 seen, **(M1)** for dividing by 1.37* ***(A1)*****(ft)*****(G3)***

[3 marks]

Examiners report

The financial part was the best done question in the paper and a large majority of candidates gained full marks here.

15a. *[2 marks]*

Markscheme

for attempt at substituted $\frac{y\text{distance}}{x\text{distance}}$ ***(M1)***

gradient = 2 ***(A1)(G2)***

[2 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

15b. *[2 marks]*

Markscheme

$2x - 3$ ***(A1)(A1)***

(A1) *for* $2x$, ***(A1)*** *for* -3

[2 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

15c. *[3 marks]*

Markscheme

for their

$2x - 3 =$ *their gradient and attempt to solve* ***(M1)***

$x = 2.5$ ***(A1)*****(ft)**

$y = -5.25$ *(***(ft)** *from their x value)* ***(A1)*****(ft)*****(G2)***

[3 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

15d. *[4 marks]*

Markscheme

for seeing
$\frac{-1}{their(a)}$ ***(M1)***

solving
$2x-3=-\frac{1}{2}$ *(or their value)* ***(M1)***

$x = 1.25$ ***(A1)*****(ft)*****(G1)***

$y = -6.1875$ ***(A1)*****(ft)*****(G1)***

[4 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

15e. *[3 marks]*

Markscheme

(i)
$2 \times 2 - 3 = 1$ *(***(ft)** *from (b))* ***(A1)*****(ft)*****(G1)***

(ii)
$y = mx + c$ *or equivalent method to find*
$c \Rightarrow -6 = 2 + c$ ***(M1)***

$y = x - 8$ ***(A1)*****(ft)*****(G2)***

[3 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

15f. *[1 mark]*

Markscheme

$x = 1.5$ ***(A1)***

[1 mark]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.

15g. *[3 marks]*

Markscheme

for substituting their answer to part (f) into the equation of the parabola (1.5, −6.25) *accept* $x = 1.5$, $y = -6.25$ ***(M1)(A1)*****(ft)*****(G2)***

gradient is zero *(accept* $\frac{dy}{dx} = 0$*)* ***(A1)***

[3 marks]

Examiners report

Parts (a) and (b) were very well done. After that, only the stronger candidates were able to cope. The equation of the tangent at the point with coordinates (2, 6) was badly done but some candidates managed to find the equation of the tangent line from their GDC. The equation of the axis of symmetry was reasonably well done although many just wrote down 1.5 instead of $x = 1.5$.

Some forgot to write down that the gradient at the vertex was 0.