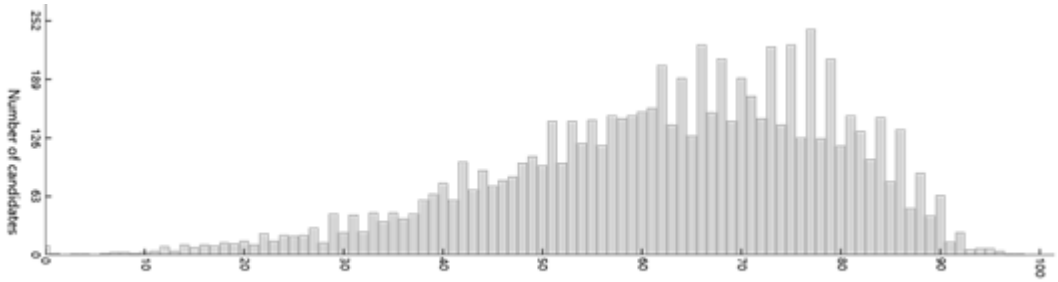
2021 ATAR course examination report:
Mathematics Applications

Year	Number who sat	Number of absentees
2021	7581	190
2020	7611	192
2019	8047	163
2018	8451	178

The number of candidates sitting and the number attempting each section of the examination can differ as a result of non-attempts across sections of the examination.

Examination score distribution–Written



Summary

The examination consisted of two sections: a Calculator-free section and a Calculator-assumed section.

Attempted by 7575 candidates	Mean 62.66%	Max 97.96%	Min 0.00%
Section means were:			
Section One: Calculator-free	Mean 71.44%		
Attempted by 7574 candidates	Mean 25.00(/35)	Max 35.00	Min 0.00
Section Two: Calculator-assumed	Mean 57.94%		
Attempted by 7555 candidates	Mean 37.66(/65)	Max 64.31	Min 0.00

General comments

There were sufficient complex questions to ensure a good spread of scores and sufficient simple questions to ensure candidates could demonstrate their understanding of concepts. The length of the paper seemed appropriate with 97% of the candidates attempting Question 15 and 97% of the candidates attempting Question 16. Responses indicated that basic arithmetic skills are still very poor with many candidates.

Advice for candidates

- Focus on key words/phrases in questions, such as ‘in context’.
- Practise doing calculations without a calculator, particularly multiplying fractions/decimals and converting fractions to percentages.
- Show working, even for two-mark questions.
- Practise plotting points on a Cartesian plane.

Advice for teachers

- Stress the importance of setting out responses in a logical and methodical way.
- Stress the importance of using brackets.
- Continue to emphasise the importance of using correct terminology. Refer students to the Glossary of terms at the end of the Year 12 syllabus.
- Remind students to read questions carefully.

Comments on specific sections and questions

Section One: Calculator-free (52 Marks)

Candidates performed very well in this section, as shown by a mean of 71.44%. However, basic arithmetic skills were lacking among many candidates. These included converting fractions into percentages and reducing a fraction to its lowest terms.

Question 1 Attempted by 7471 Candidates Mean 3.73(/5) Max 5 Min 0
Part (a) was done poorly, with most candidates giving the recursive rule rather than the rule for the n^{th} term of the sequence. Another common error in part (a) was the incorrect writing of the rule as $T_n = 84 + (n-1) - 3$, rather than $T_n = 84 + (n-1)(-3)$. Generally, part (b) was done well, despite incorrect responses in part (a). In part (c), many candidates used trial and error or continued subtracting 3% until they reached 54%. Of those candidates that had the correct rule in part (a) and substituted 54 for T_n, many struggled to solve the equation correctly.

Question 2 Attempted by 7569 Candidates Mean 7.71(/10) Max 10 Min 0
Part (a) was answered well. Generally, part (b)(i) was done well, however, some candidates incorrectly thought that a graph drawn with intersecting edges is non-planar. Part (b)(ii) was answered well. Part (c) was done reasonably well, although a large number of candidates gave additional erroneous information, such as weights and directions, and therefore could not gain full marks. Part (d) was done well. While most candidates could answer part (e), some gave complex and confusing explanations, without referring to the key word 'allocation'.

Question 3 Attempted by 7556 Candidates Mean 3.71(/6) Max 6 Min 0
Part (a) was done poorly, with common errors including counting an extra face where CD and FG intersect and including an extra edge to make Euler's formula work. A number of candidates claimed that the graph was not planar even though they were asked to show that it was planar. Part (b) was done reasonably well. In part (c), very few candidates recognised the route as semi-Eulerian. Part (d)(i) was done reasonably well. Part (d)(ii) was done poorly, with many candidates either not attempting this part or giving incorrect names for the type of edge identified, such as a critical edge, connecting edge, or sink.

Question 4 Attempted by 7567 Candidates Mean 6.80(/9) Max 9 Min 0
Parts (a) and (b) were answered well. In part (c), most candidates correctly identified the use of row percentages, but then struggled to calculate the percentages correctly. In part (d), many candidates were unable to identify a correct association.

Question 5 Attempted by 7536 Candidates Mean 5.87(/8) Max 8 Min 0
Part (a) was done reasonably well, although many candidates did not multiply by 100. In part (b), most candidates were able to state the correct path, however, some gave an incorrect path that did not total 2700 metres. For part (c)(i), most candidates correctly identified the path as being Hamiltonian, but were unable to provide the full response of 'Hamiltonian cycle'. The most common error in part (c)(ii) was giving answers that did not include the technician returning to the control room.

Question 6 Attempted by 7419 Candidates Mean 4.50(/7) Max 7 Min 0
Part (a) was done reasonably well. However, some candidates incorrectly stated the rule for the n^{th} term instead of giving a recursive rule, while others struggled to read the vertical scale correctly, giving responses such as $T_{n+1} = T_n + 2000$, $T_1 = 14\,000$. In part (b), many candidates were unable to reduce the fraction $\frac{24\,000}{32\,000}$ to $\frac{3}{4}$. Incorrect responses included $\frac{24\,000}{32\,000} = \frac{24}{32} = \frac{12}{16} = \frac{2}{8} = 0.4$, $\frac{24}{32} = \frac{4}{7}$, or $\frac{2\cancel{4}^{2}}{3\cancel{2}^{0}} = \frac{22}{30}$. Of those candidates that simplified the fraction correctly, many gave the rule as $T_n = 32\,000\frac{3^{n-1}}{4}$, instead of $T_n = 32\,000\left(\frac{3}{4}\right)^{n-1}$.
Parts (c) and (d) were done reasonably well.

Question 7 Attempted by 7333 Candidates Mean 4.83(/7) Max 7 Min 0
Part (a) was done reasonably well, however, many candidates could not evaluate 0.2(55). Part (b) was done poorly, with many candidates unable to plot the two points correctly. In part (c), most candidates interpreted the pattern in the residual plot correctly. Generally, part (d) was done well, although some candidates struggled to correctly interpret the correlation coefficient.

Section Two: Calculator-assumed (94 Marks)
This section appeared to be more difficult than Section One for candidates, with a mean of 57.94%. Questions 12 and 14 proved to be the discriminating questions. Candidates performed well on the routine questions but experienced difficulty with questions that required interpretation of solutions.

Question 8 Attempted by 7487 Candidates Mean 7.33(/11) Max 11 Min 0
Part (a) was done well, however, some candidates did not provide any response at all. Part (b) was answered well. Most candidates could calculate the seasonal index in part (c), although some did not include the percent sign where required. A common error was giving an answer of 152.62 = 1.526. Part (d) proved problematic with many candidates; errors included not using a ruler, only plotting one point, or not being able to determine a second point apart from the *y*-intercept. In part (e)(i), most candidates identified that the value of *n* was 25, but did not multiply by the seasonal index. Part (e)(ii) was done well, with most candidates recognising extrapolation had been used.

Question 9 Attempted by 7491 Candidates Mean 9.32(/15) Max 15 Min 0
Part (a) was answered well by candidates. In part (b), some candidates only plotted one point and others plotted the two points inaccurately. Part (c) was generally done well. In part (d), many candidates struggled to contextualise the gradient and did not use correct units. Part (e) was generally done well, however, some candidates did not make mention of the 'strength' when referring to the correlation coefficient. Part (f) was done well. Part (g)(i) was answered well, apart from those not multiplying by 1000. Part (g)(ii) was done poorly with many candidates stating 'it is just a prediction'. Part (h) was done poorly, with most candidates stating that extrapolation was unreliable rather than applying this to the context of the question. Although part (i) was generally done well, a number of candidates thought the statement was valid.

Question 10 Attempted by 7285 Candidates Mean 7.65(/14) Max 14 Min 0
In part (a), candidates showed a variety of strategies to answer this question. Part (b) was generally done well. Part (c) was done well by most, apart from those using 16 000 as T_1 rather than T_0. Part (d) was generally done well. Many candidates struggled with part (e); common errors were not calculating the interest on the final payment and, for those that calculated $17 534.44, failing to subtract the $16 000. Candidates able to use their CAS calculator correctly performed well on this question part. Part (f) was a straightforward CAS calculator application, although many candidates made careless errors with the parameters in the finance application.

Question 11 Attempted by 7069 Candidates Mean 5.18(/8) Max 8 Min 0
Part (a)(i) was generally done well, however, some candidates used C_3 instead of C_4. Part (a)(ii) was done poorly, with many candidates unable to convert a term into a day and date. Part (b)(i) was generally done well. Although part (b)(ii) was done reasonably well; the most common error was misinterpreting 20 January as C_{10} instead of C_{11}.

Question 12 Attempted by 7218 Candidates Mean 2.51(/6) Max 6 Min 0
Parts (a) and (b) were generally done well, however, part (c) was done poorly. The most common incorrect method used was $\frac{13+13+9.5+3r}{6}=11$, i.e. $r=10.17$. Some candidates who correctly calculated the value of the vehicle at the end of 6 years ($12 176.04) used the finance application on their CAS calculator with N = 3, PV = 16782.37, PMT = 0, FV = –12176.04, and P/Y = C/Y = 1, which gave I = –10.143, i.e. interest rate = 10.14%.

Question 13 Attempted by 7443 Candidates Mean 6.86(/12) Max 12 Min 0
Part (a) was generally done well, with the most common error was the commencement of Task E after Task A and Task B. Part (b) was done well. Part (c) was not done particularly well, given that a dotted line had been included in questions in both the 2019 and 2020 examinations. Most commonly, candidates responded with ‘it is a dummy path’, without stating what the line indicated in the context of the question. Part (d) was generally done well. In Part (e), most candidates could calculate the float time correctly but could not explain its meaning in terms of the renovation. Part (f) was done poorly, with many candidates struggling to interpret the context. Part (g) was answered well. Part (h) was generally done well, however, some candidates did not take note that both tasks were delayed.

Question 14 Attempted by 7163 Candidates Mean 5.32(/11) Max 11 Min 0
Part (a)(i) was generally done well, however, a number of candidates did not know the correct terminology for this type of investment. Part (a)(ii) was done quite well. Common mistakes included having the same signs for PV and PMT, and adding the $4000 rather than subtracting it. Part (a)(iii) was done well, although some did not carry forward the balance from the first year or incorrectly used N = 24. In part (b), the most common errors included having the same signs for both PV and FV, FV = 0, and attempting to use the effective rate of interest formula.

Question 15 Attempted by 7367 Candidates Mean 4.97(/7) Max 7 Min 0
Part (a) was generally done well, although some did not demonstrate the use of Prim’s algorithm, as was specified in the question. Part (b) was done well. While part (c) was generally done well, some candidates added the upgrade from D to C without removing another edge or removed an edge with the greater capacity.

Question 16 Attempted by 7374 Candidates Mean 5.34(/10) Max 10 Min 0
Part (a)(i) was answered well by candidates. Part (a)(ii) was done poorly with many stating that the maximum flow for the network was 45. Part (b) was done very well. While candidates generally performed well in part (c), some did not take note of the direction of the arrow on edge BC, leading to an incorrect maximum flow. Part (d) was done poorly, with most candidates not attempting it, even though there was a similar question on the 2020 examination paper. Part (e) was generally done well.