Zig Zag Education

2017 specification
(first exams in 2018)

Topic Tests:
Fundamentals Tests – Set B

For AS / A Level Year 1 AQA
Statistics and Mechanics

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Contents

Teacher's Introduction

Content

This pack contains 9 fundamental level topic tests and solutions for the AQA 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. This pack is an updated version of the Applied AS / Year 1 topic tests – the suggested times have been increased to provide students with a more reasonable amount of time to complete each test.

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.

Large data set questions

As part of their assessment, students will be tested on data from a **large data set** provided by AQA. This data set contains data on vehicles registered in various locations in England between 2002 and 2016. These topic tests make use of the original large data set provided by AQA, which contains data on household food and drink purchases; familiarity with these is not assumed and is not needed to take these tests.

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.

Update v1.1, September 2018
Improved and increased suggested times to complete each test. Additionally in answers scale corrected 3.1b Q3, added 'Graph Paper Needed' flag where needed.

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resulting from minor specification changes, suggestions from teachers and peer reviews, or occasional errors reported by customers

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Cross-referencing Grid

Topic	AQA spec. points	Sub-topics	Edexcel Pearson textbook [ISBN: 9781292232539]
Data Collection	K1	Populations and samples, sampling, non-random sampling, types of data, the large data set	1
Measures of Location and Spread	L3	Measures of central tendency, other measures of location, measures of spread, variance and standard deviation, *coding (Edexcel only)*	2
Representations of Data & Correlation	L1 – L2, L4	Outliers, box plots, cumulative frequency, histograms, comparing data, correlation, linear regression	3 - 4
Probability	M1	Calculations, mutually exclusive and independent events, Venn diagrams, tree diagrams	5
Statistical distributions	N1	Probability distributions, binomial distribution, cumulative probabilities	6
Hypothesis testing	O1 – O2	Hypothesis testing, finding critical values, one-tailed tests, two-tailed tests	7
Constant Acceleration	Q1 – Q3, R3	Displacement-time graphs, velocity-time graphs, constant acceleration formulae, vertical motion under gravity	9
Modelling in Mechanics & Forces and Motion	P1, R1 – R4	Force diagrams, forces as vectors, forces and acceleration, motion in 2 dimensions, connected particles, pulleys	8, 10
Variable Acceleration	Q4	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	

1. Phoebe has recorded some data. For this data $Q_1 = 56$ and $Q_3 = 80$.
    An **outlier** is defined to be a value that is either more than 1.5 interqua
    than 1.5 interquartile ranges below Q_1.
    Identify which of the following three values are outliers according to t

2. A physicist calculates the density of some metals. The densities, in kil
    shown in the box plot below:

    Density (kg/m^3)
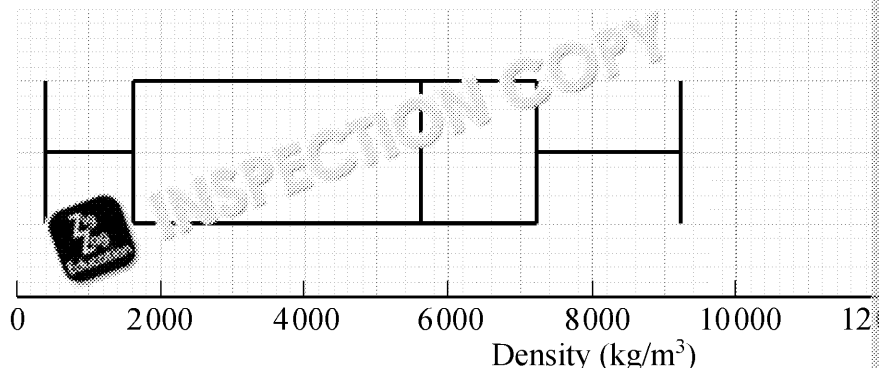
    a) What is the **median** density of these metals?
    b) What is the **interquartile range** of the densities of these metals?
    c) What is the **range** of the densities of these metals?

3. A zookeeper measures the heights of some penguins. His data is show
    table below:

Height of penguin, x cm	$40 \leq x < 45$	$45 \leq x < 48$	$48 \leq x < 49$
Frequency	3	6	9

    a) Draw a **histogram** to represent this data.
    b) On the same axes, draw a **frequency polygon** to represent the dat

4. A doctor records the masses, m kg, and ages, A months, of the babies
    data is shown in the scatter diagram below:

    Age, A (months)
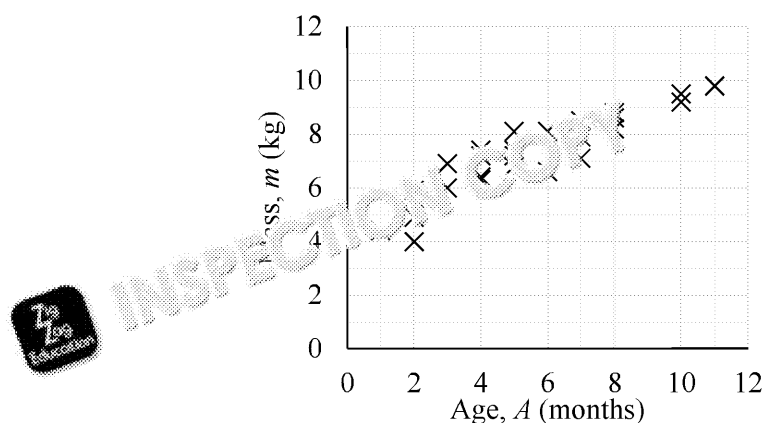
    a) Describe the **correlation** between the age of the babies and their
    The equation of the regression line of m on A for this data is $m = 0.5A$
    b) A nine-month-old baby is brought to the doctor. **Estimate** this ba
    c) Is it **reasonable** to estimate this baby's mass using the regression
    d) **Interpret** the value 0.5 in the equation for the regression line.

Preview of Questions Ends Here

1. a) The null hypothesis, H_0, is the hypothesis that you assume to be correct. **A1**
   b) The alternative hypothesis, H_1, tells you about the population parameter
      if your assumption is shown to be wrong. **A1**

2. a) One-tailed **A1**
   b) One-tailed **A1**
   c) Two-tailed **A1**

3. a) The test statistic is the number of people who
      say they support the development plan. **A1**
   b) H_0: $p = 0.3$ **A1**
      H_1: $p < 0.3$ **A1**
   c) The null hypothesis will be rejected if, assuming that $p = 0.3$, the probability of
      support the development plan is less than 5%. **A1**

4. A critical value is: the first value of the probability distribution to fall inside the critical region
   OR the first value that, if the test statistic equals it, causes you to reject the null hypothesis.

5. **Method 1:**
   Assume H_0 is true, then $X \sim B(25, 0.4)$ **M1**
   $P(X \le 6) = 0.0736$ [using tables or calculator] **A1**
   $0.0736 > 0.05$ so there is not enough evidence to reject H_0 **A1**
   Method 2:
   Let c be the critical value.
   $P(X \le c) \le 0.05$ **(M1)**
   $P(X \le 5) = 0.0294 < 0.05$
   $P(X \le 6) = 0.0736 > 0.05$
   So the critical region is $X \le 5$ **(A1)**
   The observed value of 6 does not lie in the critical region so H_0 is not rejected. **(A1)**

6. Assume H_0 is true, then $X \sim B(30, 0.3)$ **A1**
   $P(X \ge 13) = 1 - P(X \le 12) = 1 - 0.9155 = 0.0845$ **M1**
   $P(X \ge 14) = 1 - P(X \le 13) = 1 - 0.9599 = 0.0401$ **M1**
   The critical region is $14 \le X \le 30$ **A1**

7. **Method 1:**
   Assume H_0 is true, then $X \sim B(20, 0.4)$ **M1**
   $P(X \le 5) = 0.1256$ **A1**
   The test is two-tailed; therefore, we test at significance level 0.05
   $0.1256 > 0.05$ **M1**
   There is insufficient evidence to reject H_0 **A1**
   Method 2:
   Let c_1 and c_2 be the two critical values.
   $P(X \le c_1) \le 0.05$ and $P(X \ge c_2) \le 0.05$ **(M1)**
   For the lower tail:
   $P(X \le 3) = 0.0160 < 0.05$
   $P(X \le 4) = 0.051 \ldots$
   So $c_1 = 3$
   For the upper tail:
   $P(X \ge 12) = 1 - P(X \le 11) = 1 - 0.9437 = 0.0563 > 0.05$
   $P(X \ge 13) = 1 - P(X \le 12) = 1 - 0.9790 = 0.0210 < 0.05$
   So $c_2 = 13$ **(A1)**
   The critical regions are $0 \le X \le 3$ and $13 \le X \le 20$.
   The observed value of 5 does not lie in a critical region so H_0 is not rejected. **(A1)**

Preview of Answers Ends Here

This is a limited inspection copy. Sample of answers ends here to stop students looking up answers to their assessments. See contents page for details of the rest of the resource.