

ASSESSMENT
INFORMATION BRIEF:

REVELIAN NUMERICAL
REASONING TEST
(RNRT)

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About Revelian

Revelian is Australia's leading provider of employment assessments.

Founded in 1999, Revelian's goal is to provide a more effective and economical way to recruit and develop talented people for your business.

Revelian's products and services deliver significant benefits such as:

- Providing a highly automated and objective recruitment process
- Delivering better quality hires who are likely to be safer, smarter and more reliable
- Ensuring improved retention and higher morale.

The end result is lower recruitment costs, faster time to hire and finding better people.

About Revelian

Some of the key attributes that distinguish Revelian include:



Full range of recruitment and development tests



Unrivalled 7 days per week client and candidate support



Australian assessments, Australian normative data



Unlimited assessments per hire pricing option



Immediate results for both candidates and clients



Australian based psychology and development teams



Quality endorsed company (AS/NZ ISO9001)

Revelian Numerical Reasoning Test

- **Assesses** Candidate levels of numerical reasoning ability
- **Predicts** Numerical elements of job performance
- **Number of questions** 25
- **Time to complete** 12 minutes (timed)

What is Numerical Reasoning?

Numerical reasoning refers to the ability to understand numerical relationships and concepts and to reason using numbers. Numerical reasoning has strong links to job performance in a variety of roles requiring the ability to work with numbers. The RNRT consists of 25 questions, each of which requires the candidate to process numerical information in order to answer the question correct. The candidate is scored based on the number of questions they have answered correctly.

Why measure Numerical Reasoning when selecting staff?

People who score well on numerical reasoning tests are more likely to quickly grasp numerical concepts, effectively problem solve using numerical information, and make sound, logical decisions involving numbers. As a result, people with high levels of numerical reasoning ability are more likely to perform well in roles requiring the ability to work with numbers.

Numerical reasoning becomes more important as a predictor of job performance as the complexity of the job increases. As such, numerical reasoning is especially important in jobs that require people to process large amounts of data, such as complex technical jobs and managerial roles.

Example Questions

The RNRT includes several different types of numerical questions. Each question requires the candidate to acquire information in numerical form, and then retain, organise, and manipulate that information in order to answer the question correctly. By examining the performance of the candidate across a number of different question types, an estimate of the candidates overall level of numerical reasoning ability can be obtained. An example question is shown below.

The screenshot shows a web-based test interface. At the top, it says "Numerical Reasoning Test - Example Questions" on the left and "Question 2 of 3" on the right. Below this, the question is titled "Example Question 2" and asks "What is the missing number that should take the place of the question mark?". The numbers are arranged in a sequence: 22, 24, ?, 28, 30, 32. Below the sequence is a text input field with the label "Type your answer here:". At the bottom of the interface, there are three buttons: "Previous Question" (with a left arrow), "Flag Question" (with a flag icon), and "Show Answer" (with a right arrow).

The example question shown here is relatively easy – most individuals get this question correct. In the actual assessment, the questions become more difficult as the candidate moves through the test. Questions in the assessment range in difficulty from those that a large majority of candidates answer correctly, to questions that only a small proportion of candidates answer correctly. This broad range of questions and question types means that the RNRT provides a comprehensive assessment of numerical reasoning ability applicable across roles of varying complexity.

Normative Groups

When a candidate completes the RNRT, their score is calculated by totaling the number of correct answers they achieved out of a possible 25. This score is actually meaningless until you contrast it with scores achieved previously by specific groups of people. The group that you contrast the score against is vitally important for the interpretation you make. In other words, the more relevant the comparison group to the position, the greater confidence you can place in the interpretation of the score achieved by the candidate.

Revelian has three types of comparison groups that may be used when interpreting candidate scores on the RNRT (up to three of these can be displayed in the candidate's report at any one time):

1. Employed Adults
2. Management Level
3. Company Specific Benchmark

Note: Additional normative comparison groups beyond the general Employed Adults group are available to enterprise clients only.

1. Employed Adults Normative Groups for RNRT

Revelian's Employed Adults normative group consists of a large group of individuals from a wide range of industries and job types. The group consists primarily of non-indigenous Australians (approximately 72%), while the remaining 28% of this population is comprised of a broad array of ethnic groups.

2. Management Level Normative Groups for RNRT

Revelian also provides managerial level comparisons. This provides additional information that aids in determining whether a candidate has the numerical reasoning capacity commonly found in peers at a similar level. The management level normative group currently available for the RNRT is a general Graduates group. Additional management normative groups will be available over time.

3. Company Specific Benchmark for RNRT

Revelian can benchmark the existing level of numerical reasoning ability of current employees at an organisation. This ensures that only candidates applying for positions that meet or exceed this level are selected. If you would like further information about organisational RNRT benchmarks please contact Revelian.

Reporting Results

Once a candidate has completed the assessment, they are assigned a percentage score which indicates the proportion of the comparison group(s) that they exceeded. In the example below, the candidate answered 19 questions correctly, and this score has been compared against three comparison groups. The score exceeded 85% of people in a company specific group formed of individuals currently employed at ABC Company; 93% of people in an industry benchmark of Graduates; and 97% of people in the general population group of Employed Adults.

RNRT Score	Level of Numerical Reasoning Ability					Comparison Score		
	Far Below Average	Below Average	Average	Above Average	Far Above Average	ABC Company	Graduates	Employed Adults
19 V						Above Average (85%)	Far Above Average (93%)	Far Above Average (97%)
V	Verification testing has confirmed score							
V↓	Verification testing has resulted in a score decrease							
NV	Test score is NOT verified							

When multiple candidates for the one position complete the RNRT, then the results of those candidates are compared against one another in a position report, which ranks the candidates in terms of their performance on the assessment. An example of this type of reporting is shown below.

	Name	Level of Suitability					Comparison Score		
		Far Below Average	Below Average	Average	Above Average	Far Above Average	ABC Company %ile	Graduates %ile	Employed Adults %ile
1	Katherine Adams						85% V	93% V	97% V
2	Cherie Halls						49% V	55% V	76% V
3	Scott Hill						19% NV	23% NV	44% NV
4	Malcolm Vesper						0% V	2% V	4% V
Please note: a) In order to make effective use of this report, attention must be given to the "Important Considerations" section. b) Click on the candidate links for assessment information pertaining only to that candidate.									
RNRT scores: V The candidate has been tested under supervised conditions and the original RNRT score has been confirmed NV The candidate has been tested remotely under unsupervised conditions. As such, Revelian recommends that this assessment be followed by a supervised assessment in order to verify the candidate's score. Once a supervised assessment is completed, Revelian will update the candidate's score if a significant change in score occurs.									

Online Security

Like all Revelian assessments, the RNRT can be completed remotely over the internet under unsupervised conditions. This provides a high level of flexibility and convenience for the candidate. When testing is conducted under unsupervised conditions, however, it is possible that the candidate may have had assistance in completing the assessment, and it is essential to protect the security of the assessments. Revelian adopts the following best practice strategies to ensure on-line security, and reduce the likelihood of cheating.

Motivating candidates to complete honestly

All candidates are informed that if they progress in the recruitment process, they will be tested again with different questions to confirm their results. This ensures that candidates are motivated to complete the assessments honestly and accurately. Prior to completing the Revelian assessments, all candidates are required to electronically endorse a short statement, indicating that they:

- Will not receive help from others when answering assessment questions; and
- Will be honest, accurate and perform at the best of their ability.

Unique assessment form for every candidate

Candidates who sit the assessment will randomly receive a unique set of questions, different to those streamed to other candidates. This is achieved through Revelian's application of Linear-on-the-Fly (LOFT) item streaming for the RNRT. Furthermore, answer options in each test are randomly scrambled. Both these features ensure that no two candidates will receive the same test, thus greatly reducing the possibility that candidates will collaborate when completing assessments.

Secure assessment delivery via flash

Our online testing engine is delivered via Flash technology, which allows us to deliver the assessment securely, and to ensure that assessment time is tracked accurately. Flash delivery also allows Revelian to securely download the entire assessment to the candidate's computer, which eliminates the influence of internet connection speed on the candidate's testing experience. Finally, our testing engine disables the "copy" and "paste" functions on the candidate's computer, which prevents them from copying test questions to provide to others.

Detailed assessment session logging

From the moment the candidate logs on to the Revelian website, to the moment they finish their assessments, Revelian creates detailed test logs of the candidates testing session, including time

spent answering questions, and internet connectivity. Should the candidate indicate that their internet connection dropped out, or that they were disturbed while completing the assessment, then assessment logs can be consulted to verify the candidate's claims.

Candidates can only complete the assessment once within a 12 month period

Candidates can get better at specific assessments through practice. In order to ensure that all candidates can be compared against one another fairly, Revelian restricts candidates to one assessment within a 12 month period. To facilitate this, we gather identification details from candidates at a number of stages of the application and assessment process, so that new candidates can be compared against candidates in our database. If a candidate has been tested within the previous 12 months, then they are not able to sit the assessment again. Rather, they are provided with the opportunity to "release" their previous results to the new employer. This strategy eliminates candidate practice effects, resulting in fairer and more accurate assessment scores.

Verification testing

Revelian provides a free verification service, whereby individuals who have been tested remotely on the Revelian Numerical Reasoning Test (RNRT) can be re-tested on a parallel form of the test with different questions under supervised conditions. Revelian's systems automatically compare the results from the initial unsupervised assessment to the verification assessment. If the candidate does not verify their initial score then their results are updated to reflect the results from the second verification assessment and the client is informed.

Validation and Psychometric Summary

Theoretical Background

Specific aptitude theory proposes that specific abilities, such as numerical reasoning, are important in personnel selection as performance in different jobs requires different specialist abilities. Therefore the prediction of job performance is said to be enhanced by focusing on the specific aptitude (or aptitudes) required for each unique role¹. For example, the use of numerical reasoning tests would be suitable for roles requiring the ability to use and work with numbers.

The premise of specific aptitudes dates back to the early 1900's when cognitive abilities were first suggested to exist within a hierarchy, with general cognitive ability at the broadest level, followed by general aptitudes (e.g. numerical reasoning), then narrower subcomponents referred to as specific aptitudes (e.g. spelling and arithmetic) at the third level². Since then, a considerable amount of research has explored the relationship between both general cognitive ability and specific aptitudes and their relationship with training outcomes and job performance.

Research has demonstrated numerical reasoning to be an excellent predictor of job performance and training success. For example, a large review of 56 scientific papers identified numerical reasoning as an excellent predictor of future job performance and training success³. This finding has also been demonstrated in various other studies across a number of different occupations. As such, numerical reasoning can be considered a valid and reliable measure to predict future job performance and training success.

Development and Validation of the Revelian Cognitive Ability Test

The Revelian Numerical Reasoning Test was developed in a number of stages. These were:

- **Question Development:** Initially a large number of numerical reasoning questions were developed of varying item difficulty and item type. Including items of varying difficulty would allow candidates with diverse levels of numerical reasoning ability to be adequately assessed. Including items of varying type would ensure that content remained novel and adequately covered the construct of interest. Questions were evaluated, and modified

¹ Mount, M., Oh, I., & Burns, M. (2008). Incremental validity of perceptual speed and accuracy over general mental ability. *Personnel Psychology* (61), pp. 113-139.

² Brown, K., Le, H., & Schmidt, F. (2006). Specific aptitude theory revisited: Is there incremental validity for training performance? *International Journal of Selection and Assessment* (14), pp. 87-100.

³ Bertua, C., Anderson, N., & Salgado, F. J. (2005) The predictive validity of cognitive ability tests: A UK meta-analysis. *Journal of Occupational and Organizational Psychology* (78), pp. 387-409.

where necessary, through a process of expert review which considered various aspects of item development including item clarity and cultural bias. This review first occurred with items in written form and then again once items were developed in a computerised format.

- **Question Testing:** Question testing was undertaken in two stages. For initial testing purposes, items were grouped into blocks and streamed to candidates as part of a recruitment process following their completion of a general measure of cognitive ability. Responses to these test items were not scored nor considered as part of this recruitment process. After a sufficient sample of participants had responded to an item block (n=200) this data was collated and analysed to assess the adequacy of each new item. Item analysis, including both classical and item response theory techniques, determined which items were retained, modified or removed at this stage of development.

Retained items were then used to form parallel forms of a general cognitive ability, an assessment used for recruitment across a diverse range of positions and industries. Large datasets were then captured (in some cases in excess of 30,000 data points) to further calibrate the characteristics of each item. Principal component analysis and scale reliabilities were then used to demonstrate the adequacy of an assessment consisting of these numerical reasoning items only.

- **Assessment Validation:** Those items retained through both phases of question testing were then used to form a bank of numerical reasoning items. Using Linear-on-the-Fly (LOFT) item streaming methodology, random forms of the RNRT were then streamed and validated using two pilot populations. Under LOFT items are streamed randomly to candidates, ensuring that each candidate is administered a unique form of the assessment. Both item type and difficulty is controlled, allowing for fair and equitable comparisons between candidate scores. Both pilot populations had been sourced from pools of candidates who had previously completed Revelian assessments.

The first pilot involved participants completing a randomly streamed form of the RNRT to validate its initial calibration, i.e. time-limit, number of items. Participants (n=79) were of diverse ethnic backgrounds, age and gender who had applied for positions across various industries and management levels. Results demonstrated support for the initial calibration of the RNRT with a normal score distribution, adequate internal consistency and no floor or ceiling effects.

The second pilot involved participants completing a randomly streamed form of the RNRT as well as another measure of numerical reasoning, i.e. the numerical reasoning component of the Pearson Differential Aptitude Test (DAT). Participants (n=87) were equally counterbalanced, with one half of the sample completing the RNRT followed by the DAT and the other half completing the DAT followed by the RNRT. Correlational

analysis demonstrated strong construct validity for the RNRT in relation to the Pearson DAT.

Data from both pilot studies contributed to initial normative comparison groups as well as estimates of internal consistency and standard error of measurement, both of which were used in determining verified score ranges for the assessment.

Psychometric Summary

The statistical results of the development and validation process are summarised below, and provide confidence that the RNRT represents a reliable and valid measure of numerical reasoning ability. The RNRT has:

- Strong face and content validity. The various numerical item types used in the RNRT, e.g. sequence, matrix, arithmetic, reasoning, demonstrate clear relevance to as well as comprehensive coverage of the construct of interest.
- An internal consistency of 0.86. This indicates that the questions within the RNRT form a coherent group that reliably assess numerical reasoning ability.
- A correlation with the Pearson DAT of 0.65 ($p < .001$). The DAT is a well-established and empirically supported assessment of numerical reasoning ability. This correlation indicates that the RNRT is validly assessing the construct of numerical reasoning ability.
- Equivalence in item form difficulty. Due to the random nature of LOFT item streaming, overall level of item difficulty may differ slightly between candidates. By controlling item difficulty and content, it was shown that no meaningful difference in candidate scores can be attributed to random item streaming.
- A sufficiently large item bank. The number of unique forms of the RNRT ensures that no two candidates will be streamed the exact same assessment, thus contributing to its ongoing validity and security.

Revelian's Range of Assessments

Revelian has a number of psychometric assessments designed to reliably and validly measure key candidate characteristics. These assessments are summarised below.

Revelian Cognitive Ability Test (RCAT)

Predicts a candidate's future work performance

The Revelian Cognitive Ability Test measures the candidate's level of general mental ability. This is an indication of the candidate's capacity to acquire, integrate, recall and apply new information. An analysis of 85 years of personnel selection has shown that general mental ability is the best predictor of performance in a wide range of roles.

- 51 items
- 20 minute time-limit
- The test can be completed either remotely or under supervised conditions
- Is a predictor of the candidate's potential work performance

Revelian Verbal Reasoning Test (RVRT)

Predicts verbal reasoning element of future work performance

The Revelian Verbal Reasoning Test measures the candidate's level of verbal reasoning. This is an indication of the candidate's capacity to understand relationships and concepts framed in words, and solve problems using that information. Research has indicated verbal reasoning as a predictor of future job performance, particularly for roles that require the ability to comprehend and analyse written information.

- 35 items, 10 minute time limit
- Can be completed either remotely or under supervised conditions
- Is a predictor of the candidate's work performance, particularly for roles involving the use of verbal reasoning ability

Revelian Numerical Reasoning Test (RNRT)

Predicts a candidate's numerical reasoning element of future work performance

The Revelian Numerical Reasoning Test measures the candidate's level of numerical reasoning. This is an indication of the candidate's capacity to understand numerical relationships and concepts and problem solve using that information. Research has indicated numerical reasoning as a predictor of future job performance, particularly for roles that require individuals to process large amounts of data, such as complex technical and managerial roles.

- 25 items, 12 minute time limit
- The test can be completed either remotely or under supervised conditions
- Is a predictor of the candidate's work performance, particularly for roles involving the use of numerical reasoning ability

Revelian Abstract Reasoning Test (RART)

Predicts abstract reasoning element of future work performance.

The Revelian Abstract Reasoning Test measures the candidate's level of abstract reasoning. This is an indication of the candidate's capacity to solve conceptual problems by identifying relationships and analysing patterns. Research has indicated abstract reasoning as a predictor of future job performance, particularly for roles that require the ability to learn new skills quickly, problem solve and or develop strategies/solutions.

- 32 items, 10 minute time limit
- Can be completed either remotely or under supervised conditions
- Is a predictor of the candidate's abstract work performance, particularly for roles involving the use of abstract reasoning ability

Revelian Values Inventory (RVI)

Match the candidate to the organisation.

The Revelian Values Inventory predicts potential cohesion between company values and a candidate's personal values; linked to organisation commitment.

- Un-timed (approximately 5- 10 minutes, candidate can sit the test remotely or supervised)
- Matches candidate's values to organisational values

Emotional Intelligence Assessment (MSCEIT)

Identifies candidates most likely to have greater career success.

The MSCEIT assesses an individual's ability to understand their own emotions, the emotions of others' and to use emotions to enhance thought.

- Un-timed (approximately 45 minutes, candidate can sit the test remotely or supervised)
- Also available in a development version for use amongst existing staff

Revelian 16 Personality Factor Questionnaire (16PF®)

Measures core personality traits influencing behaviour.

The 16PF Questionnaire (16PF®) is a widely recognised personality test and measures core personality traits that influence behaviour.

- Un-timed (approximately 30-minutes, candidate can sit the test remotely or supervised)
- Predicts work behaviour, communication style and performance

Revelian Work Preference Profile (RWPP)

Matches a candidate's preference to the job.

Work Preference Profiling predicts potential job satisfaction by matching the candidate's preference to the task requirements of the job. This type of assessment is linked to predicting job satisfaction.

- Un-timed (approximately 10 -15 minutes, candidate can sit the test remotely or supervised)
- Matches a candidate's preference to the job profile
- Supervisor or incumbent completes a Position Analysis prior to the candidates being compared to the role
- Predicts future job satisfaction

Revelian Behavioural Profile (RBP)

Measures workplace behaviour.

Individual behaviour relates to communication, team cohesion, performance and effectiveness. The Revelian Behavioural Profile looks at the work style behaviours of the individual.

- Un-timed (approximately 15 minutes, candidate can sit the test remotely or supervised)
- The assessment measures how people are likely to respond to challenges, the amount of interpersonal interaction they require, how they will adapt to the pace of a work environment, and how compliant they will be
- As personal self- awareness of behaviour increases, so does productivity and performance
- Also available in a development version for use amongst existing staff

Revelian Work Safety Assessment (RWSA)

Measures a candidate's workplace safety behaviour.

The Workplace Safety Assessment identifies those most likely to embrace safe work practices and less likely to exhibit counterproductive safety behaviour.

- Un-timed (approximately 10 -15 minutes, candidate can sit the test remotely or supervised)
- Linked to lower absenteeism, lower compensation costs, and a more trustworthy team
- Measures factors such as:
 - Safety Control
 - Risk Aversion
 - Stress Management
 - Drug Aversion
 - Attitudes towards Violence
- Also available in a development version for use amongst existing staff

Revelian Work Reliability Scale (RWRS)

Measures a candidate's level of workplace integrity.

The Work Reliability Scale measures attitudes towards workplace theft and dishonesty. These have been shown to link with counterproductive behaviours such as theft, absenteeism, and property damage.

- Un-timed (approximately 10 minutes, candidate can sit the test remotely or supervised)
- Identifies candidates who have the potential to steal, be dishonest, take unwarranted sick days or be uncooperative with their team
- Linked to fraudulent behaviour, shrinkage, sick leave and unexplained losses