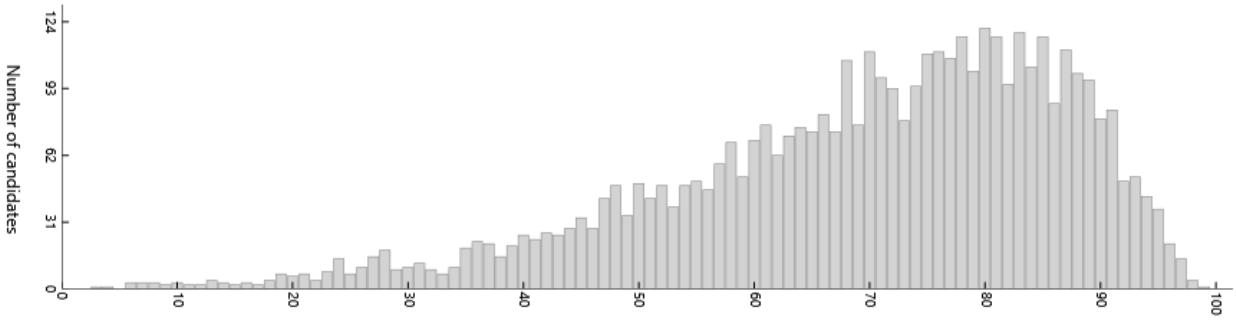
2017 ATAR course examination report: Mathematics Methods

Year	Number who sat	Number of absentees
2017	4328	42
2016	4540	48

Examination score distribution – Written



Summary

Attempted by 4328 candidates Mean 69.37% Max 98.67% Min 3.33%

The examination consisted of two sections: a Calculator-free section and a Calculator-assumed section. Candidates performed to a similar standard in both the Calculator-free and Calculator-assumed sections.

Section means were:

Section One: Calculator-free	Mean 69.86%		
Attempted by 4328 candidates	Mean 24.45(/35)	Max 35.00	Min 0.00
Section Two: Calculator-assumed	Mean 69.11%		
Attempted by 4328 candidates	Mean 44.92(/65)	Max 64.34	Min 1.31

General comments

The examination was well attempted. The relatively few questions left unattempted indicated the examination's accessibility to most candidates. Although candidates generally performed calculations well, many had difficulty explaining how results were determined. There was also a lack of precision in drawing graphs for probability distributions and curve sketching.

Advice for candidates

- When asked to show or demonstrate a result, ensure that all steps and explanations are given.
- Identify the conditions that are needed for a particular probability distribution to be appropriate.
- Give clear explanations and take note of the number of marks when determining the detail required when answering the question.
- Remember that questions worth more than two marks require justification for full marks to be awarded.

Advice for teachers

- Students answered well when they were asked to perform calculations relating to sample proportions and probability distributions but generally struggled to interpret the results, indicating that they need more practice.
- Standard questions involving calculus, logarithms and the exponential function were well attempted.

- Students did not perform well when they needed to use the Fundamental Theorem of Calculus.

Comments on specific sections and questions

Section One: Calculator-free (52 Marks)

In Section One, candidates demonstrated a sound understanding of the log laws and standard calculus questions. They handled the probability questions well. However, candidates struggled with demonstration and explanation in questions relating to margin of error, the Fundamental Theorem of Calculus and area under the curve.

Question 1 attempted by 4324 candidates Mean 3.94(/5) Max 5 Min 0
This question was answered well generally. A common error in part (b) was treating this question as a conditional probability question. In part (c), most candidates obtained 0.2 but many were unable to cube the result.

Question 2 attempted by 4292 candidates Mean 4.63(/6) Max 6 Min 0
This question was done well generally. A common error was to use normal probabilities. Candidates' graph work was often very poor.

Question 3 attempted by 4279 candidates Mean 3.13(/4) Max 4 Min 0
This question was answered well. Common errors were in not collecting exponential terms and applying the log of both sides with the original equation.

Question 4 attempted by 4033 candidates Mean 1.51(/3) Max 3 Min 0
This question was answered poorly. Although candidates used the formula correctly for margin of error, they struggled to state a relationship between the two sample sizes. Other common mistakes were in having the reciprocal ratio or not squaring a half. Some candidates gave only the answer, without providing working. Consequently they were not awarded the marks attached to working.

Question 5 attempted by 4305 candidates Mean 5.92(/8) Max 8 Min 0
In part (a), most candidates gave the *x* coordinate but not the *y*. Part (b) was answered quite well but many candidates did not realise that $e^{\ln 2}$ equals 2. Another common error was to ignore the rectangle and only consider the integral.

Question 6 attempted by 4322 candidates Mean 5.62(/7) Max 7 Min 0
This question was answered well. In part (c), most candidates answered gradient or rate of change; however, a common error was to discuss maximum and minimum stationary points.

Question 7 attempted by 4324 candidates Mean 4.56(/6) Max 6 Min 0
This question was answered well, with most candidates demonstrating an understanding of the log laws and rules. However, many candidates struggled in part (b), often skipping key steps and not fully showing how the result was obtained.

Question 8 attempted by 4321 candidates Mean 2.73(/5) Max 5 Min 0
This question was answered poorly, with many candidates ignoring the word 'hence' in part (b) and subsequently they did not use the Fundamental Theorem.

Question 9 attempted by 4283 candidates Mean 4.58(/8) Max 8 Min 0
Part (a) was answered well; however, many candidates struggled to explain the relationship between the integrals and the area under the curve. Part (b) was answered poorly, with many candidates not determining the limits of the integral. However, they were usually correct in using an average method for the best estimate of the integral.

Section Two: Calculator-assumed (99 Marks)
In Section Two, candidates performed well in questions relating to probability distributions provided they recognised the appropriate distribution. They evaluated and calculated results correctly but struggled with the interpretation and explanation of some concepts. Once again, the application of calculus to rectilinear motion was handled well.

Question 10 attempted by 4237 candidates Mean 2.11(/3) Max 3 Min 0
Although this question was answered well, many candidates omitted to show the use of trig pythagorean identity to gain full marks for working.

Question 11 attempted by 4225 candidates Mean 7.20(/9) Max 9 Min 0
This question was answered well. The main errors made were using discrete formula or using median instead of mean in part (b), and in part (c) not square rooting or using the wrong boundaries with the integral. Some candidates did not round to the nearest minute.

Question 12 attempted by 4310 candidates Mean 9.85(/13) Max 13 Min 0
This question was answered well. However, in part (b) most candidates named the Binomial distribution but a few omitted to give parameters. The main error was in using Normal probabilities. In part (c), many candidates recognised and stated that x is greater than four but included four on their CAS calculator.

Question 13 attempted by 4297 candidates Mean 5.41(/9) Max 9 Min 0
Although parts (a) and (b) were done quite well, parts (c) and (d) were answered poorly. In part (c), many candidates did not fully explain why Lui Yang was better off in the long term. In part (d), many candidates either did not attempt the question or multiplied $6.11 by 1.2 rather than dividing by 0.8.

Question 14 attempted by 4306 candidates Mean 6.25(/9) Max 9 Min 0
In part (a), problems were encountered by many candidates who were not precise in their use of calculus. Common mistakes were in not using the second derivative or not stating that there was no point of inflection. In part (b), many candidates did not show the line of the asymptote in their sketch.

Question 15 attempted by 4280 candidates Mean 5.95(/10) Max 10 Min 0
This question was not answered well. In particular, part (b) was answered poorly, as many candidates did not define the rate with respect to the height. Part (c) was also answered poorly, with candidates not finding the rate of change of volume at time 2 seconds.

Question 16 attempted by 4309 candidates Mean 6.11(/8) Max 8 Min 0
Parts (a) and (b) of the question were answered well. However, in part (c), most candidates did not receive the final mark because they did not give October 2031 as their answer. Other issues included using the incorrect starting position or the incorrect rate of decay.

Question 17 attempted by 4223 candidates Mean 4.60(/6) Max 6 Min 0
This question was answered very well. The most common error was candidates not justifying the minimum with the second derivative or any other method.

Question 18 attempted by 4300 candidates Mean 6.85(/11) Max 11 Min 0
Parts (a), (b) and (c) were answered well but part (d) was very poorly attempted. It clearly showed that candidates lacked understanding when interpretation was required in this section of the course.

Question 19 attempted by 4222 candidates Mean 8.81(/12) Max 12 Min 0
Although this question was mostly answered well, common errors included poor rounding or incorrect use of CAS in simple multiplication. In part (c) (iii) the expected value of x squared was often incorrectly calculated and there were many errors in using numbers from part (ii). Some candidates left their answer as variance. In part (d) most candidates answered the mean correctly but not the standard deviation. Many candidates simply stated the rules of change of scale and origin without answering the question.

Question 20 attempted by 4248 candidates Mean 6.18(/9) Max 9 Min 0
This question was answered quite well. In part (b), many candidates were able to anti-differentiate but did not identify two different constants. A common error was in not using the time of 6 seconds and not solving simultaneous equations correctly. In part (c), most candidates recognised that the velocity must be equated to zero. In part (d), those candidates who integrated the absolute value of velocity were generally correct, while those who tried to use a line diagram generally made errors.