National
Qualifications
2025

X844/76/11

Applications of Mathematics
Data booklet

FRIDAY, 16 MAY

9:30 AM – 11:35 AM

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.

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. Lifetime ISA
3. Feeding chicks
4. Some helpful R commands

1. Deductions from salaries

Scottish tax bands 2024/25

Band	Taxable income	Scottish tax rate
Personal Allowance	Up to £12,570	0%
Starter rate	£12,570 — £14,876	19%
Basic rate	£14,876 — £26,561	20%
Intermediate rate	£26,561 — £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 2024/25 tax year).

For payslips dated between 6 April 2024 and 5 April 2025, 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. Lifetime ISA

You can use a Lifetime ISA (Individual Savings Account) to buy your first home or save for later life. You must be 18 or over but under 40 to open a Lifetime ISA.

You must make your first deposit into your ISA before your 40th birthday and can make further deposits until the day before your 50th birthday.

You can save up to £4000 a year as a lump sum or by putting in cash when you can. The government will add a 25% bonus to your savings, up to a maximum of £1000 per year.

The bonus is paid every month, on new deposits that have been made.

Once in your account the bonus becomes part of your savings and interest can be applied.

When you turn 50, you will not be able to make any further deposits into your Lifetime ISA or earn any further bonuses. Your account will stay open, and your savings will still earn interest.

You can withdraw money from your ISA if you are:

- buying your first home
- aged 60 or over
- terminally ill, with less than 12 months to live.

You will pay a withdrawal charge of 25% if you withdraw cash or assets for any other reason (also known as making an 'unauthorised withdrawal'). This charge is deducted from the amount withdrawn. This recovers the government bonus you received on your original deposits.

Adapted from: www.gov.uk/lifetime-isa

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3. Feeding chicks

One of the most important considerations for poultry owners is picking the right type of feed. When feeding freshly hatched chicks, it might be tempting to save money by feeding them the same feed given to adult birds.

However, a specially formulated diet that will help them grow at this early stage of life is required. Specialised chick feed is recommended from birth up until six weeks old. This type of feed has between 20% and 24% protein to boost their metabolism and enable them to increase their mass appropriately and feather out rapidly.

At three weeks old, chicks typically weigh 200 grams. If a chick has not been fed specialised chick feed, they are likely to experience stunted growth indicated by a mass of under 200 grams.

After six weeks, the chicks can slowly transition to another type of feed.

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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(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)

To predict with your Linear Model:

`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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