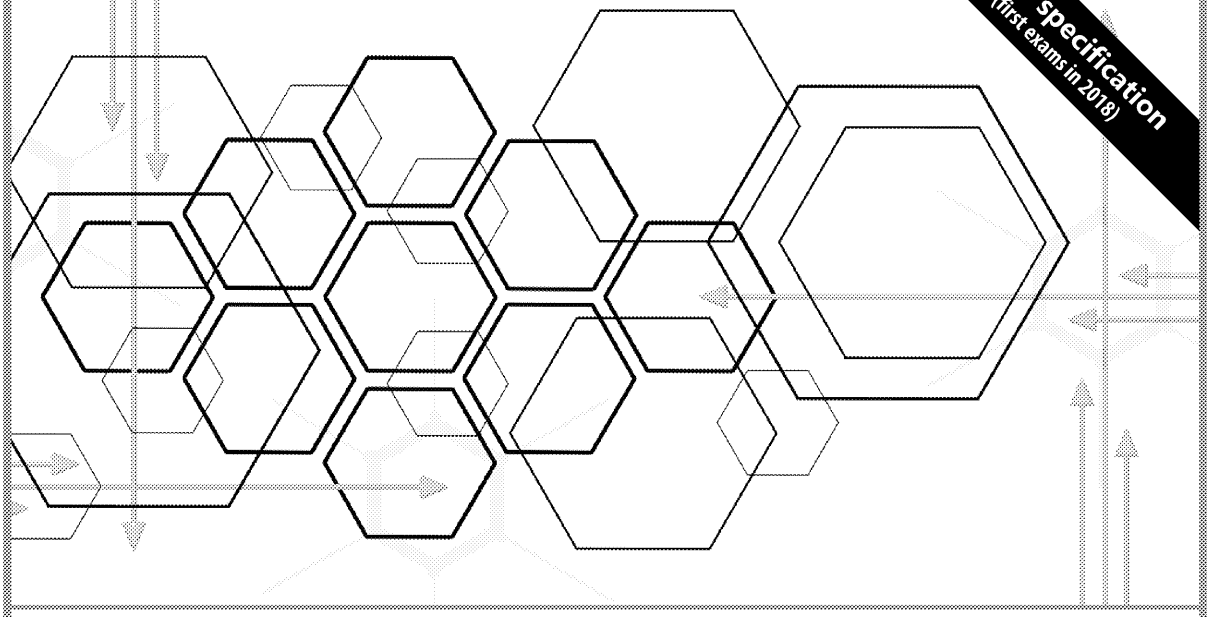
Zig Zag Education

Maths

A Level | OCR A | H240

2017 specification (first exams in 2018)



Topic Tests: Fundamentals Tests – Set A

For A Level Year 2 OCR A

Statistics and Mechanics

zigzageducation.co.uk

POD 8964

Contents

Teacher's Introduction

Content

This pack contains 6 fundamentals level topic tests and solutions for the OCR A Applied Mathematics Year 2 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 to help students who may have made a mistake or who are struggling on a particular question.

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 OCR. This data set contains data on workers' commutes and the age structure of the England & Wales population from two years in various locations. 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 have mastered 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 combines and extends 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.

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.

Cross-referencing Grid

Topic	OCR A spec. points	Sub-topics
Regression and Correlation	2.02c–e, 2.05a, [illegible]	Exponential models, measuring correlation, hypothesis testing for zero correlation
Conditional Probability	2.03a–e	Set notation, conditional probability, conditional probabilities in Venn diagrams, probability formulae, tree diagrams
The Normal Distribution	2.04e–h, 2.05b	The normal distribution, finding probabilities, the inverse normal distribution, the standard normal distribution, finding μ and σ, approximating a binomial distribution, hypothesis testing with the normal distribution
Moments	3.01a–c, 3.04a–c	Moments, resultant moments, equilibrium, centres of mass, tilting
Forces and Friction	3.03e, 3.03l–v	Resolving forces, inclined planes, friction, modelling with statics, friction and static particles, dynamics and inclined planes, connected particles
Kinematics and Projectiles	3.02a, 3.02e, 3.02g–i	Horizontal projection, projection at any angle, projection motion formulae, vectors in kinematics, variable acceleration in one dimension, differentiating vectors, integrating vectors

1. Write the following equations in the form $\log y = A + B\log x$, where A a should be given to **3 significant figures** where appropriate:

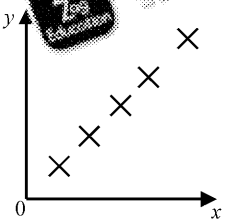
   a) $y = 10x$ b) $y = 10x^3$ c) $y - x^{-1} = 0$

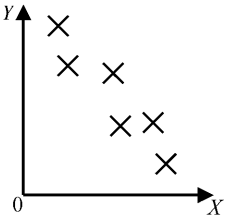
2. Write the following equations in the form $y = kb^x$, where k and b are re given to **3 significant figures** where appropriate:

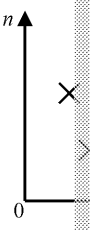
   a) $\log y = 1 + x$ b) $1 + \log y = 2x$ c) $\ln y = \ln 2 - 0.5x$

3. Fill in the gaps in the following sente e:
   'The **product moment cor** **efficient** r takes numerical valu

4. **Estima** e v ne product moment correlation coefficient r for th

   a) 

   b) 

   c) 

5. The following data is a simple random sample taken from the large data s people who work from home and the number of 0–4 year olds in various

Work from home	4,180	2,473	3,337	6,9
0–4 year olds	6,579	5,698	9,431	11,7

   Use your calculator to calculate the product moment correlation coefficie who work from home and the number of 0–4 year olds. Give your answe

6. A train conductor in London thinks there is a **positive correlation** betw travel to work by train in an area and the median age of people in that ar sample from the large data set covering **thirty local authorities** in Lond calculates a product moment correlation coefficient of $r = 0.3013$. Test a whether there is evidence for the train conductor's claim. State your hy

7. Fabian collects the following data showing th pu tion of ants in hi

Day, *d*	1		54	95	128
Ant population, *A*	34	27	29	54	140
log(*A*) (3 s.f.)	1.53			1.73	

   a) C d complete Fabian's table.
   b) Use your calculator to calculate the product moment correlation c **rounded** values of log(A). Give your answer to **3 significant figu**

Preview of Questions Ends Here

Solutions to The Normal Distribution – Test A

1. Normal distributions are symmetric about their mean, but the illustrated data is not [1 Mark]

2. 63, 3 **A1A1** [2 Marks]

3. 0 **A1** [1 Mark]

4. a) $P(X \leq 151) = 0.5$ **A1**
   b) $P(X = 151) = 0$ **A1**
   c) $P(X > 151) = 0.5$ **A1** [3 Marks]

5. 68% of the data in a normal distribution lies within 1 standard deviation of the mean
   So $3.5 = 3.9 - \sigma$ and $4.3 = 3.9 + \sigma$
   Hence $\sigma = 0.4$ **A1** [2 Marks]

6. $X \sim N(7$
   a) $6) = 0.158655\ldots = 0.159$ (3 s.f.) **A1**
   b) $5.5) = 0.933192\ldots = 0.933$ (3 s.f.) **A1**
   c) $P(4 < X < 7.5) = 0.690112\ldots = 0.690$ (3 s.f.) **A1** [3 Marks]

7. a) $P(Z > a) = 0.4000$
   $\therefore a = 0.253347\ldots = 0.2533$ (4 d.p.) **A1**
   b) $P(Z < a) = 0.8500$
   $\therefore a = 1.03643\ldots = 1.0364$ (4 d.p.) **A1** [2 Marks]

8. B(n, p) can be approximated by a normal distribution if:
   n is large **A1**
   p is close to 0.5 **A1** [2 Marks]

9. a) $\mu = np$
   $= 125 \times 0.48$ **M1**
   $= 60$ **A1**
   b) $\sigma^2 = np(1-p)$
   $= 125 \times 0.48 \times (1-0.48)$ **M1**
   $= 31.2$ **A1** [4 Marks]

10. a) $P(Y \leq 85) \approx P(X < 85.5)$ **M1**
    $= 0.226627... = 0.227$ (3 s.f.) **A1**
    b) $P(Y > 80) \approx P(X > 80.5)$ **M1**
    $= 0.943327... = 0.943$ (3 s.f.) **A1** [4 Marks]

11. $H_0 : \mu = 120$, $H_1 : \mu < 120$, so the test is one-tailed
    Sample size = 25
    Level of significance = 10%
    Assume that $X \sim N(120, 4^2)$ **M1**
    Sample mean $\overline{X}$ is normally distributed with $\overline{X} \sim N\left(120, \frac{4^2}{25}\right)$ i.e. $\overline{X} \sim N(120, 0.8$

    $P(\overline{X} < 119) = 0.105649...$ **M1**

    0.105649… > 0.1 so there is insufficient evidence at the 10% level of significance to reject the mean of the whole population is 120 **A1** [4 Marks]

Preview of Answers Ends Here