National
Qualifications
2026

X844/76/11

Applications of Mathematics
Data booklet

FRIDAY, 15 MAY
1:00 PM – 3:05 PM

Pre-release material

This booklet will be issued to centres in advance of the date of examination.

Candidates will be issued with a clean copy of this booklet. Copies will be issued at the start of the examination session and collected at the end of the session. Candidates must not take their own copies of this booklet into the examination.

An electronic version of this booklet will also be available during the examination.

Centres should ensure that candidates are familiarised with any contexts and information contained in this booklet in preparation for the examination.

Some examination questions will be based on this material.

This booklet contains a set of four documents:

1. Deductions from salaries
2. Mortgage products and affordability
3. Honeybees
4. Some helpful R commands

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1. Deductions from salaries

Scottish tax bands 2025/26

Band	Taxable income	Scottish tax rate
Personal Allowance	Up to £12,570	0%
Starter rate	£12,570 – £15,397	19%
Basic rate	£15,397 – £27,491	20%
Intermediate rate	£27,491 – £43,662	21%
Higher rate	£43,662 – £75,000	42%
Advanced rate	£75,000 – £125,140	45%
Top rate	Over £125,140	48%

National Insurance contributions

You begin paying National Insurance once you earn more than £1048 a month (this is the amount for the 2025/26 tax year).

For payslips dated between 6 April 2025 and 5 April 2026, you pay 8% of your monthly earnings between £1048 and £4189; 2% of your monthly earnings above £4189.

National Insurance is calculated on a person's salary **before deductions** such as pension contributions.

2. Mortgage products and affordability

If you take out a mortgage, lenders consider the loan-to-value (LTV) ratio. This ratio is used in mortgage lending to calculate the amount of credit that can be offered to a borrower.

LTV is an assessment of risk that financial institutions examine before approving a mortgage. Typically, loan assessments with high LTV ratios are considered higher-risk loans. Consequently, if the mortgage is approved, the loan will have a higher interest rate. Mortgages are more expensive for borrowers with a higher LTV due to these higher interest rates.

A lower LTV is preferred by lenders, as it represents a lower-risk loan. However, borrowers must pay a larger deposit when taking out the mortgage. Most lenders offer the lowest possible interest rate when the LTV ratio is at or below 60%.

If you choose a fixed rate mortgage, once it expires, you can remortgage and hopefully get a lower rate if the LTV has improved which will reduce the monthly payments.

Borrowers and lenders must also consider affordability when arranging a mortgage. It is generally recommended that the 28/36 rule is followed. This means that:

- no more than 28% of taxable monthly income should be spent on housing loan costs, primarily mortgage payments
- the total monthly debt repayments of a household should not exceed 36% of taxable monthly income — this also includes credit card debt and other loan repayments alongside mortgage payments.

If a borrower's debt repayments are likely to exceed the above percentages, a lender may reject the application due to affordability concerns.

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3. Honeybees

A beehive is an enclosure for a honeybee colony. In traditional beehives, no internal structures were provided and honeybees created their own honeycomb. Modern beehives have internal structures which are designed to encourage honeybees to construct honeycomb on frames which can be easily removed to extract honey.

Most commercial beekeepers won't allow a single colony to have more than 100 000 honeybees as it is easier to control smaller colonies.

The average honeybee lives for 6 weeks and will collect nectar within a 3-kilometre radius but may travel up to 10 kilometres when hungry.

4. Some helpful R commands

Entering data to R Studio

To read in data from an Excel csv file called *excel_data.csv* to R Studio and name it `mydata`, first use the drop down menus in R Studio **Session > Set Working Directory > Choose Directory** to indicate the location of *excel_data.csv* on your computer. The following code will then read the data into R Studio:

```
mydata<-read.csv("excel_data.csv")
```

`attach(mydata)` — this adds the variable names

At the end of the analysis remember to use `detach(mydata)` to disassociate the variable names.

(a) Graphics

<u>If you have the numeric variables X and Y:</u>

`hist(X, main= "Title",xlab="x-axis label",ylab="Frequency")` — this produces a histogram of the variable named X, it adds a title and axis labels

`boxplot(Y, main="Title", ylab="y-axis label")` — produces a boxplot of the numerical variable Y

`boxplot(X,Y, main="Title", xlab="x-axis label", ylab="y-axis label", names=c("X","Y"))` — produces a comparative boxplot of the numerical variables X and Y

`plot(X,Y, main="Scatterplot of Y on X",xlab="x-axis label",ylab="y-axis label")` — produces a scatterplot of Y on X

<u>If you have the categorical variable X:</u>

`table(X)` — computes the number of observations in each level of the categorical variable X

`pie(table(X), main="Title")` — this gives a simple pie chart of the categories in variable X with the specified title

`barplot(table(X), main="Title", xlab="x-axis label", ylab="Frequency")` — this gives a bar chart of the categorical variable X with the required title and axis labels

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4. (continued)

(b) Descriptive Statistics

`mean(X)` — computes the mean of the numerical variable X

`sd(X)` — computes the standard deviation of the numerical variable X

`summary(X)` — computes the mean, median, minimum, maximum and upper and lower quartiles of the numerical variable X

`IQR(X)` — computes the interquartile range of the numerical variable X

`prop.table(table(X))` — returns the proportion of observations in each level of the categorical variable X

`prop.table(table(X))*100` — returns the percentage of observations in each level of the categorical variable X

`table(X,Y)` — produces a cross-tabulation between the two categorical variables X and Y

(c) Correlation and Regression

`cor.test(X,Y)` — computes the correlation between X and Y and performs a test of the null hypothesis of zero correlation

`lm(Y~X)` — fits a linear regression line to the data (lm command stands for linear model)

`abline(lm(Y~X))` — adds the least squares linear regression line to an existing scatterplot of Y on X

`summary(lm(Y~X))` — displays the coefficient of determination (R-squared)

<u>To predict with your Linear Model:</u>

`predict(lm(Y ~ X), newdata=data.frame(X=C),interval = "pred")` — computes the predicted value of Y when X=C along with a 95% prediction interval

(d) Hypothesis Testing

`t.test(X,Y)` — performs a two-sample t-test between X and Y

`t.test(X,Y,paired=TRUE)` — performs a paired t-test between X and Y

`prop.test(x = c(a, b), n = c(n1, n2))` — performs a two-sample test for equality of proportions

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