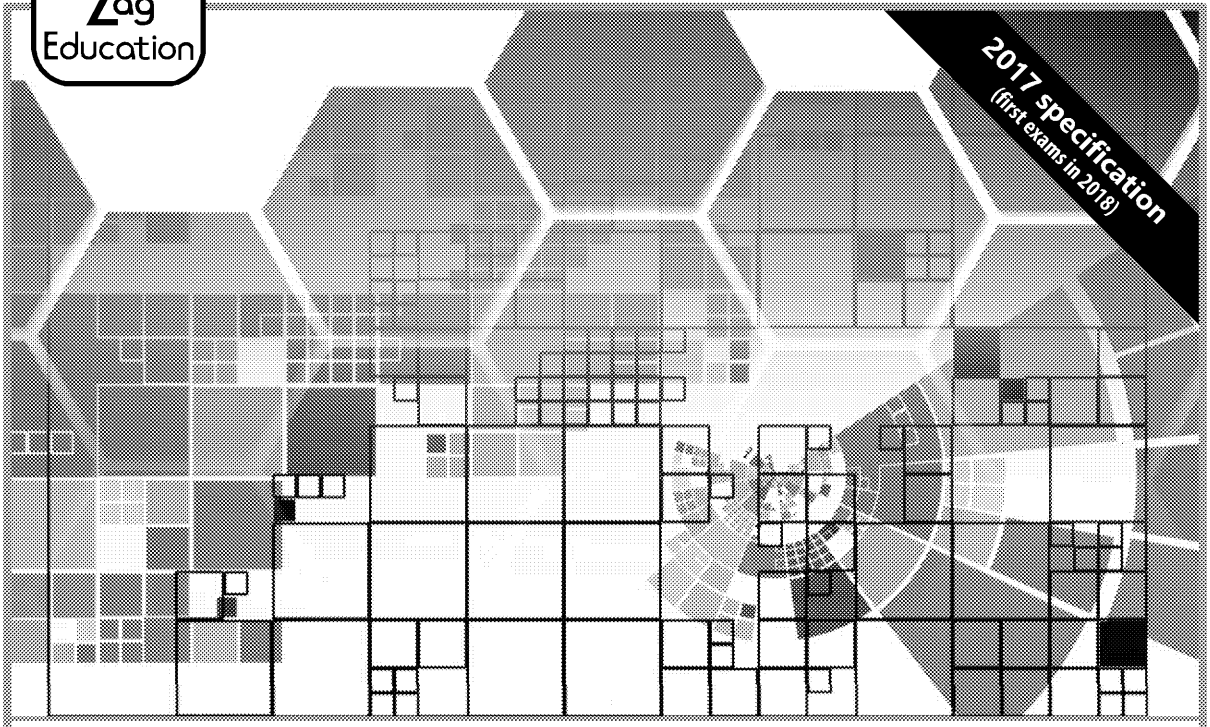
Zig Zag Education

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



Topic Tests: Challenge Tests – Set A

For AS / A Level Year 1 Edexcel Statistics and Mechanics

Update v1.1 April 2018

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Contents

Teacher's Introduction

Content

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

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

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 challenge tests

These **challenge** tests have been designed to **stretch and challenge** your students. 50% of the marks come from questions similar in style to our fundamentals tests. These questions isolate and test the core skills in each topic. The other 50% of the marks come from questions of increased difficulty that progress and start to combine the concepts in the topic.

Timings

The recommended times for students to complete each test are given at the top of individual tests.

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

The perfect starting point for students of all abilities are our **fundamentals** tests. These isolate and test the core skills in each topic so that your students can show what they can do. They get a confidence boost and you can see at a glance where each student's weaknesses lie.

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.

For each collection of Set A tests we also offer a corresponding collection of Set B duplicated tests with the same styles of questions but 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.

For total flexibility, the Set A and Set B tests of all three levels can be run on a rolling basis, using the fundamentals tests as starters, with a time interval between them, leaving one expert level test to use at the end of the course for topic revision.

Update v1.1 12 April 2018

Error corrected in Test 7.2a, question 6a. 20 seconds corrected to 2 seconds.

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

Variable Acceleration – Test A (36 mins)

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

1. A tram is moving in a straight line. The velocity of the tram, v m s^{-1}, a
$v = t^2 - 6t + 8$ for $0 \le t \le 10$
   a) Find the **initial velocity** of the tram.
   b) At what times is the tram instantaneously **at rest**?
   c) Find the time at which the tram has velocity 15 m s^{-1}

2. A particle moves along a straight line. Its velocity, v m s^{-1}, at time t se
$v = 4t^3 - 24t^2 + 20t$ for $0 \le t \le 1$. During this ti... velocity of the p
Find the **total distance travelled** by the particle between $t = 0$ and $t =$

3. A particle starts at th... O and moves along the x-axis. The displa
is given ... $= ...t^2$ for $0 \le t \le 4$
Find t... **imum displacement** of the particle away from O.

4. A particle moves in a straight line with velocity v at time t given by the
   a) Find an expression for the particle's **acceleration** at time t.
The displacement, s, of the particle when $t = 2$ is $s = 84$
   b) Find an expression for the **displacement** of the particle at time t.

5. A particle is moving along a straight line. The initial velocity of the p
seconds the acceleration, a m s^{-2}, of the particle is given by $a = 2t - 7$
   a) Find the **velocity** of the particle at time t seconds.
   b) Find the values of t for which the particle is instantaneously **at res**

6. A body moves in a straight line with **constant acceleration** a m s^{-2} an
Use calculus to show that the velocity, v m s^{-1}, of the body at time t se

7. A space probe leaves Earth and heads towards the nearest star system
acceleration away from Earth, a km s^{-2}, at a time t seconds after leavin
expression $a = 3.75t^{-1/2}$ for $t \ge 1$. When $t = 1$ the probe is travelling at
   a) Find the **velocity** of the probe at a time t seconds after leaving Ear
When $t = 1$ the probe is 5 km from Earth. The nearest star system is 4
   b) How long **to the nearest day** will the probe take to reach the near

8. A bee flies between its hive and vario... f ow... The bee's motion is
along a straight line. Its velo... v ... s^{-1}, at time t seconds is given by
At time $t = 0$ it is 15 ... its hive in the direction of positive velocity
   a) Find ... e... ion for the **acceleration**, a, of the bee at time t.
   b) S... at the bee is at its hive when $t = 3$
   c) At what other time is the bee at its hive?

Preview of Questions Ends Here

Solutions to Measures of Location and Spread – Test A

1. a) $\text{Mean} = \dfrac{35+38+29+37+44+34+19+41+38}{9}$ **M1**

$= \dfrac{315}{9} = 35$ **A1**

Median = 37 **A1**

Mode = 38 **A1**

Range = $44-19=25$ **A1**

b) Mean increases since 36 is greater than the original mean of 35. **A1**

Median decreases since the new median now occurs between the 5th and 6th val

Mode stays the same since there are still two 38s and one of every other n

Range stays the same since 36 is between the largest and smallest numbers on t

2. a) There are 14 + 16 + 10 + 6 + 3 + 1 = 50 data points in the frequency table. **M1**

The 10th percentile is the $0.1 \times 50 = 5^{th}$ smallest value and the 90th percentile is the 9

The modal value is 0 so the 10th percentile is 0. **A1**

The smallest value is 3 so the 90th percentile is 3. **A1**

b) Interquartile range $= 3-0=3$ **A1**

c) $\sum fx = 14\times0+16\times1+10\times2+6\times3+3\times4+1\times5=16+20+18+12+5=71$ **M**

$\sum fx^2 = 14\times0^2+16\times1^2+10\times2^2+6\times3^2+3\times4^2+1\times5^2=16+40+54+48+25$

$$\text{Standard Deviation} = \sqrt{\frac{\sum fx^2}{n}-\left(\frac{\sum fx}{n}\right)^2}$$

$$= \sqrt{\frac{183}{50}-\left(\frac{71}{50}\right)^2} = \sqrt{3.66-1.42^2} = 1.28202... = 1.28 \text{ (3 s.f.)}$$

d) Mean number of pets per house in Long Road is $71 \div 50 = 1.42$ **M1**

This is less than 1.5 so, on average, there are more pets per house in Short Roa

The standard deviation of pets per house is smaller in Short Road than in Long

house is less varied in Short Road than in Long Road. **A1**

3. a) $\text{Mean} = \dfrac{\sum x}{n} = \dfrac{4974}{30} = 165.8 = 166 \text{ grams (3 s.f.)}$ **M1A1**

$$\text{Standard Deviation} = \sqrt{\frac{\sum x^2}{n}-\left(\frac{\sum x}{n}\right)^2}$$

$$= \sqrt{\frac{832422}{30}-165.8^2} = \sqrt{257.76} = 16.0549... = 16.1 \text{ grams (3}$$

b) Now, $n = 32$, $\sum x = 4974+166+171 = 5311$ **M1**

$\sum x^2 = 832422+166^2+171^2 = 889$ **M1**

So mean $= 5311 \div 32 = 165.968... = 166$ grams (3 s.f.) **A1**

Standard Deviation $= \sqrt{\frac{889}{32}-\left(\frac{5311}{32}\right)^2} = 15.5713... = 15.6 \text{ grams (3 s.f.)}$ **M**

4. Mean = mean $\div 10 = 11.0 \div 10 = 1.10$ mm (3 s.f.) **A1**

Standard Deviation = coded standard deviation $\div 10 = 18.2 \div 10 = 1.82$ mm (3 s.f.) **A**

5. Median is 8 so third smallest number is 8. **M1**

Mode is 10 so the two largest numbers are 10s. **M1**

Mean is 8.2 so total is $8.2 \times 5 = 41$ so the two smallest numbers add up to $41-8-10$

Two smallest numbers must both be smaller than 8 (and different from each other) a

Preview of Answers Ends Here