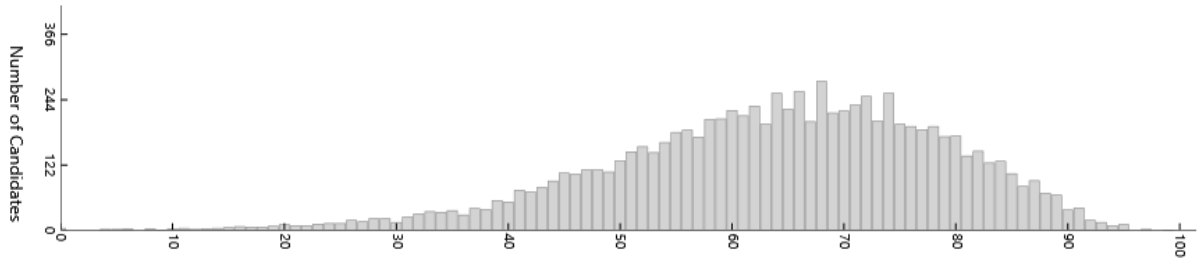
2016 ATAR course examination report:
Mathematics Applications

Year	Number who sat	Number of absentees
2016	8867	199

Examination score distribution



Summary

The examination had a mean of 63.72%. Candidate scores ranged from 0.00% to 99.35%. The standard deviation was 14.92%. The section means were: Section One: Calculator-free 71.42% with a standard deviation of 14.75%; and Section Two: Calculator-assumed 59.62% with a standard deviation of 16.03%.

Attempted by 8864 candidates	Mean 63.72%(/100)	Max 99.35%	Min 0.00%
Section means were:			
Section One: Calculator-free	Mean 25.00(/35)	Max 35.00	Min 0.00
Section Two: Calculator-assumed	Mean 38.75(/65)	Max 64.35	Min 0.00

General comments

The examination was well-balanced with a good proportion of simple and complex questions. Timing did not seem to be an issue as most candidates attempted all questions. Question 1 (minimum spanning tree) appeared to be the easiest on the paper with a mean of 86.94% and Question16 (annuities) appeared to be the most difficult with a mean of 42.26%.

The syllabus requires candidates to ‘explain’, ‘comment on’ and ‘give reasons’. Some struggled with this aspect. Candidates also had difficulty with the correct use of the new vocabulary used in the networks topic. Many candidates did not read questions carefully and lost easy marks. Also, it appeared that many candidates were not familiar with their calculator and failed to take full advantage of its features.

The network questions were answered well. Questions that required some written explanation were done poorly. It was disappointing that many candidates could not convert a score out of 50 to a percentage.

Advice for candidates

- Read questions carefully to avoid losing easy marks.
- Make sure your explanations are clear and concise.
- If a question is worth two marks, show an intermediate step as this may result in a mark.
- Know the difference between a recursive rule and a general rule for a sequence.
- Use thick highlighters where necessary e.g. Question 14.

Advice for teachers

- Answers to money questions should be correct to two decimal places.
- Learning correct terminology needs to be emphasised regularly.
- Rounding correctly needs to be practised.

Comments on specific sections and questions

Section One: Calculator-free

Attempted by 8863 candidates Mean 25.00(/35) Max 35.00 Min 0.00

Most candidates attempted all questions in this section and found it easier generally than Section Two. Basic arithmetic and algebraic skills were lacking, especially in Question 4. The section contained some fairly routine questions. However, questions that required explanations were done poorly.

Question 1 attempted by 8852 candidates Mean 6.09(/7) Max 7 Min 0
Part (a) was very done well with only a few candidates missing one value. Part (b) was done well. Most candidates demonstrated the use of Prim's algorithm either by using the table or the network itself. The most common error was forgetting to put the lengths on each arc.

Question 2 attempted by 8819 candidates Mean 4.81(/7) Max 7 Min 0
Part (a) was well answered. However, there was confusion between the shortest path and the minimum completion time. A common error was to give the critical path but omit the minimum completion time. Part (b)(i) was done fairly well. Most candidates understood the earliest starting time. Both this part and (b)(ii) challenged most candidates, especially the float time. Part (c) was done well generally.

Question 3 attempted by 8853 candidates Mean 6.21(/8) Max 8 Min 0
Part (a) was answered very well. Part (b) was done well generally, with most candidates applying the algorithm correctly. Common errors were: careless subtractions, not recognising that the minimum number of lines was only three after the first row and column operations. Some candidates tried to apply the algorithm using only one matrix rather than rewrite the new matrix each time. This led to careless errors and loss of marks.

Question 4 attempted by 8820 candidates Mean 6.80(/12) Max 12 Min 0
Part (a)(i) was answered well generally. However, notation was a problem with candidates giving $Tn + 1$ rather than T_{n-1} and forgetting to give T_1. Part (a)(ii) was done poorly with many candidates struggling to determine the general rule. Very few candidates were able to give the answer as a fraction. Part (b)(i) was done well.

Part (b)(ii) was not done as well as expected due to poor arithmetic skills. Many answers were left as $\frac{7 \cdot 5}{1 \cdot 5}$ and $7 \cdot 5 \times 1 \cdot 5$. Part (c) again highlighted the poor use of notation, with many candidates writing $T_n = 12 + (n-1) - 5$ instead of $T_n = 12 + (n-1)(-5)$. For those with the correct general rule, poor algebraic skills led to more errors. This question was a good discriminator.

Question 5 attempted by 8829 candidates Mean 7.37(/9) Max 9 Min 0
Part (a) was done well generally, although common errors included new graphs with overlapping edges, not labelling the nodes and repositioning the nodes. This question was meant to be straightforward with, at most, two edges requiring redrawing.

Part (b) was also meant to be straightforward, but many candidates did not understand that 'verify' meant that Euler's rule works for the planar graph in part (i). However, many stated it did not work. The main error was not counting the outside face. Part (c) was done well. Most

candidates stated the correct graph but the reasons given were poor due to incorrect use of terminology.

Question 6 attempted by 8826 candidates Mean 4.55(/7) Max 7 Min 0
Part (a) was done well. Part (b) was done well generally. However, many candidates had difficulty converting $\frac{8}{50}$ and $\frac{19}{50}$ to percentages. Part (c) was done fairly well, but it was evident that many candidates did not understand the term 'association'.

Section Two: Calculator-assumed
Attempted by 8857 candidates Mean 38.75(/65) Max 64.35 Min 0.00

Most candidates attempted all questions in this section. Candidates found this more difficult than the first section. Some of the finance questions proved a little difficult for some, especially Question 16. Clearly, some candidates could not use the finance app on their calculators. The setting out for the maximum flow question was quite untidy. Rounding was also an issue for some candidates.

Question 7 attempted by 8765 candidates Mean 6.37(/9) Max 9 Min 0
Part (a) was done well generally, with the most common errors being incorrect rounding or no evidence of rounding. Part (b) was done well generally. The most common errors were giving an answer as a decimal or writing 85%. Part (c) was done poorly. Most candidates gave the answer $T_n = 13000 \times 0{\cdot}85^{n-1}$. Part (d) was done fairly well. Part (e) was done reasonably well although many candidates clearly did not read the question carefully and wrote 'after 4 years'.

Question 8 attempted by 8805 candidates Mean 10.10(/17) Max 17 Min 0
For part (a) most candidates correctly identified tidal range as the explanatory variable. Part (b) was generally done well with most candidates correctly plotting the four points. However, many did not label the axes. Part (c) was generally done well with the most common error forgetting to mention the direction of the relationship. Part (d) was answered well. Part (d)(i) was done well generally apart from those candidates that could not round correctly. Part (d)(ii) was done poorly. Many candidates did not plot two calculated points on the graph. Again part (d)(iii) was done poorly. Most candidates could not correctly interpret the slope. Most candidates calculated correctly r^2 for part (e) but their interpretations were poor. Part (f)(i) was generally done well. Most candidates estimated correctly the tidal current from their formula. However, comments mentioned mainly interpolation and not the correlation coefficient. Part (f)(ii) was done well generally.

Question 9 attempted by 8745 candidates Mean 4.70(/8) Max 8 Min 0
Parts (a), (b) and (d) were done well generally, although in part (a) the main error was in not listing the paths. Parts (c) and (e) were attempted poorly. Many candidates seemed to be unsure of what was being asked.

Question 10 attempted by 8760 candidates Mean 8.19(/11) Max 11 Min 0
Part (a) was very done well apart from some incorrect rounding for the value of C. Part (b)(i) was generally done well. Part (b)(ii) was done fairly well. However, some candidates multiplied by the seasonal index and omitted to round to the nearest 10. Some candidates rounded 144.74 to 145 and then gave 150 as their final answer. Parts (c)(i) and (ii) were generally done well. The most common error was forgetting to multiply by the seasonal index.

Question 11 attempted by 8788 candidates Mean 5.05(/10) Max 10 Min 0
Part (a) was done well. A few candidates gave their answers as 624 900 and 225 100. Part (b) was done reasonably well. However, many candidates ignored the word 'rate'. Part (c) was done very well. Again with part (d), the word 'rate' seemed to be ignored, with most candidates comparing numbers rather than percentages. Part (d) was done very poorly. Most candidates wrote 1 449 600 not realising that this was only 61.4% of the total.

Question 12 attempted by 8611 candidates Mean 5.35(/11) Max 11 Min 0
Part (a) was done well, apart from some candidates writing 0.015% as the monthly interest rate. Part (c) was done well. However, many candidates answered 43 months, not recognising that an extra payment in the 44th month was required to pay off the loan. Part (d) was done poorly. Most candidates just multiplied their answer to part (c) by 500. Also, of those candidates who calculated the amount owing at the end of the 43rd month, many forgot to calculate the interest on that amount. In part (e) most candidates identified that the loan would never be paid off but provided no justification. Part (f) was done well with most candidates making good use of the finance app.

Question 13 attempted by 8513 candidates Mean 3.67(/6) Max 6 Min 0
Part (a)(i) was done well. Part (a)(ii) was done poorly with most candidates not considering the context of the question. Many could not interpret the 0.69266 element of the solution, and hence wrote 128 months instead of 129. In part (b) most candidates used the correct formula but used 5.4 instead of 0.054. Another common error was comparing the two options incorrectly by looking for the lowest percentage rate.

Question 14 attempted by 8737 candidates Mean 5.98(/7) Max 7 Min 0
Part (a) was done well. However, a disappointing number of candidates counted at least one of vertices, edges or faces incorrectly. Although parts (b) and (c) were done fairly well, many candidates were not clear and concise in their statements. Part (d) was done well. However, candidates need to use a good thick highlighter for these type of questions as some were very hard to read.

Question 15 attempted by 8802 candidates Mean 5.73(/8) Max 8 Min 0
Almost all candidates answered part (a) correctly. Part (b)(i) was done poorly. Most candidates referred to the network rather than the adjacency matrix which was clearly stated in the question. Symmetry was mentioned, but most failed to mention the leading diagonal. Part (b)(ii) was very well done. Part (b)(iii) was meant to be a fairly straightforward question, but many candidates misinterpreted the question and saw 'two-stage, one-way' as separate parts. Many candidates also listed two-way journeys.

Question 16 attempted by 8388 candidates Mean 5.49(/13) Max 13 Min 0
Part (a)(i) was done well. The common error was giving $T_1 = 500000$ instead of T_0. Part (a)(ii) was done reasonably well. Most candidates seemed to use recurrence rather than the finance app. Consequently, the common error was to read $T_{23} = 30042$ as representing $30 042 available at the start of year 23 instead of at the end of year 23, with the annuity only lasting 22 years. Part (a)(iii) was done well. Most candidates used the word perpetuity in their explanation, albeit the spelling was poor. Parts (b)(i), (ii) and (iii) were done poorly. Most candidates wrote answers which were usually wrong. Some tried using recurrence with little success. Not many candidates seemed to be familiar with the finance app.