

Mathematics Booklet	<h1>Psychometric Tests (Numerical)</h1>
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This is one of a series of booklets designed to help you increase your confidence in handling Mathematics. This booklet contains both theory and exercises which cover:-

1. **What are psychometric tests?**
2. **What to expect**
3. **Question types**
4. **Online tests**
5. **Practice questions**
6. **Hints and tips**

There are often different ways of doing things in Mathematics and the methods suggested in the booklets may not be the ones you were taught. If you are successful and happy with the methods you use it may not be necessary for you to change them. If you have problems or need help in any part of the work there are a number of ways you can get help.

For students at the University of Leeds

- Ask your lecturers
- You can contact a Mathematics Support Tutor from the [Skills@Library](http://skills.library.leeds.ac.uk) centre, 15 Blenheim Terrace; you can also email us: skills@library.leeds.ac.uk
- Come to a Drop-In session – daily during teaching times
- Look at one of the many textbooks in the library.

For others

- Ask your lecturers
- Access your Study Advice or Maths Help Service
- Use any other facilities that may be available.

If you do find anything you may think is incorrect (in the text or answers) or want further help please contact us by email.

Tel: 0113 3434096
Web: <http://skills.library.leeds.ac.uk/>
Email: skills@library.leeds.ac.uk

Tel: 01482 466199
Web: www.hull.ac.uk/studyadvice
Email: studyadvice@hull.ac.uk

1. What are psychometric tests?

Psychometric tests are used by large graduate recruiters. There are many different kinds of psychometric test. The most common are numerical reasoning, verbal reasoning, diagrammatic and personality questionnaires. This booklet will look at numerical reasoning tests.

If you apply for a job at a large company or organisation, it is likely that you will be invited to an assessment centre for a day. These are days where candidates are brought in and tested to find out if they are suitable for the post. Typical assessment centre elements are interviews, psychometric tests, and group tasks. The results from each of the elements are then used to determine whether you are offered a position or not.

The employer uses the tests in order to see how well you will cope when dealing with numerical information. It is likely that a graduate post would require you to deal with graphs and figures in reports and so your prospective employer needs to know that you will be able to handle these correctly.

It is important to note that a poor performance on a psychometric test may not lead to you being rejected if you have performed well on other tasks.

This booklet will explain the format of numerical reasoning tests, how they work and what you can expect them to contain.

2. What to expect

The test itself usually comprises a question booklet and an answer sheet. You will not be allowed to mark the question booklet; however you will be provided with scrap paper for working out your answers.

If you are taking a test by Saville & Holdsworth (one of the more popular test publishers) your answer sheet will resemble a lottery form. It will be pink and white and answers are filled in by marking a box with a line. Care should be taken that you are filling in your responses on the correct line.

Before the test commences you will be given the opportunity to try some practice questions. These are there to help you to get used to the format, and to show the person supervising the test that you understand the instructions. There are normally two or three of these questions and the test supervisor will check that the candidates have answered these correctly before moving on to the test proper.

The test is not a competition between the candidates. The score that you obtain will be checked against a database of scores obtained by people of your gender, age and background when taking a similar test. This is then used to find out if your numerical reasoning ability is above or below average compared with your peers. So do not feel that your score will be compared with the person next to you.

Most test papers are designed so that they can be taken either with or without the use of a basic calculator. If you are expected to use a calculator, then one will be provided for you. If you are taking the test without a calculator, you will be expected to be able to answer fewer questions correctly in the time allowed than candidates who are using a calculator.

Most tests are not designed to be completed in the allotted time. Do not feel that you have to get through all the questions as quickly as possible. It is the accuracy of your answers that is of the greatest importance, so a candidate getting 18 out of 20 questions correct will be seen more favourably than one getting 15 out of 30, for example.

The questions usually comprise a table or graph and then some related questions. Numerical reasoning tests tend to be of the multiple choice format, with 5 or 6 possible answers. Note that these are constructed to include answers that are obtained by making common errors. They also usually include a 'don't know' or 'cannot say' option.

Some psychometric test questions can be quite lengthy and thus hard to understand. It is important, therefore, that you read through the questions at least twice to make sure that you understand exactly what you are being asked to calculate.

3. Question types

As the tests are based around information in tables and graphs, this limits the types of questions that can be used. This section explores some of the possibilities.

In order to give yourself the best possible chance in a psychometric test, you need to make sure that you are comfortable with the following mathematical topics:

- Percentages - finding a percentage of a value, increasing/decreasing by a percentage, finding a percentage increase/decrease
- Ratio - finding the ratio between two items, cancelling down ratios
- Estimation - giving a close estimate of an answer, knowing whether your answer is sensible

Tables

- Using two values in a table to find a new value. For example:

	Population	Percentage under 20
Country A	20 000 000	15%

How many inhabitants of country A are under 20 years of age?

To find this value, multiply the population value by the percentage. So the calculation is $20000000 \times 0.15 = 3000000$ (note 0.15 is the decimal equivalent of 15%).

Note that a variation of this question is to use values per thousand (or other values) rather than a percentage. In this case, you would first divide the population by a thousand (or other stated amount), then multiply this result by the given rate.

- Using a percentage rise in a table to predict the future. For example:

	Yr1	Yr2
Sales	400	500

If sales increase at the same rate, what will the sales be in year 3?

To answer this question, first of all you need to know the rate of increase between years 1 and 2.

To find a percentage increase, use the formula $\frac{\text{new-old}}{\text{old}} \times 100$

So here the increase is $\frac{500 - 400}{400} \times 100 = \frac{100}{400} \times 100 = 25\%$. Now we have the increase, we apply this to the year 2 figure. To increase 500 by 25% you can either find 25% of 500, then add it on or find 125% of 500. Hence the year 3 figure is $\pounds 500 \times 1.25 = \pounds 625$.

- Using a percentage to determine past values. For example

Year	2006
Profits (000s)	1500

Given that the profits in 2006 were an increase of 30% on 2005's profits, what was the profit in 2005?

We are looking for a value which when increased by 30% becomes 1500. (You don't need to worry about the fact that it is actually 1 500 000 - as long as all the values you deal with are of the same magnitude). If you wanted to increase a value by 30% you would multiply it by 1.3, so to undo this increase, you divide by 1.3.

In this case, $\frac{1500}{1.3} = 1153.85$ to 2 decimal places. Normally the answer options are rounded, so you would look for the answer closest to this figure, such as 1 154 000 (after including the zeroes)

- Finding a percentage increase or decrease. For example:

Company	Yr1	Yr2
A	400	500
B	250	275
C	210	245

Which company showed the greatest percentage increase between year 1 and year 2?

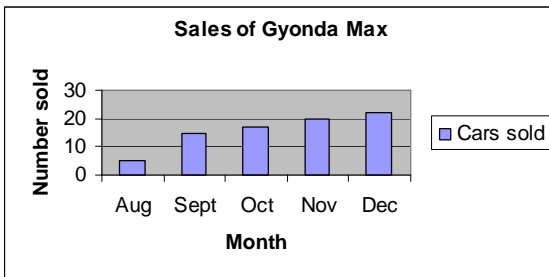
Sometimes you will be able to eliminate some of the answer options immediately as they will represent decreases not increases. A handy clue here is to look at the relative sizes of the numbers involved. For example if 100 increases by 20, it has increased by 20%. However if 200 increases by 20, it has only

increased by 10%. So if two numbers have increased by similar amounts, the percentage increase is greater for the number that started off the smallest.

Usually to answer this type of question you will need to perform a number of calculations. Taking each company in turn, find the percentage difference between the two figures. Then, once this is done, select the largest. So here, Company A has an increase of 25% (as before), Company B has an increase of 10% and Company C has an increase of 16.7%. Company A has the largest percentage increase.

Graphs

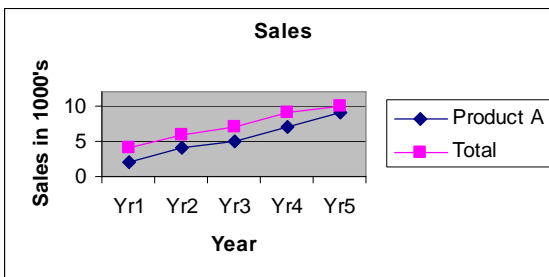
- Reading and using a value from a single graph



For example: **If the Gyonda Max sells at £8000 each, what is the total value of sales in November?**

To answer this, first of all you need to read off from the graph how many cars were sold in November. In this case it is 20. As the cars cost £8000, the total value of sales is $20 \times £8000 = £160000$

- Using values from a graph to find an unknown value

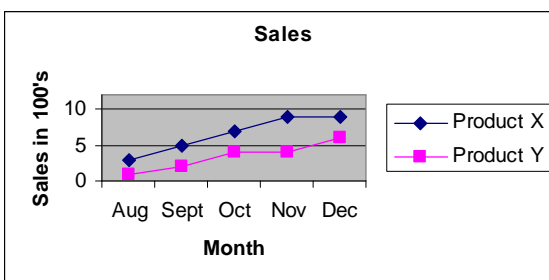


For example: **The company makes 2 products, A and B. How many of product B were sold in Year 2?**

First of all, make sure you understand what is shown by the graph. The graph gives the information for product A and the total sales. As the question has told you that the company only sells two products, the sales of product B can be found by subtracting the sales of product A from the total sales.

To answer the question, read off the values for A and total at year 2. Here they are 4(000) and 6(000), hence the number of B sold must be $6000 - 4000 = 2000$.

- Using graphs with prices



For example: **Product X sells for £50; product Y (the premium version of X) sells for £80. How much more would the company have made in October if all of their sales had been of product Y?**

To answer this question, we need two pieces of information. Firstly, how much money did the company actually make in October, and secondly how much they would have made if all sales were product Y.

Once these are known, you can then find the difference between the two.

In October, 700 Xs and 400 Ys were sold. So the value of this was $700 \times £50 + 400 \times £80 = £67000$. In total, 1100 products were sold that month. If these were all product Y, then the value would be $1100 \times £80 = £88000$. Hence the required value is $£88000 - £67000 = £21000$

Be aware that there will normally be at least one question where you will not be able to produce an answer from the information given. In this case you should select the 'cannot say' option. One particular example of this can be found on a Civil Service practice paper. A table is given including the amount of agricultural land in each country, along with the population for each country. The question is: Which country has the fewest number of agricultural workers? Whilst we have the population figures, we do not know what proportion of the population is involved in farming and so cannot answer the question.

4. Online tests

Recently it has become common practice for psychometric tests to be used at an earlier stage of the recruitment process by offering them online. These will need to be completed within a set time period, but you can do them wherever you like as you will be given a web address and password for the test. It is also up to you as to when you take the test within the period, so if your brain works best at midnight, you can take it then! Clearly this makes it harder to police the test to make sure that it is you taking it and that you're not cheating. Because of this, employers using online tests will often have a second, longer test under test conditions at an assessment centre.

Some of the employers that use online testing will provide practice questions for you to try. You should ensure that you approach these questions in the same way as you would the actual test, so that you get a proper feel for what the test will be like.

If you are facing an online test, then you should take a look at www.shldirect.com or http://students.efinancialcareers.co.uk/numerical_test.htm as registering with these sites will allow you to try timed tests that may be quite similar to the one you will face.

5. Practice questions

1. Which faculty had the highest percentage of female staff?

Faculty	Total staff	Number of female staff
Arts	20	8
Languages	26	13
Sciences	30	10

2. If profits rise at the same rate as they did from 2007-8, what will the profits be for 2008-9?

Year	Profit (millions)
2007	25
2008	30

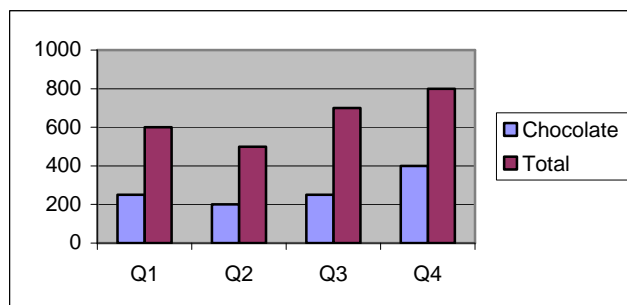
3. If the increase from 2006 to 2007 was 30%, how much profit was made in 2006?

4. Which student had the widest range of scores?

Subject	Student A	Student B
Art	70	85
French	82	64
Maths	56	71
Physics	90	58

5. Which student had the highest mean score over all subjects?

The graph below shows the sales of packets of Bob's Biscuits over the 4 quarters of last year. Chocolate biscuits sell for £1.50 a packet and all other varieties for £1.25 a packet.



6. How much were the sales in Q2 worth?

7. If all the biscuits sold in Q3 had been chocolate, how much more would the sales have been worth?

6. Hints and tips

Familiarise yourself with the diagrams before answering the questions. Are the figures in tens, hundreds, thousands? What is the scale on the graph?

Look carefully at the options. If the values stated in the question indicate an increase, you can then discount any option involving a decrease.

Label your workings out. It may not be possible for you to produce very neat work under exam conditions, but you may find that some questions require figures worked out in previous questions. Being able to find these figures means not having to work them out all over again.

Avoid obsessing over one question. All questions are worth the same marks, so it is much better to spend your limited time on questions that you can answer.

If you are using a computer-readable answer sheet (pink and white boxes), record each answer before moving on to the next question. This makes it less likely that you will fill in the box corresponding to the wrong question.

Some tests will have several charts and tables with the questions jumping between them. You may find it easier to familiarise yourself with one table and then do the related questions before moving on to the next. Note that you will have to be extra careful with filling in the answer sheet if you do this.

Practice as much as possible before the event. This will make the layout of the test and the types of questions more familiar, which will aid with nerves.

For further information on the topics covered here, please refer to the following Hull University Study Advice Services booklets:

- Percentages
- Fractions, decimals and percentages: how to link them
- Estimation and mental methods
- Maths phobia

All of these can be downloaded from the website: www.hull.ac.uk/studyadvice

Practice Tests in test conditions

University of Leeds Careers Service offers practice SHL tests in numerical reasoning, verbal reasoning and diagrammatic tests. These are carried out under test conditions by an SHL trained examiner. Following the test you will receive feedback on your performance. These sessions do cost £x to cover test materials and take place in the Careers service centre. For further information please refer to: <http://careerweb.leeds.ac.uk/graduates/gettingajob06/psychometrictest.asp>.

Helpful books

These books provide further information and practice.

BRYON, Mike. 2002. *How to pass advanced numeracy tests*. London: Kogan Page. Library location: BJL QA 37.2 B9 7th Floor.

BRYON, Mike. 2004. *The advanced numeracy test workbook*. London: Kogan Page. Library location: BJL QA 40 B9 7th Floor.

SMITH, Heidi. 2003. *How to pass numerical reasoning tests : a step by step guide to learning the basic skills*. London: Kogan Page. Library location: BJL QA 43 S6 7th Floor.

RHODES, Peter S. 2004. *Practice tests for diagrammatic and abstract reasoning*. London: Hodder & Stoughton. Library location: BJL HF 5549.5 E5 R4 3rd Floor.

Useful Websites

Saville & Holdsworth

www.shldirect.com

This site contains some practice questions that you can try with immediate correct/incorrect feedback. If you register with the site, you can try timed tests. From time to time they also trial new tests on the site, so you can get even more practice.

Morrisby

<http://www.morrisby.com/>

Select the 'Test-taker's guide' tab then 'sample questions' to access the practice questions. Question types include: abstract reasoning (diagrammatic), verbal ability (pick the odd word out), numerical ability (fill in gaps in a sequence), perceptual (pick the odd image out), shapes (recognising a flipped or rotated shape) and mechanical.

Psychometric Success

<http://www.psychometric-success.com>

From this website you can download a number of practice tests with answers. Tests include: data interpretation (tables), reasoning (spotting number patterns), computation (basic arithmetic) and estimation (coming up with sensible, but not exact answers). The site also includes information on the tests and on assessment centres in general.

Numerical Tests - EFinancialCareers

http://students.efinancialcareers.co.uk/numerical_test.htm

Practice makes perfect - designed by test specialists, online practice tests with answer booklets which help revise for the real thing.

Answers

1. The percentages are: Arts 40% female, Languages 50% female and Sciences 30% female. Hence the faculty with the largest percentage of female staff is Languages.

2. The actual difference in profits is 5m, so as a percentage, this is $\frac{5}{25} \times 100 = 20\%$. Increasing the 2007 figure by 20% gives $30 \times 1.2 = 36$. Hence the predicted 2008 profit is 36m.

3. When the 2006 profit was increased by 30%, the result was 25m. To get back to the original result, divide 25 by 1.3, giving $\frac{25}{1.3} = 19.23$ to 2 decimal places. Hence the 2006 profit was approximately 19m.

4. To find the range, subtract the lowest score from the highest. For student A this is $90 - 56 = 34$ and for B this is $85 - 58 = 27$. So student A has the largest range of scores.

5. To find the mean of the scores for each student, add the scores together and divide the total by the

number of scores. Hence for student A: $\frac{70 + 82 + 56 + 90}{4} = 74.5$ and for student B:

$\frac{85 + 64 + 71 + 58}{4} = 69.5$ Hence student A has the highest mean score.

6. From the graph, there were 200 packs of chocolate biscuits sold and the total was 500, meaning that 300 packs of non-chocolate biscuits were sold. Hence the desired value is $200 \times £1.50 + 300 \times £1.25 = £675$.

7. The first part of this is similar to 6. The actual sales in Q3 are: $250 \times £1.50 + 450 \times £1.25 = £937.50$. If these were all chocolate biscuits, the calculation would be $700 \times £1.50 = £1050$. Hence the difference would be $£1050 - £937.50 = £112.50$

L. Ireland 11/06

Note: This booklet is based upon one from Hull University Study Advice Service