SAMPLE PAGES

Edexcel GCSE Modular Mathematics Stage 1 Examples and Practice Higher

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UNCORRECTED PROOFS

These pages from the Edexcel GCSE Modular Maths Higher Stage 1 Examples and Practice book are uncorrected and may contain minor mathematical or typographical errors.

Heinemann

Tel: 01865 888084 www.heinemann.co.uk

About this book

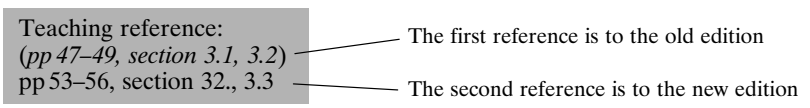
This *Practice and Revision* book is designed to help you get the best possible grade in your Edexcel GCSE maths examination. The authors are senior examiners and coursework moderators and have a good understanding of Edexcel's requirements.

Higher Stage 1 Practice and Revision covers all the topics that will be tested in your Foundation Stage 1 examination. You can use this book to revise in the run up to your exam, or you can use it throughout the course, alongside the *Edexcel GCSE Maths* Higher core textbook.

Helping you prepare for your exam

To help you prepare, each topic offers:

- **Key points** to reinforce the key teaching concepts
- **Teaching references** showing you where the relevant material is covered in both the old and new editions of the *Edexcel GCSE Maths* Higher core textbook. These references show you where to find full explanations of concepts, and additional worked examples e.g.



  Where material is new to the new specification there is no reference to the old edition textbooks.
- **Worked examples** showing you how to tackle a problem and lay out your answer
- **Exercises** with references showing you which exercises in the *Edexcel GCSE Maths* Higher core textbook contain similar questions. The first reference, in brackets and italic, is to the old edition. The second reference is to the new edition
- **A summary of key points** so you can check that have covered all the key concepts

Which edition am I using?

The new editions of the *Edexcel GCSE Maths* core textbooks have yellow cover flashes saying "ideal for the 2001 specification". You can also use the old edition (no yellow cover flash) to help you prepare for your Stage 1 exam.

Exam practice and using the answers

An exam style practice paper at the back of the book will help you make sure that you are totally exam-ready. This paper is exactly the same length and standard as your actual Stage 1 exam.

Answers to all the questions are provided at the back of the book. Once you have completed an exercise you can use the answers to check whether you have made any mistakes. You need to show full working in your exam – it isn't enough to write down the answer.

Contents – Higher Stage 1

1 Standard form, powers, fractions and decimals

1.1 Prime factor decomposition, HCF and LCM

Teaching reference:
(*pp 2–5, sections 1.2, 1.3, 1.4*)
pp 2–4, sections 1.2, 1.3, 1.4

Example 1

Express 1008 as the product of its prime factors.

$$1008$$
$$8 \times 126$$
$$2 \times 2 \times 2 \times 2 \times 63$$
$$2^3 \times 2 \times 7 \times 9$$
$$= 2^4 \times 3^2 \times 7$$

The number is even so 2 is a factor:

$1008 = 2 \times 504$

If you spot a larger factor then use it to speed up the process.

Prime factor decomposition is a good way of finding the HCF (highest common factor) and LCM (lowest common multiple).

Example 2

Find the HCF and LCM for 24, 78 and 182.

First factorize:

$24 = 2 \times 2 \times 2 \times 3$

$78 = 2 \times 3 \times 13$ HCF $= 6$ (the common factors are 2 and 3)

$282 = 2 \times 3 \times 47$

The LCM requires *all* of the factors for each number *but* does not need to repeat them if they are already included from one of the other numbers, i.e. only three of the 2s are needed.

$\text{LCM} = 2 \times 2 \times 2 \times 3 \times 13 \times 47 = 14\,664$

Exercise 1A **Links (*1B*, *1C*, *1D*) 1B, 1C, 1D**

1 Write the following numbers in prime factor form:

(a)	36	**(b)**	200	**(c)**	75	**(d)**	675	**(e)**	196
(f)	108	**(g)**	572	**(h)**	784	**(i)**	968	**(j)**	2016
(k)	5929	**(l)**	2156	**(m)**	5929	**(n)**	8000	**(o)**	7600

2 Find the HCF and LCM of the following sets of numbers:

(a) 24, 36 **(b)** 15, 75
(c) 20, 45 **(d)** 27, 90
(e) 140, 210 **(f)** 42, 35
(g) 15, 35, 60 **(h)** 28, 70, 98
(i) 42, 63, 105 **(j)** 16, 32, 48

1.2 Index laws with positive integer powers

Teaching reference:
(*pp 10–12, section 1.7; pp 356–359, section 20.2*)
pp 6–10, sections 1.6, 1.7

- $a^x \times a^y = a^{x+y}$
- $a^x \div a^y = a^{x-y}$

Example 3

Simplify
(a) $a^7 \times a^4$
(b) $a^6 \div a^4$

(a) $a^7 \times a^4 = a^{7+4} = a^{11}$
(b) $a^6 \div a^4 = a^{6-4} = a^2$

Exercise 1B — Links (*1G*, *20A*, *20B*) 1F, 1G

1 Simplify, then use your calculator to evaluate

(a) $2^7 \times 2^3$ **(b)** $3^8 \times 3^4$
(c) $5^2 \times 5^6$ **(d)** $4^3 \times 4^2 \times 4^2$
(e) $2^3 \times 2^4 \times 2^5$ **(f)** $3^8 \div 3^2$
(g) $7^9 \div 7^6$ **(h)** $6^4 \div 6^3$
(i) $11^{16} \div 11^{12}$ **(j)** $4^5 \div 4^5$

2 Simplify these algebraic expressions:

(a) $x^2 \times x^3$ **(b)** $x^4 \times x^5$
(c) $y^7 \div y^2$ **(d)** $y^9 \div y^3$
(e) $2x^3 \times 3x^4$ **(f)** $3y^2 \times 4y^5$
(g) $6y^8 \div 3y^6$ **(h)** $12k^4 \div 3k^3$
(i) $xy^2 \times x^2y^3$ **(j)** $a^3b^2 \times ab$
(k) $p^4q^3 \times p^2q$ **(l)** $\dfrac{x^2y^5}{xy^2}$
(m) $\dfrac{p^4q^3}{p^2q^3}$ **(n)** $\dfrac{6a^5b^3}{3ab}$
(o) $\dfrac{2a^4b \times 3ab^5}{6a^2b^2}$ **(p)** $\dfrac{4a^3b^2 \times 3a^2b^3}{6a^4b^4}$
(q) $(x+y)^3 \times (x+y)^2$ **(r)** $\dfrac{(2x+y)^5}{(2x+y)^3}$

1.3 Standard form

Teaching reference:
(*pp 110–113, section 5.10*)
pp 114–116, section 5.10

■ **A number in standard form is $A \times 10^n$ where $0 < A < 10$ and n is an integer.**

Example 4

Write in standard form

(a) 236 000 and (b) 0.010 63.

Write as a decimal number

(c) 2.01×10^7 and (d) 5.7×10^{-3}.

(a) $236\,000 = 2\overbrace{36000}^{\rightarrow}{}_{5} = 2.36 \times 10^5$

(b) $0.010\,63 = 0.\overbrace{010}^{\leftarrow}{}_{-2}63 = 1.063 \times 10^{-2}$

(c) 2.01×10^7

Build on 7 decimal places from the decimal point:

$2\underbrace{0100000}_{7} = 20\,100\,000$

(d) 5.7×10^{-3}

Work back 3 decimal places from the decimal point:

$\underbrace{005}_{-3}\ 7 = 0.0057$

Exercise 1C **Links (*5N, 5O, 5P*) 5O, 5P**

1 Write the following numbers in standard form:
(a) 30 000, 400, 0.006, 0.000 08.
(b) 2170, 63, 71 000, 0.761.
(c) 203, 50 030, 0.009 01, 0.0101.

2 Write the following numbers as decimal numbers:

(a) 3.1×10^2	**(b)** 2.6×10^4
(c) 8.9×10^1	**(d)** 6.7×10^{-1}
(e) 1.57×10^{-3}	**(f)** 2.04×10^{-4}
(g) 1.003×10^2	**(h)** 3.060×10^1
(i) 7.0103×10^{-3}	**(j)** 4.079×10^{-2}

3 Write your answers to question **2** to 1 significant figure.

1.4 Multiply and divide fractions

NB
There is no link for this section in Higher – this is not an omission.

Example 5

Work out $1\frac{7}{9} \times 3\frac{3}{8}$.

$\frac{\overset{2}{\cancel{16}}}{\underset{1}{\cancel{9}}} \times \frac{\overset{3}{\cancel{27}}}{\underset{1}{\cancel{8}}} = 6$ Step 1: change to improper fractions.
Step 2: cancel where possible.

Example 6

Work out $3\frac{5}{7} \div 5\frac{5}{21}$.

$\frac{26}{7} \div \frac{110}{21}$

$\frac{\cancel{26}^{13}}{\cancel{7}_{1}} \times \frac{\cancel{21}^{3}}{\cancel{110}_{55}} = \frac{39}{55}$

Step 1: change to improper fractions.
Step 2: inverse of $\div$ is $\times$.
inverse of $\frac{110}{21}$ is $\frac{21}{110}$.
Step 3: cancel where possible.

Exercise 1D

In the following questions, simplify as fully as possible:

1 $3\frac{3}{4} \times 2\frac{1}{5}$
2 $8\frac{1}{3} \times 4\frac{1}{5}$
3 $5\frac{3}{5} \times 1\frac{3}{7}$
4 $3\frac{1}{5} \times 1\frac{1}{8}$
5 $1\frac{2}{7} \times 2\frac{2}{3}$
6 $2\frac{5}{18} \times 4\frac{1}{2}$
7 $4\frac{11}{16} \times 5\frac{3}{25}$
8 $1\frac{1}{2} \times 1\frac{1}{4} \times 1\frac{3}{5}$
9 $2\frac{2}{3} \times 1\frac{11}{16} \times 1\frac{5}{9}$
10 $2\frac{2}{3}(3\frac{5}{8} - 2\frac{1}{5})$
11 $1\frac{3}{5} \div \frac{4}{5}$
12 $3\frac{6}{7} \div 2\frac{4}{7}$
13 $4\frac{4}{5} \div 2\frac{2}{15}$
14 $1\frac{9}{16} \div 2\frac{1}{2}$
15 $9\frac{4}{5} \div \frac{7}{20}$
16 $1\frac{6}{7} \div 4\frac{16}{35}$
17 $4\frac{5}{7} \div 2\frac{1}{5}$
18 $7\frac{1}{4} \div 8\frac{2}{7}$

1.5 Fractions and decimals

Teaching reference:
(*pp 417–420, sections 23.1, 23.2*)
pp 468–471, sections 2.3.1, 2.3.2

Fractions can be changed to decimals by doing the division.
If the denominator only has 2s and 5s when in prime factor form the decimal terminates. Otherwise the decimal is recurring.

Example 7

Turn these fractions into decimals:
(a) $\frac{7}{160}$ (b) $\frac{5}{13}$

(a) $7 \div 160$
$= 0.043\,75$

$160 = 2^5 \times 5$
The decimal terminates.

(b) $5 \div 13$
$= 0.\dot{3}84\,615\dot{}\ldots$

The decimal recurs.

Recurring decimals can be converted to fractions.

Example 8

Turn $0.\dot{3}6\dot{1}\ldots$ into a fraction.

$s = 0.361\,361\,\dot{3}6\dot{1}\ldots$
$1000s = 361.361\,361\ldots$
Subtract s: $999s = 361$
$s = \frac{361}{999}$

$\times 1000$ because the decimal has 3 recurring digits.

Exercise 1E **Links (*23A*, *23B*) 23A, 23B**

1 Use a calculator to convert each of the following fractions to a decimal:

(a) $\frac{3}{8}$ **(b)** $\frac{7}{64}$ **(c)** $\frac{17}{25}$ **(d)** $\frac{97}{125}$

(e) $\frac{217}{625}$ **(f)** $\frac{7}{24}$ **(g)** $\frac{8}{33}$ **(h)** $\frac{7}{13}$

(i) $\frac{3}{22}$ **(j)** $\frac{77}{121}$ **(k)** $\frac{271}{999}$ **(l)** $\frac{14}{39}$

2 Find the fraction which is equal to the recurring decimals. Simplify as fully as possible.

(a) $0.1\dot{1}\ldots$ **(b)** $0.6\dot{3}\dot{6}\dot{3}\ldots$

(c) $0.3\dot{1}\ldots$ **(d)** $0.216\,\dot{2}1\dot{6}\ldots$

(e) $0.45\dot{4}\dot{5}\ldots$ **(f)** $0.\dot{1}31\dot{4}\ldots$

(g) $0.147\,\dot{1}4\dot{7}\ldots$ **(h)** $0.\dot{7}40\,\dot{7}4\ldots$

(i) $0.642\,3\dot{2}\dot{3}\ldots$ **(j)** $0.561\dot{1}\ldots$

1.6 Estimating and checking

Teaching reference: (*pp 219–221, section 12.4*) pp 260–262, section 12.4

It is always useful to have a rough idea of the answer to a calculation. Sometimes you do not need to know the exact answer. Other times you may want to check whether the exact answer given is actually likely to be correct. An estimate does that for you.

Example 9

A tin of emulsion paint says that it covers 19.6 m^2. The room to be done has a perimeter of 13.2 m and a height of 2.8 m. Is one tin of paint enough?

$$\text{Number of tins required} = \frac{\text{Area}}{19.6} = \frac{13.2 \times 2.8}{19.6}$$

$$\simeq \frac{13 \times 3}{20} = \frac{39}{20} \simeq 2$$

As you do not paint the door or windows 2 tins should be enough.

Example 10

You are on the phone to your stockbroker to sell 623 shares. He says they sell at £7.92 per share.

The income will be $623 \times$ £7.92.

This is roughly $600 \times 8 =$ £4800

- 1 significant figure is accurate enough for most estimating.

However, if the question was 'Will this raise £5000?' you could do $625 \times 8 =$ £5000 in your head as a better estimate.

You have increased the number of shares and the price.
The answer to the question is 'No'.

Two useful facts when estimating

- When multiplying by a positive number less than 1 the answer will be smaller.
- When dividing by a positive number less than one the answer will be bigger.

Example 11

$729 \times 0.93 = 736.56$ Is this correct?

Answer: It must be wrong

$729 \times 0.93 < 729$

Actually the number 792 was keyed into the calculator by mistake. This type of error is quite common.

Example 12

Estimate $637 \div 0.87$

Firstly, you know the answer must be greater than 637.

For your estimate you can use $630 \div 0.9$ (choosing numbers you can do in your head)

$\simeq 700$

(You can also deduce that the exact answer is more than 700 because using 630 instead of 637 makes a smaller answer, and using 0.9 instead of 0.87 also makes a smaller answer.)

Exercise 1F — Links (*12D*) 12D

1 Use 1 s.f. approximations to estimate:

(a) 37.62×0.315 **(b)** 0.76×827

(c) 911.7×0.026 **(d)** 5.309×0.689

(e) $15.72 \div 0.513$ **(f)** $8.37 \div 0.387$

(g) $1.209 \div 0.091$ **(h)** $721 \div 0.068$

2 Without a calculator, work out:

(a) $\dfrac{15 \times 4}{0.2}$ **(b)** $\dfrac{270}{0.03}$ **(c)** $\dfrac{29.1 + 6.9}{0.6}$

(d) 0.2×60 **(e)** 0.3×0.6 **(f)** 25×0.6

3 Use suitable approximations to estimate the value of the following:

(a) $\dfrac{28.32 \times 71.9}{5.603}$ **(b)** $\dfrac{\sqrt{17.3} \times 34.1}{8.26}$

(c) $(3.19)^2 \times \sqrt{27.9}$ **(d)** $\dfrac{72.3 \times 29.08}{51.2 - 49.3}$

(e) $\dfrac{18.2}{0.35}$ **(f)** $\dfrac{58.2}{0.8}$

4 Estimate the value of the following. Say whether your estimate is bigger or smaller than the exact answer.

(a) $\dfrac{17.6 \times \sqrt{19.32 - 2.19}}{0.19}$ **(b)** $\dfrac{(2.37 - 0.52)^3}{\sqrt{8.231}}$

(c) $\sqrt{15.3} - (2.1 \times 0.49)$ **(d)** $\dfrac{(7.836)^2 - (2.092)^3}{\sqrt{7.63 + 18.19}}$

5 Estimate how long it takes to travel 423 km at 0.72 km/min.

6 The value of 217 shares at 43p each.

7 The cost of 2327 units of electricity at 7.19p per unit

8 Estimate how long it takes to fill a 100 litre tank at 0.62 litres per second.

9 Estimate how many seconds there are in a week.

10 A plant grows, on average, 0.013 mm/minute.
Estimate: **(i)** how much if grows in an hour.
(ii) how much it grows in a day (24 hours)

Summary of key points

- $a^x \times a^y = a^{x+y}$
- $a^x \div a^y = a^{x-y}$
- **A number in standard form is $A \times 10^n$ where $0 < A < 10$ and n is an integer.**
- **1 significant figure is accurate enough for most estimating**
- **When multiplying by a positive number less than 1 the answer will be smaller.**
- **When dividing by a positive number less than 1 the answer will be bigger.**