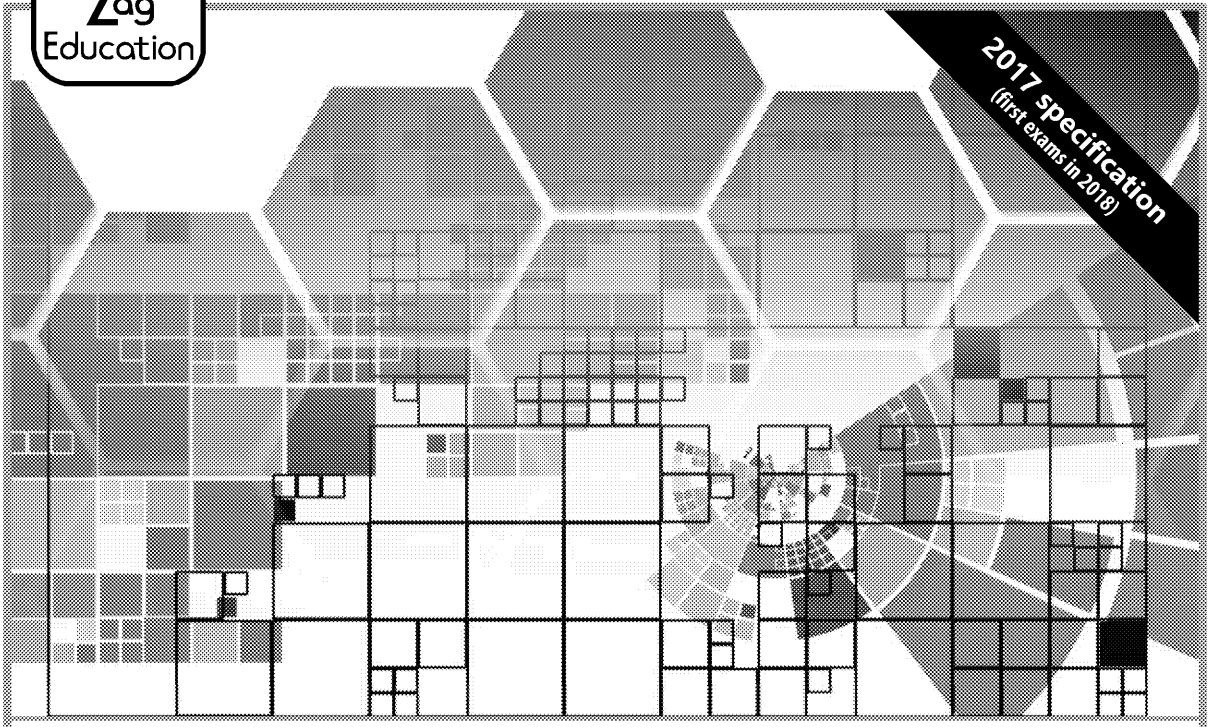
Zig Zag Education

Maths **AS / A Level | Edexcel | 8MA0/9MA0**



Topic Tests: Fundamentals Tests – Set B

For AS / A Level Year 1 Edexcel Statistics and Mechanics

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Contents

Teacher's Introduction

Content

This pack contains 9 fundamental level topic tests and solutions for the Edexcel Applied Mathematics AS / Year 1 A Level content.

These topic tests have been **fully cross-referenced** to the Pearson, Hodder and Collins textbooks for your convenience (see reference sheet on page 2). Each test has been designed to reflect the specification fully.

About the fundamentals tests

These **fundamentals** tests focus on isolating and testing the core skills of each topic. The questions are designed to use simple numbers and contexts **so that students can show what they can do,** and to allow them to easily identify any weaknesses.

Each test comes with fully worked solutions, containing helpful tips, hints, and technique boxes for students who are struggling on a particular question.

Suggested use of the A and B tests

Each test in Set A has a corresponding test in Set B that features the same styles of questions but with different numbers. This allows for a variety of **flexible** uses including:

- **Test → Homework**: Students use test B as a homework to consolidate on areas of weakness identified from completing test A under test conditions in class.
- **Homework → Test**: Students revise as homework using test A before doing test B in class under test conditions.
- **Test → Classwork**: Students work through test B with teacher input to consolidate on areas of weakness identified from completing test A under test conditions in class.
- **Classwork → Test**: Students work through test A with teacher input, before checking their learning by completing test B under test conditions.

Timings

The recommended times for students to complete each test are given at the top of individual tests. Suggested times for our entire range of topic tests are also compiled in a table on the timings sheet for convenience (see page 3). For these fundamentals tests, the relevant times are the first two listed under each topic.

Calculator use

The effective use of a calculator is one of the objectives of the new specification and is encouraged for all the enclosed tests. In particular, students should be comfortable using the statistical functions on their calculator.

The large data set

As part of their assessment, students will be tested on data from the **large data set** provided by Edexcel. This data set contains meteorological data from various locations and time periods. Familiarity with the large data set is assumed in these topic tests, but a copy of it is not needed to take the tests themselves.

Also available from ZigZag Education

For students who are ready to go beyond the fundamentals, a complete set of **challenge** tests are available. 50% of the marks in these tests come from concepts covered in the fundamentals tests in order to reinforce learning and boost students' confidence, while the other 50% increases in difficulty and progresses the concepts covered.

To prepare students for the exam itself, our **expert** tests contain 25% repeated marks from the fundamentals and challenge tests, and 75% exam-style material with compound/multistep questions.

Cross-referencing Grid

Topic	Edexcel spec. points	Sub-topics	Edexcel Pearson textbook [ISBN: 9781292232539]
Data Collection	1.1	Populations, samples, sampling, non-random sampling, types of data, the large data set	1
Measures of Location and Spread	2.3	Measures of central tendency, other measures of location, measures of spread, variance and standard deviation, *coding (Edexcel only)*	2
Representations of Data & Correlation	2.1 – 2.2, 2.4	Outliers, box plots, cumulative frequency, histograms, comparing data, correlation, linear regression	3 - 4
Probability	3.1	Calculations, mutually exclusive and independent events, Venn diagrams, tree diagrams	5
Statistical distributions	4.1	Probability distributions, binomial distribution, cumulative probabilities	6
Hypothesis testing	5.1 – 5.2	Hypothesis testing, finding critical values, one-tailed tests, two-tailed tests	7
Constant Acceleration	7.1 – 7.3, 8.3	Displacement-time graphs, velocity-time graphs, constant acceleration formulae, vertical motion under gravity	9
Modelling in Mechanics & Forces and Motion	6.1, 8.1 – 8.4	Force diagrams, forces as vectors, forces and acceleration, motion in 2 dimensions, connected particles, pulleys	8, 10
Variable Acceleration	7.4	Functions of time, using differentiation, maxima and minima problems, using integration, constant acceleration formulae	11

Timings Sheet

For the **fundamentals** tests, refer to the tests marked X.1a and X.1b.
For the **challenge** tests, refer to the tests marked X.2a and X.2b.
For the **expert** tests, refer to the tests marked X.3a and X.3b.

Topic test reference	Recommended time (minutes)	Topic test reference	Recommended time (minutes)	
Data Collection		**Probability**		
1.1.a	12	4.1a	30	
1.1b	12	4.1b	30	
1.2a	9	4.2a	26	
1.2b	10	4.2b	26	
1.3a	1	4.3a	32	
1.3b	12	4.3b	32	
Measures of Location and Spread		**Statistical Distributions**		**M**
2.1a	28	5.1a	24	
2.1b	28	5.1b	24	
2.2a	31	5.2a	24	
2.2b	30	5.2b	24	
2.3a	34	5.3a	31	
2.3b	32	5.3b	31	
Representations of Data & Correlation		**Hypothesis Testing**		
3.1a	16	6.1a	17	
3.1b	16	6.1b	17	
3.2a	19	6.2a	17	
3.2b	19	6.2b	17	
3.3a	22	6.3a	17	
3.3b	22	6.3b	17	

Variable Acceleration – Test B (27 mins)

Subtopics: Functions of time, using differentiation, maxima and minima proi constant acceleration formulae

1. A particle is moving in a straight line. Its velocity, v m s^{-1}, at time t se $v = 8t + 2t^2 - t^3$ for $0 \le t \le 4$
   Find the particle's **velocity** when
   a) $t = 1$
   b) $t = 2$
   c) $t = 4$

2. A particle moves in a straight line. Its veloci , at ime t is given by down an expression for the particle' ce le ation, a, at time t.

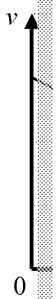
3. An object moves al s gnt line. Its velocity, v, at time t is given displac t . Find an expression for the **displacement** of the

4. Explain whether or not each of the following expressions for displacem an object that is travelling with **variable acceleration**:
   a) $s = -3$
   b) $s = t^3 + t^2$
   c) $s = t^2 - t^{-2}$

5. A lorry is moving in a straight line. The velocity, v m s^{-1}, of the lorry $v = 2t^2 + 2t - 24$ for $0 \le t \le 10$
   a) Find the **initial velocity** of the lorry.
   b) At what time is the lorry instantaneously **at rest**?
   c) Find the time at which the lorry has velocity –20 m s^{-1}

6. A particle starts at a point P and moves along a straight line. Its displacement from P at time t, denoted by s, is given by $s = 12t - 2t^2$ for $0 \le t \le 6$, sketched in the graph to the right.
   Use calculus to find the **maximum displacement** of the particle away from P. **[5]**

7. A particle travels in a straight line. At time t seconds its velocity, v m s^{-1}, is given by $v = t^3 - 3t + 4$ for $0 \le t \le 2$, s ed in the graph to the right.
   a) Without using the sketch, show that the particle's **lowest velocity** occurs when $t = 1$ **[5]**
   b) What is the particle's velocity at that time? **[1]**



8. A particle moves in a straight line. Its velocity, v m s^{-1}, at time t secon $0 \le t \le 2$. During this time the velocity is never negative.
   Find the **total distance travelled** by the particle between $t = 0$ and $t =$

9. Mei drops an apple from her window. The apple's distance from the gr after Mei drops it is modelled by the equation $D = 5 - 5t^2$. For what val

Preview of Questions Ends Here

Solutions to Statistical Distributions – Test B

1. a) No. A variable must take only certain numerical values to be modelled as a dis
take any value, so is continuous, not discrete. **B1**

b) Yes, because fair dice can take any value from the set of values $\{1, 2, 3, 4\}$. **B1**

c) No. The number of minutes is the same in every hour, so is not random or a variable. **B1**

d) Yes, as number of birds can only take integer values. **B1**

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2. $\frac{2}{10}+\frac{1}{10}+\frac{1}{10}+\frac{1}{10}+\frac{2}{10}+y=1$ **M1**

$\frac{7}{10}+y=1$

$y=1-\frac{7}{10}=\frac{3}{10}$ or 0.3 **A1**

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3. The dic e fair, i.e. the probability of each result must be the same **B1**

4. a) $P(X=3)=\frac{1}{5}$ or 0.2 **B1**

b) $P(X\le 2)=\frac{2}{5}$ or 0.4 **B1**

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5. $k+2k=1$ **M1**

$3k=1,\ \therefore k=\frac{1}{3}$ **A1**

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6. a) $P(X=x)=\frac{1}{4}$ **B1**

$x=1, 2, 3, 4$ **B1**

b)

x	1	2	3	4
$P(X=x)$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$

B1

7. There are a fixed number of trials, n **B1**
There are only two possible outcomes (e.g. success and failure) **B1**
There is a fixed probability of success, p **B1**
Trials are independent **B1**

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8. a) **Method 1:** using binomial probability functi formula or
$x=6, n=25, p=0.31$ **M1**
$P(X=6)=0.136308...=0.$ **A1**

Metho 2: binomial probability formula $P(X=r)=\binom{n}{r}p^r(1-p)^{n-r}$
$r=$ 25, $p=0.31$
$P(X=6)=\binom{25}{6}\times 0.31^6\times(1-0.31)^{25-6}$ **M1**
$=0.136308...=0.136$ (3 s.f.) **A1**

b) Using binomial cumulative probability function on calculator

$x = 5, n = 25, p = 0.31$ **M1**

$\mathrm{P}(X \le 5) = 0.165586... = 0.166$ (3 s.f.) **A1**

c) $\mathrm{P}(X \ge 8) = 1 - \mathrm{P}(X \le 7)$ **M1**

$x = 7, n = 25, p = 0.31$

$\mathrm{P}(X \le 7) = 0.468117...$ [using binomial cumulative probability function on cal

$\therefore \mathrm{P}(X \ge 8) = 1 - 0.468117... = 0.531882... = 0.532$ (3 s.f.) **A1**

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d) $n = 25, p = 0.31$

x	p
0	$9.35895... \times 10^{-5}$
1	$1.14477... \times 10^{-3}$
2	$6.81204... \times 10^{-3}$
3	0.026332…
…	…

M1

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$0.0\ldots < 0.05 < 0.0745682\ldots$

$\therefore k = 3$ **A1**

9. a) **Method 1:** using binomial probability function on calculator

$x = 6, n = 35, p = 0.25$ **M1**

$\mathrm{P}(X = 6) = 0.0943578... = 0.0944$ (3 s.f.) **A1**

Method 2: using binomial probability formula $\mathrm{P}(X = r) = \binom{n}{r} p^r (1-p)^{n-r}$

$\mathrm{P}(X = 6) = \binom{35}{6} \times 0.25^6 \times (1-0.25)^{35-6}$ **M1**

$= 0.0943578... = 0.0944$ (3 s.f.) **A1**

b) $x = 6, n = 35, p = 0.25$ **M1**

$\mathrm{P}(X \le 6) = 0.191978... = 0.192$ (3 s.f.) [using binomial cumulative probability

c) $\mathrm{P}(X > 7) = 1 - \mathrm{P}(X \le 7)$ **M1**

$\mathrm{P}(X \le 7) = 0.322281...$ [using cumulative probability function on calculator] M

$\therefore \mathrm{P}(X > 7) = 1 - 0.322281... = 0.677718... = 0.678$ (3 s.f.) **A1**

Preview of Answers Ends Here