2005 HSC Notes from the Marking Centre Mathematics

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2005 HSC NOTES FROM THE MARKING CENTRE MATHEMATICS

Introduction

This document provides candidates and teachers with feedback in relation to the quality of responses provided by candidates to the 2005 Mathematics HSC examination paper. It should be read in conjunction with the 2005 HSC Mathematics examination paper, the marking guidelines and the *Mathematics Stage 6 Syllabus*.

General Comments

As a general comment candidates need to read the questions carefully and set out their working clearly. It is unwise to do working on the question paper, and if a question part is worth more than 1 mark the examiners expect more than just a bald answer. Any rough working should be included in the answer booklet for the question to which it applies.

Question 1

Overall this question was done well. Most candidates attempted all parts of this question.

(a) This part was done well. A common error was to round to two decimal places rather than two significant figures. Candidates are reminded that writing the full calculator display and then rounding may enable part marks to be awarded.

(b) In better responses candidates demonstrated knowledge of the correct rule by stating the factors without wasting time testing various expansions, trying to obtain a result they should have known.

(c) This part was generally answered well.

(d) Most candidates attempted this part. In the better responses candidates demonstrated an understanding of algebraic fractions by finding the lowest common denominator and correctly simplifying the numerator. Common errors included incorrect removal of brackets, removing the denominator, or treating the expression as an equation.

(e) Candidates who interpreted the question as $-1 \leq x-3 \leq 1$ were generally successful. Those who split the question into two inequalities often had difficulty with the negative case or were unable to put the two inequalities together. Graphical solutions were generally correct.

(f) This part was not done well. In better responses candidates demonstrated an understanding of the terms ‘vertex’, ‘focal length’ and ‘focus’. Common errors included stating that focus = (0, a) = (0, 2), focus = 2, focus = (0, 1), or vertex = (0,–1).

Question 2

There was ample evidence that candidates are aware of the need to show some working.

(a) This was a trigonometric equation to be solved within a domain specified in radians. The responses needed to be written in radians and with correct notation. Weaker responses included such statements as $\cos 45° = \frac{\pi}{4}$ or $\cos = \frac{\pi}{4}$.

(b) This part was generally done well.

(i) Most responses demonstrated correct use of the product rule, but many included errors in simplifying.

(ii) Very few candidates attempted to rewrite the question in the form of the product rule, with most candidates using the quotient rule. Many responses contained significant errors in simplifying, such as incorrect cancelling.

(c) (i) Weaker responses showed a lack of competency with the use of brackets. A small number of responses contained little or no working, which made it impossible to award part marks.

(ii) This part was generally done well. However, not all responses included correct simplification after the limits of integration had been applied.

(d) This part required the derivative of the simple logarithmic function leading to the equation of the tangent at a specific point on the curve. Average responses included the correct derivative in general terms, ie $y' = \frac{1}{x}$, and better responses noted the gradient was $\frac{1}{e}$.

Question 3

Most candidates made a satisfactory attempt at this question.

(a) Most candidates who understood the summation symbol gave the correct answer of 27. However, many candidates did not understand the symbol or the limits. Some candidates used the formula for the sum of an arithmetic progression (AP) to determine 7+9+11.

(b) (i) The majority of candidates applied the cosine rule to answer this question. However, many candidates used the cosine rule incorrectly or did not calculate the largest angle or could not evaluate $\cos\theta = -\frac{1}{2}$. Attempts to evade the negative sign by arbitrarily changing signs or introducing absolute value signs caused errors.

(ii) Most candidates were able to use $A = \frac{1}{2}ab\sin C$ and recognise that the angle C was the included angle.

(c) (i) Most candidates calculated the gradient or the equation of *BC* and used the point-gradient formula to determine the equation of *AD*.

(ii) This question was successfully answered by the majority of candidates. However, some candidates made errors in solving the two simultaneous equations.

(iii) A number of candidates did not use the opposite sides of a parallelogram to determine point E. The majority of candidates calculated the equation of BC and then substituted $y = 4$ to determine point E (11, 4).

(iv) The better responses to this question presented a logical argument with appropriate theorems to justify their statements. However, common errors included not specifying the parallel lines, incorrectly stating the angle, or not determining accurately the ratio of the sides. Candidates who attempted to show the sides are in proportion needed to show three pairs of corresponding sides in proportion.

(v) Some candidates did not present their answer as a ratio or fraction. It was also common for candidates to incorrectly calculate the lengths using the distance formula. A number of candidates followed $\frac{AD}{EC} = \frac{2}{1}$ with remarks such as the ratio is 1:2 or $EC = 2 \times AD$.

Question 4

(a) This part was generally done well. Many candidates realised that all the subparts of (a) could be done without converting 0.6 radians to degrees.

(i) Successful candidates used the formula $l = r\theta$ or found a proportion of the circumference. Common errors included using 0.6π or 108º or 34º as θ.

(ii) This part was not done well and often it was omitted. In successful responses, candidates either used the cosine rule, the sine rule or right-angled triangle trigonometry, and then used the appropriate calculator mode. Common errors in the use of the cosine rule included using incorrect signs and neglecting to take the square root. Candidates who used the sine rule often made errors in calculating the base angles.

(iii) This part was generally done well, although many candidates found the area of the minor segment instead of the sector. Quite a number successfully found the correct proportion of the circle area. Candidates are reminded that the correct substitution into the appropriate formula should be shown.

(b) Most candidates successfully demonstrated knowledge of differentiation and stationary points. However, poor algebraic skills in expansion, factorisation and substitution were evident.

(i) This part was done well. Common errors included finding $f(0)$, discovering an extra solution and attempts at expanding and refactorising.

(ii) Almost all candidates knew to differentiate and solve $f'(x) = 0$, but many made algebraic errors. Candidates are reminded of a number of points:

- substitute into the given function to find y values
- the test being used should be clearly indicated and a conclusion drawn about the stationary point

- when using the first derivative test it is advisable to use a table, which must be clearly labelled
- $f''(x) = 0$ is a necessary but not sufficient condition for a point of inflexion.

(iii) The graph caused no problem to candidates who had successfully completed part (ii). Some, however, did not continue their graph far enough to show the x-intercept of 3. Others found points of inflexion when the question did not require this. Algebraic errors meant that it was often impossible to draw a curve to fit the candidate's stationary points. Candidates are reminded that the graph of a cubic function is continuous and smooth. Care should be taken with curve sketching and graphs should be large, neat and roughly to scale.

(iv) In the better responses candidates stated the general principle for a curve to be concave down and then solved the inequality. A number of candidates could not correctly solve $6x + 6 < 0$.

Question 5

(a) This part was straightforward, with $\log_3 7$ easily evaluated through the use of logarithms to base 10 or e. Many candidates presented an appropriate expression in terms of a new base; however the subsequent use of the calculator was often flawed.

(b) Most candidates attempted this question with some measure of success. Candidates are reminded, however, that a proof is much more than a list of relevant facts, and construction of a logical and well supported argument is required. Common errors included the misnaming of angles, use of ambiguous statements and the presentation of unsupported claims.

(c) Although most candidates realised that the line in question had a gradient of 5, a significant number of candidates did not then recognise the question as one of calculus. Common errors included equating the function (rather than its derivative) to 5 or to $5x$–3.

(d) Performance on this question was very strong. Most candidates (wisely) opted to deal with probabilities directly, without resorting to an expansive tree diagram. The issue of selection without replacement resulted in some confusion; however most candidates worked logically through the production of the various probabilities. Due to the large number of tickets, incorrect answers tended to agree with correct answers to several decimal places, so it proved crucial that candidates show all their working.

Question 6

(a) Many candidates clearly knew how to apply Simpson's rule. For many others, however, there was confusion over the 'pattern' of 4 and 2, the value of h, the number of applications needed, use of the trapezoidal rule and the labelling of ordinates $y_1, y_2, .., y_n$.

(b) (i) The majority of candidates were successful in this part.

(iii) Most candidates understood that $\frac{dV}{dt}$ was required. Some candidates struggled with this derivative, often leaving out the negative sign. Some common variations included trying to use an average rate and introducing exponentials.

(iii) This part required an interpretation of a physical situation and when $\frac{d^2V}{dt^2} = 2$. A large number of candidates could not understand what to do next (many just took $t = 2$ from this). Many candidates incorrectly solved $\frac{dV}{dt} = 0$ to get $t = 60$, and a few used graphs of V or V' to help justify their answer.

(c) (i) Most candidates attempted this part and many were successful in getting $x = \pm 2$. However, not all of these answered the question of finding the points of intersection as shown on the diagram.

(ii) It was challenging for most candidates to understand the process needed and the link to part (i). Many tried to use x functions, while many others could not come up with the correct split of regions and/or wanted to take a difference of volumes, or they doubled an expression because of the symmetry. Many candidates also used the wrong limits, such as using $y = 2$ rather than 4 for the middle value.

Question 7

In general, candidates appeared to find this question quite challenging.

(a) The most obvious and consistent error involved the incorrect use of the value of n as 14 and hence $(n - 1) = 13$, in parts (i) and (ii).

(i) A percentage of candidates determined their answers by long-hand methods of calculation rather than by using the formula. Of those who tried to use formulae, the confusion between arithmetic and geometric was quite evident. For example, some converted the $2500 increase to a 5% increase each year.

(ii) The wording '4% increase' led to some confusion with $2000 being incorrectly used in an arithmetic formula.

(iii) In the better responses, candidates indicated a clear understanding of the summation formulae for both arithmetic and geometric series. Some confusion existed in the use of 20 years having used 13 in parts (i) and (ii). Common errors included finding the difference between the T_{20}'s; using the techniques of time repayments and superannuation; double use of geometric series due to error in (i); use of $r = 0.04$ and using the second term of the series as the initial term; and poor calculator usage from correct expressions.

(b) A reasonable percentage of candidates did not attempt this part of the question.

(i) Given there were so many '2s' in the question and that it was the answer, it was important for candidates to show how their response was obtained eg $\frac{dx}{dt} = 2$; (2, 0); (0, 2) and the maximum value of the given graph was also 2.

(ii) Most of those who attempted this part got the correct time of $t = 4$, but the reasoning behind their response did not recognise the area relationship under $\frac{dx}{dt}$. Many responses revolved around a description of the given graph in terms of velocity and time. Only the better responses related the use of integration to the desired justification.

(iii) Graphical techniques were obviously lacking for a large group of candidates. Errors included the omission of a scale on the horizontal axis, the horizontal portions of the solution being almost impossible to distinguish from the given horizontal axis, and concavity of the curved sections not relating to the original graph.

Question 8

In this question 7 out of the 12 marks were associated with questions requiring candidates to 'show' a result. Candidates are reminded that if their working does not lead to the correct result they should not try to manipulate it incorrectly so that it does.

(a) Better responses to this part used clear setting out and explained the steps that were being attempted.

(i) Showing that the given expression for the volume was correct entailed beginning with the correct formula for the volume of a cylinder and then recognising that the radius was x, the height was $2h$ and then eliminating x via the use of Pythagoras' theorem. Better responses to this part clearly stated these substitutions.

(ii) The most common error in this part was in differentiating with respect to h. Many candidates did not treat R^2 as a constant. Candidates who expanded to find $V = 2\pi R^2 h - 2\pi h^3$ generally had more success than those who tried to use the product rule. Amongst those candidates who did differentiate successfully the next most common error was in determining the nature of the stationary point. Some candidates did not attempt to determine its nature while others did not show that this particular turning point satisfied the conditions stated in the first derivative or second derivative test.

(b) Better responses to this part recognised that the area of a quadrant of a circle could be found by using the formula for the area of a circle. Common errors in this part were made in writing the equation of the circle, for example $y = \sqrt{4 - x^2} = 2 - x$, and determining an integral expression that represented the shaded region.

(c) Better responses to this part used clear and logical setting out.

(i) The better responses involved candidates writing down an expression for A_1 and then an expression for A_2 in terms of A_1 before obtaining the desired result.

(ii) Many candidates could write down the general expression for A_n but were unable to simplify to the desired result. Common errors included writing the last term of the geometric series as 1.12^n instead of 1.12^{n-1}, and not being able to simplify the term $4.8 \times 10^5 \left(\dfrac{1.12^n - 1}{0.12} \right)$.

(iii) An answer to this question could be obtained algebraically or by a trial and error substitution into the given formula. Both methods were attempted. Common errors made by candidates in this part included not recognising the need to solve $A_n = 0$, not being able to solve $1.12^n = 4$, and not being able to correctly interpret their answer in terms of the question.

Question 9

When asked to 'Show that …', candidates need to show the reasons and working that allowed them to arrive at the conclusion.

(a) (i) Nearly all candidates showed that they understood the primitive of $4\sin 2t$ is $-2\cos 2t$. The better responses correctly included the constant of integration and the substitution of the initial conditions to show that the constant was 2.

(ii) A majority of candidates who attempted this question showed that they understood the key feature of this graph was a cosine curve with a wavelength of π. Better responses were given by candidates who understood this and then plotted some key points to correctly place the graph on the number plane. Common errors included graphing a sine curve or $2\cos 2t$ or $-2\cos 2t$ and then not translating it correctly. Many candidates correctly identified that the velocity was zero when the curve crossed the horizontal axis.

(iii) Many candidates demonstrated that they understood that the required distance was found by finding the area under the curve from $t = 0$ to $t = \pi$ and then correctly evaluating their definite integral. A common alternative method was to integrate $2 - 2\cos 2t$ to find the displacement function. Again candidates were expected to show the use of the initial conditions to find the constant and proceed with the required substitution.

(b) (i) Many candidates correctly found the length of *BD*. Some then realised that the same method could be used in ΔBDE to find *DE* and similarly to find *EF*.

(ii) In better responses, candidates were able to correctly identify the terms of the series and state the correct formula. This enabled them to proceed to a correct solution. They avoided the mistakes of many who did not identify the correct terms of the series and made mistakes which could have easily been avoided. Candidates who tried to work backwards from the solution needed to show that they were evaluating the limiting sum of the series given.

Question 10

Overall, this question was answered poorly by most of the candidates. Many candidates made careless mistakes in either quoting a formula or substituting into a correctly quoted formula. Poor setting out by many candidates resulted in mistakes such as leaving out signs, indices, and brackets.

(a) (i) This question was done poorly as most candidates did not recognise the simultaneous solution required to form the correct quadratic equation $x^2 - mx - b = 0$. Other candidates used the gradient formula to show $\alpha + \beta = m$ but could not then show $\alpha\beta = -b$. Many candidates tried to use $y - mx - b = 0$ as the quadratic.

(ii) Most candidates attempted this question and the majority made the link to the distance formula but were unable to manipulate their expression to get to the required answer. The majority did not establish the result $(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$, which led to the required result. Many candidates did not correctly quote the distance formula or, having correctly quoted it, did not use it correctly. Some candidates were careless in the use of the square root symbol, leaving it only half-complete or absent in lines of working. Other candidates who tried working backwards were again unsuccessful due to the increasing complexity of the algebra involved.

(iii) Some candidates were able to quote the perpendicular distance formula and use it correctly. Some candidates were able to quote the correct formula but substituted incorrectly or were unable to complete the algebraic manipulation correctly.

(iv) This part had a low attempt rate. Those who did attempt the question had difficulty with the differentiation, treating the constants as variables. This generally led to pages of meaningless algebra. Candidates who differentiated correctly went on to find the correct point, but more than half of them did not establish the nature of the stationary point.

(b) (i) This part had the highest attempt rate in this question but generally was done poorly as most candidates had difficulty in explaining their answer in a logical way. Instead of focusing on the difference in arrival times, candidates were more concerned with waiting times. Many candidates worked through the given numerical values and stated that X and Y met without realising they were working with a given example and did not explain the inequalities.

(ii) Candidates who attempted this question with a diagram were normally successful. Some candidates were successful in working out the area of the triangles and went on to find the correct probability. Some candidates tried to work out the overlapped area directly, but typically did not find the correct dimensions.

(iii) Very few candidates attempted this part. Successful candidates used the same approach as in part (ii), but with an introduced pronumeral to establish a probability equation to solve for the time.

Mathematics

2005 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
1 (a)	2	1.1	P3
1 (b)	2	1.3	P3
1 (c)	2	10.8, 13.6	H5, H8
1 (d)	2	1.3	P3
1 (e)	2	1.4	P3
1 (f)	2	9.5	P4
2 (a)	2	13.1, 13.2, 5.2, 5.3	H5
2 (b) (i)	2	13.5, 8.8	P7, H5
2 (b) (ii)	2	8.8	P7
2 (c) (i)	2	12.5	P8, H5, H8
2 (c) (ii)	2	13.6	P8, H5, H8
2 (d)	2	12.5, 8.4	H5, P6, P5, H3
3 (a)	1	7.0	H5
3 (b) (i)	2	5.5	P4
3 (b) (ii)	1	5.5	P4
3 (c) (i)	2	6.2	P4
3 (c) (ii)	2	6.3	P4
3 (c) (iii)	1	2.3	P4
3 (c) (iv)	2	2.5	H5, H2
3 (c) (v)	1	2.4, 6.8	H5
4 (a) (i)	1	13.1	H5
4 (a) (ii)	2	5.5, 13.1	H5
4 (a) (iii)	1	13.1	H5
4 (b) (i)	2	1.4, 4.2, 10.5	H5
4 (b) (ii)	3	10.2, 10.4	P7, H5, H6
4 (b) (iii)	2	10.5	P6, H5, H6
4 (b) (iv)	1	10.4	H5, H6
5 (a)	1	12.3	H3
5 (b)	3	2.5	H5
5 (c)	3	8.4, 12.5	P4, H5
5 (d) (i)	2	3.3	H5
5 (d) (ii)	1	3.2, 3.3	H5
5 (d) (iii)	2	3.3	H5
6 (a)	3	11.3	H8

Question	Marks	Content	Syllabus outcomes
6 (b) (i)	1	4.1, 1.3	P3
6 (b) (ii)	2	14.1	P7, H4, H5
6 (b) (iii)	2	14.1	P6, P7, H4, H5
6 (c) (i)	1	1.4	P4
6 (c) (ii)	3	11.4	H5, H8
7 (a) (i)	2	7.5	H4, H5
7 (a) (ii)	2	7.5	H4, H5
7 (a) (iii)	3	7.5	H4, H5
7 (b) (i)	1	14.3	H5, H7, P5
7 (b) (ii)	2	14.3	H5, H8
7 (b) (iii)	2	14.3	H7, H9
8 (a) (i)	1	2.3	P4
8 (a) (ii)	3	10.6	H5, P7
8 (b)	3	11.4	H8
8 (c) (i)	1	7.5	H4, H5
8 (c) (ii)	2	7.5	H4, H5
8 (c) (iii)	2	7.5	H4, H5
9 (a) (i)	2	14.3	H5, H8
9 (a) (ii)	3	13.2. 14.3	H5
9 (a) (iii)	2	14.3	H5, H8
9 (b) (i)	2	5.1	P4
9 (b) (ii)	3	7.3, 5.2	H5
10 (a) (i)	1	1.3, 9.2	P4
10 (a) (ii)	2	1.3, 6.5, 9.2	P4
10 (a) (iii)	2	6.5, 2.3	P3, P4
10 (a) (iv)	2	10.6	H6, P7, H5
10 (b) (i)	1	6.4	H4, H5
10 (b) (ii)	2	6.4, 2.3, 3.3	H4, H5, H9
10 (b) (iii)	2	3.3, 6.4, 2.3	H4, H5, H9

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2005 HSC Mathematics
Marking Guidelines

Question 1 (a)

Outcomes assessed: P3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Correct evaluation or indication of understanding of rounding to two significant figures	1

Question 1 (b)

Outcomes assessed: P3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Includes the factor $(x - 3)$ or equivalent merit	1

Question 1 (c)

Outcomes assessed: H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct primitive	2
• Correct primitive for one term	1

Question 1 (d)

Outcomes assessed: P3

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Demonstrates some understanding of the process	1

Question 1 (e)

Outcomes assessed: P3

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• An answer which displays some understanding of the meaning of absolute value in this context OR • Which finds one relevant end point	1

Question 1 (f)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• An answer that demonstrates that the student has located the vertex or found the focal length	1

Question 2 (a)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Has at least one of the two correct solutions or gives the answer ‘$x = 45°$ or $x = 315°$’	1

Question 2 (b) (i)

Outcomes assessed: P7, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Shows some understanding of the product rule or that $\frac{d}{dx}(\sin x) = \cos x$	1

Question 2 (b) (ii)

Outcomes assessed: P7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Shows some understanding of the quotient rule	1

Question 2 (c) (i)

Outcomes assessed: P8, H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct primitive	2
• An answer of the form $A\log\left(x^3 + 1\right)$	1

Question 2 (c) (ii)

Outcomes assessed: P8, H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Correct primitive or equivalent merit	1

Question 2 (d)

Outcomes assessed: P5, P6, H3, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Finds the gradient at $(e, 1)$ OR • Finds the equation of a line that passes through $(e, 1)$	1

Question 3 (a)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 3 (b) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Attempts to apply the cosine rule	1

Question 3 (b) (ii)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct answer following from part (i)	1

Question 3 (c) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Finds gradient or shows that the given line passes through (6, 0) or equivalent merit	1

Question 3 (c) (ii)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Attempts to solve the equations simultaneously	1

Question 3 (c) (iii)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct answer following from part (ii)	1

Question 3 (c) (iv)

Outcomes assessed: H2, H5

MARKING GUIDELINES

Criteria	Marks
• Correct proof	2
• Correct proof without appropriate justification or identifies a pair of equal angles with justification or equivalent merit	1

Question 3 (c) (v)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 4 (a) (i)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 4 (a) (ii)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Attempts to apply the cosine rule or facts about a right-angled triangle with an angle of 0.3 radians	1

Question 4 (a) (iii)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	1

Question 4 (b) (i)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Finds one correct solution	1

Question 4 (b) (ii)

Outcomes assessed: P7, H5, H6

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Locates both turning points or finds one turning point and correctly determines its nature	2
• Correctly differentiates or equivalent merit	1

Question 4 (b) (iii)

Outcomes assessed: P6, H5, H6

MARKING GUIDELINES

Criteria	Marks
• A graph of the correct shape showing a maximum at (–3, 0), a minimum to the right of the y-axis and crossing the *x*-axis at 3	2
• A graph with two of the features mentioned above or equivalent merit	1

Question 4 (b) (iv)

Outcomes assessed: H5, H6

MARKING GUIDELINES

Criteria	Marks
• Correct solution	1

Question 5 (a)

Outcomes assessed: H3

MARKING GUIDELINES

Criteria	Marks
• Correctly applies the change of base formula	1

Question 5 (b)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• A correct proof that ΔBCE is equiangular	3
• Substantial progress towards the proof	2
• States that $BC = AD$ or shows that one angle is 60°	1

Question 5 (c)

Outcomes assessed: P4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Correctly differentiates $2e^x + 3x$ and attempts to solve $2e^x + 3 = 5$ or equivalent merit	2
• Either correctly differentiates $2e^x + 3x$ or equates their derivative to 5	1

Question 5 (d) (i)

Outcomes assessed:H5

MARKING GUIDELINES

Criteria	Marks
• Correct numerical expression for the probability	2
• Answer $\frac{1}{27}$ or evidence of an understanding that the winning tickets are not replaced	1

Question 5 (d) (ii)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer following from part (i)	1

Question 5 (d) (iii)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct numerical expression for the probability	2
• Makes some progress towards computing the probability	1

Question 6 (a)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Demonstrates substantial understanding of how to apply Simpson's rule	2
• Demonstrates some understanding of how to apply Simpson's rule	1

Question 6 (b) (i)

Outcomes assessed: P3

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 6 (b) (ii)

Outcomes assessed: P7, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Correctly differentiates or equivalent merit	1

Question 6 (b) (iii)

Outcomes assessed: P6, P7, H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Attempts to calculate $\frac{d^2V}{dt^2}$ or equivalent merit	1

Question 6 (c) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 6 (c) (ii)

Outcomes assessed: H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Correctly calculates the volume of one part or equivalent merit	2
• Splits the volume into two parts or equivalent merit	1

Question 7 (a) (i)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct answer	2
• Recognition of the terms of an arithmetic series with a common difference of 2500	1

Question 7 (a) (ii)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Recognition of the terms of a geometric series with a common ratio of 1.04	1

Question 7 (a) (iii)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Correctly sums one of the series and attempts to sum the other series using an appropriate formula from the syllabus	2
• Attempts to sum one of the two series by applying an appropriate formula from the syllabus	1

Question 7 (b) (i)

Outcomes assessed: P5, H5, H7

MARKING GUIDELINES

Criteria	Marks
• Correct answer	1

Question 7 (b) (ii)

Outcomes assessed: H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct answer with appropriate justification	2
• Identifies $t = 4$ OR notices the connection with equal areas above and below the time axis	1

Question 7 (b) (iii)

Outcomes assessed: H7, H9

MARKING GUIDELINES

Criteria	Marks
• Answer consistent with the given graph	2
• Indicates that the acceleration is zero for $0 \le t \le 1$ and $3 \le t \le 5$ or equivalent merit	1

Question 8 (a) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	1

Question 8 (a) (ii)

Outcomes assessed: P7, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Finds the stationary point at $h=\frac{R}{\sqrt{3}}$ or equivalent progress	2
• Calculates $\frac{dV}{dh}$ or equivalent progress	1

Question 8 (b)

Outcomes assessed: H8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Finds a strategy involving two or more areas and correctly calculates one of these areas or equivalent merit	2
• Finds the area of the quadrant of the circle or writes down a correct integral expression for the area or equivalent merit	1

Question 8 (c) (i)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	1

Question 8 (c) (ii)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Develops an expression for A_n involving a geometric series or equivalent progress	1

Question 8 (c) (iii)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Shows that the 13^{th} repayment is the final payment	2
• Attempts to solve $4 - (1.12)^n = 0$	1

Question 9 (a) (i)

Outcomes assessed: H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Correct primitive or differentiates $2 - 2\cos 2t$ or verifies initial condition	1

Question 9 (a) (ii)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Correct graph or equivalent merit	2
• Correct time or time consistent with their graph or graph showing some key features	1

Question 9 (a) (iii)

Outcomes assessed: H5, H8

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Correct primitive or equivalent merit	1

Question 9 (b) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Finds the length of *BD* or equivalent merit	1

Question 9 (b) (ii)

Outcomes assessed: H5

MARKING GUIDELINES

Criteria	Marks
• Correct solution	3
• Correctly evaluates the sum of the geometric series or equivalent merit	2
• Recognition of a geometric series with common ratio $\sin^2\theta$	1

Question 10 (a) (i)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	1

Question 10 (a) (ii)

Outcomes assessed: P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Writes $(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta$ OR application of the distance formula	1

Question 10 (a) (iii)

Outcomes assessed: P3, P4

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Attempts to calculate the perpendicular distance from P to AB or equivalent progress	1

Question 10 (a) (iv)

Outcomes assessed: P7, H5, H6

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Shows that the derivative of the area *w.r.t.* x is zero when $x = \frac{m}{2}$ or equivalent progress	1

Question 10 (b) (i)

Outcomes assessed: H4, H5

MARKING GUIDELINES

Criteria	Marks
• Correct explanation	1

Question 10 (b) (ii)

Outcomes assessed: H4, H5, H9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Makes some progress towards calculating the area	1

Question 10 (b) (iii)

Outcomes assessed: H4, H5, H9

MARKING GUIDELINES

Criteria	Marks
• Correct solution	2
• Derives an equation for the probability in terms of t	1