OCR
Oxford Cambridge and RSA

CAMBRIDGE TECHNICALS LEVEL 3 (2016)

Examiners' report

ENGINEERING

Cambridge TECHNICALS

Unit 1 January 2019 series

Version 1

Contents

© OCR 2019

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

© OCR 2019

Unit 1 series overview

Unit 1 paper for January 2019 was of similar level of demand and range of questions to papers in previous series.

Candidates secured most marks in algebra and coordinate geometry questions. Calculus and exponential functions cause candidates more difficulty with them often not securing marks in either of these topics.

While several candidates scored full marks others found the examination challenging.

Candidates often used the additional page (page 11) for their answers. Candidates should be reminded to indicate clearly alongside the relevant question where additional space has been used. Several part answers were seen on page 11 without appropriate reference in the script.

Candidates should be reminded to write clearly and show all stages of their working. In several cases answers were seen (some correct) with little or no working. Incorrect or incomplete working followed by a correct answer could score little or no marks.

Candidates should be encouraged to read the questions carefully. There were instances where this was not done, particularly in question 4aii and 4bi.

Questions that are set in context usually have a contextual answer requiring the correct unit being given in the answer.

© OCR 2019

Question 1 (a)

1 (a) Factorise $5x + 10y$.

.....

..... **[1]**

Most candidates obtained the correct answer to this question.

Question 1 (b)

(b) Remove the brackets and simplify $5(x-3)+20-x$.

.....

.....

..... **[2]**

Most candidates obtained $5x - 15 + 20 - x$. However, some incorrectly grouped terms giving a final incorrect answer of $6x + 5$ or similar.

Question 1 (c)

(c) Express as a single fraction $\frac{5x+2}{3} - \frac{x+1}{2}$.

.....

.....

.....

..... **[3]**

Most candidates obtained the correct denominator (6). However the numerator was often incorrect. This was due to incorrect calculation of $(10x + 4) - (x + 1)$ or similar resulting in $9x + 5$.

© OCR 2019

Question 1 (d)

(d) Simplify $\frac{x^2+x-12}{x-3}$.

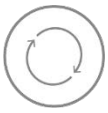
.....

.....

..... **[2]**

Several correct answers were seen as a result of incorrect working. Incorrect working included cancellation of the *x* terms leading to a single *x* and $\frac{-12}{-3}=4$ (-12/-3) leading to x + 4 as the final answer. No marks could be awarded for a correct answer gained coincidentally as a result of incorrect working.

Candidates should be encouraged to factorise quadratic expressions wherever possible. This would lead to correct cancellation of two terms of (*x*–3).



AfL Dealing with quadratic equations is usually the weakest area in algebra for candidates.

Question 1 (e)

(e) Solve the equation $3(2x - 3) = 1 - 4x$.

.....

.....

.....

..... **[3]**

Most candidates obtained $6x-9=1+4x$. Not all were then able to obtain the solution *x* = 1.

© OCR 2019

Question 1 (f)

(f) Solve the equation $x^2 - 3x + 2 = 0$.

.....

.....

.....

..... **[2]**

Several candidates incorrectly stated the quadratic formula with –3 rather than +3 leading to no marks being awarded for this part. Others attempted a trial and error approach. Using $x = 1$ gave the first correct answer and those using this method usually stopped at this stage. Others tried $x = 2$ and obtaining the other correct answer. Others attempted to factorise leading to $(x-1)(x-2)=0$ but then gave incorrect answers of $x = -1$ and $x = -2$.

Question 2 (a)

2 (a) The kinetic energy, K joules, of a car with mass m kilograms which is moving at v metres per second is given by the formula $K = \frac{1}{2}mv^2$.

Rewrite this formula so that v is the subject.

.....

.....

.....

..... **[3]**

Many correct answers were seen although some gave $v = \sqrt{\frac{K}{\frac{1}{2}m}}$ which was accepted.

© OCR 2019

Question 2 (b) (i)

(b) A ball is projected vertically upwards at 30 $m\,s^{-1}$. The height of the ball, h metres above the ground, after t seconds is given by the formula $h = 30t - 5t^2$.

(i) Find the times when the ball is 30 metres above the ground. Indicate the units used in your answer.

.....

.....

.....

..... **[4]**

Most candidates obtained $30 = 30t - 5t^2$ for 1 mark. Again, lack of understanding of quadratic equations often resulted in no further marks. Some candidates were confused and included differentiation here. This was often carried into part (ii) where its use was accepted.

Question 2 (b) (ii)

(ii) By using calculus, find the maximum height of the ball. Indicate the units used in your answer.

.....

.....

.....

..... **[4]**

Where a specific method is required by a question, candidates should not expect marks to be awarded when using a different method despite a correct solution being obtained. Candidates who did not show the use of calculus, as required, obtained no marks. Some candidates did correctly obtain $t = 3$ but then did not substitute to find the height of the ball.

© OCR 2019

Question 3 (a) (i)

3 (a) A parallelogram shape is to be laser-cut from a piece of sheet metal.

On a coordinate system the vertices of the parallelogram are O, A, B and C where O is the origin, C has coordinates (3, 4) and A has coordinates (1, 3).

In the parallelogram OABC, find

(i) the distance OC,

.....

.....

..... **[2]**

Many correct answers were seen for this problem. Some candidates did not understand that a distance was required rather than the coordinates point C (given in the question).

Question 3 (a) (ii)

(ii) the midpoint of AC,

.....

.....

..... **[2]**

Almost all candidates achieved full marks for this question.

Question 3 (a) (iii)

(iii) the coordinates of B.

.....

.....

..... **[1]**

Several correct answers of (4,7) were seen to this question. An alternative answer of (1,2) was accepted since the four vertices will form a parallelogram with a rearranged order. Candidates should be aware, however, of the convention of labelling the vertices of a 2 dimensional shape such as a quadrilateral.

© OCR 2019

Question 3 (b)

(b) The graph in Fig. 1 shows part of the curve $y = \cos x$.

On the graph draw the curve $y = \cos 2x$.

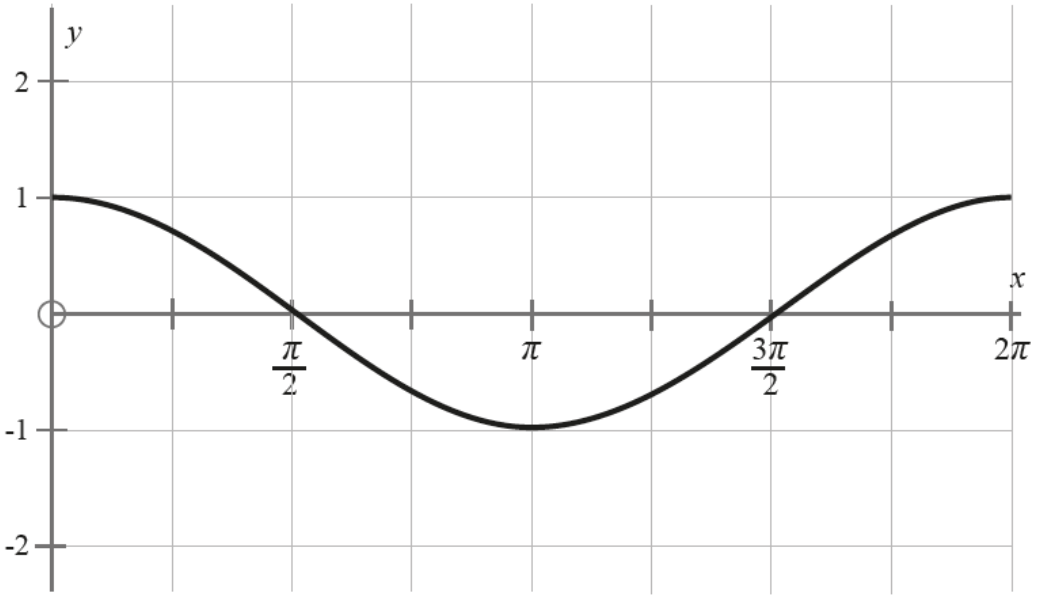


Fig. 1 **[2]**

Many incorrect graphs were presented for this question, including $y = 2\cos x$ and $y = 2 + \cos x$.
Substitution of several values of x would confirm that such graphs were not of the function required.

Question 4 (a) (i)

4 (a) (i) Convert 2 radians to degrees.

.....

.....

..... **[1]**

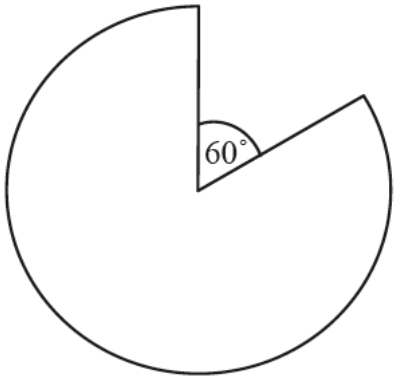
Almost all candidates obtained full marks for this question.

© OCR 2019

Question 4 (a) (ii)

(ii) A circular lamina has the shape of a circle, radius 35 cm. A sector of the circle subtending an angle of 60^0 at the centre is removed.

Find the area of the remaining shape.



.....

.....

.....

.....

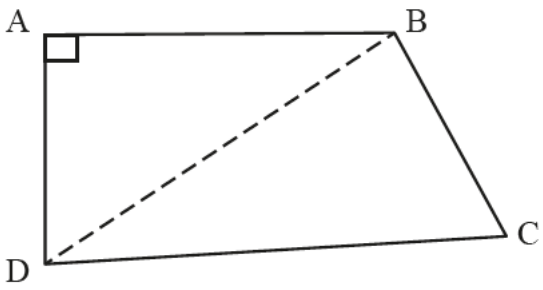
..... **[3]**

While many correct answers were seen to this question some candidates gave the area of the sector removed rather than the area remaining. Several candidates worked in metres which was acceptable providing the correct units were given in the answer.

© OCR 2019

Question 4 (b) (i)

(b) A plot of land, ABCD, is being surveyed. The shape is a quadrilateral. The lengths of the sides are: AB = 10 m, BC = 10 m, CD = 12 m and DA = 9 m. The angle at A is 90^0.



(i) Using Pythagoras' theorem, find the length DB, correct to 2 decimal places.

.....

.....

.....

..... **[2]**

Most answers presented to this question were correct.

Question 4 (b) (ii)

(ii) Hence, using the cosine rule, find the angle at C, correct to 3 significant figures.

.....

.....

.....

..... **[4]**

There were many incorrect attempts at using the cosine rule with the lengths of sides given.

Some attempts included the angles BDC and ABC rather than BCD.

© OCR 2019

Question 5 (a)

5 (a) Find $\int (\cos 2x + 1)\,dx$.

.....

.....

.....

..... **[3]**

There were only a limited number of fully correct answers to this question. Some candidates incorrectly inserted brackets and integrated cos (2*x* + 1). Several obtained the first term but omitted the second. Candidates should be reminded that the result of an indefinite integral should include an arbitrary constant for a fully correct answer.

Question 5 (b)

(b) Find the equation of the tangent to the curve $y = x^3 - 4x + 5$ at the point with coordinates (2,5).

.....

.....

.....

..... **[4]**

As with part (a), there were only limited fully correct answers. Many candidates did not understand that the gradient of the tangent need to be calculated using differentiation and the substitution of *x* = 2. A correct gradient of 8 should have resulted in the equation $y - 5 = 8(x - 2)$ (which needed to be simplified for full marks). The use of $y = mx + c$ often resulted in the correct equation but takes an extra step where some candidates made an error.

© OCR 2019

Question 6 (i)

6 A 0.005 F capacitor is charged through a 2000 Ω resistor using a 12 V supply.

The voltage at time t seconds is given by the formula $V = 12(1 - e^{-kt})$. The constant $k = \frac{1}{RC}$ where R is the resistor value and C the capacitance.

(i) Show that $k = \frac{1}{10}$.

.....

.....

..... **[1]**

Almost all candidates wrote 2000×0.005 = 10 gaining full marks.

Question 6 (ii)

(ii) Find the time taken for the potential difference across the plates to reach 10 volts.

.....

.....

.....

..... **[3]**

Most candidates reached $10 = 12\left(1 - e^{-t/10}\right)$ but many struggled from here with incorrect algebra.

$10 = 12 - e^{-t/10}$ leading to $e^{-t/10} = 2$ was often seen. The majority of candidates who obtained an equation $e^{-t/10} = k$ understood to take logs.

© OCR 2019

Question 7 (i)

7 A quality control engineer has the task of checking the mass of steel bars that are produced on a machine, and which need to have a mean mass of 1000 grams.

On Monday a sample of 20 bars, chosen at random, are weighed to the nearest 10 grams. The data are summarised in the table below.

Mass, m gram	**$975 < m \leqslant 985$**	**$985 < m \leqslant 995$**	**$995 < m \leqslant 1005$**	**$1005 < m \leqslant 1015$**	**$1015 < m \leqslant 1025$**
Frequency	2	5	6	5	2

(i) Explain why you can tell that the mean of the data is 1000 grams without doing any calculation.

.....

..... **[1]**

Many attempts seen were not precise enough to justify the answer. Answers such as 'the middle number is the highest' while clearly a correct statement does not justify why that value is the mean. Explanations that indicated that the two sides were mirror images, or that the distribution was symmetrical were required.

Question 7 (ii)

(ii) Find the standard deviation of the data.

.....

.....

.....

..... **[3]**

It is intended that candidates should use their calculators efficiently and so it was pleasing to see that many wrote down the correct answer with no working, having found the value from their calculator. The use of the divisor n as well as $n - 1$ were accepted as calculators will calculate SD one way or the other. (The use of $n - 1$ is correct in this case however finding the standard deviation using divisor n is widely used and accepted)

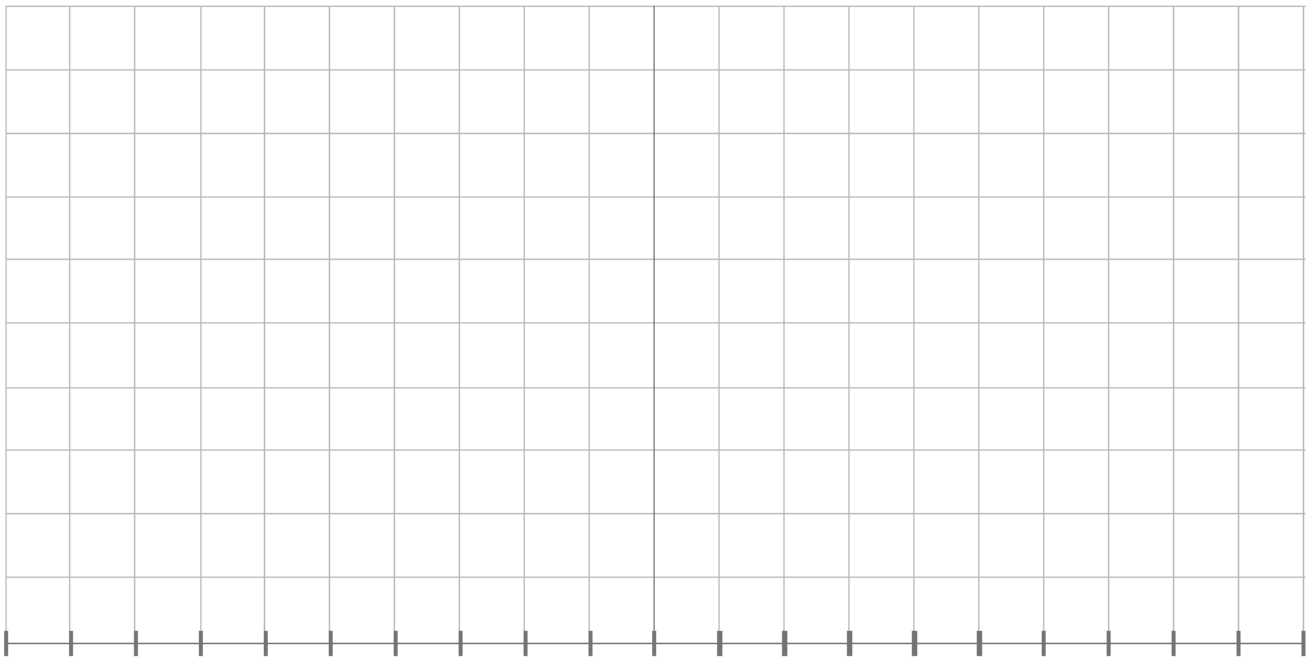
Many candidates who showed full working failed to use the formula for grouped data correctly, often omitting the frequency.

© OCR 2019

Question 7 (iii)

During the course of the week the quality control engineer checks the masses of a large number of bars. He decides that the set of masses are approximately normally distributed with mean 1000 grams and standard deviation the same as for the 20 masses collected on Monday.

(iii) On the grid below, sketch a normal distribution curve with this mean and standard deviation. Scale the horizontal axis appropriately.



[2]

Most candidates correctly produced a bell-shaped curve and many of these indicated a linear scale on both sides of the mean.

© OCR 2019

Question 7 (iv)

(iv) It is known that for a normal distribution approximately 95% of values lie within 2 standard deviations of the mean.

Find the range of values the quality control engineer should set so that 5% of bars will be rejected.

.....

.....

..... **[2]**

Incorrect answers were awarded marks for this question despite an error in the standard deviation calculated in part (ii), which had already been penalised.

© OCR 2019

Supporting you

For further details of this qualification please visit the subject webpage.

Review of results

If any of your students' results are not as expected, you may wish to consider one of our review of results services. For full information about the options available visit the OCR website. If university places are at stake you may wish to consider priority service 2 reviews of marking which have an earlier deadline to ensure your reviews are processed in time for university applications.

CPD Hub
Your route to OCR's teacher training

Attend one of our popular CPD courses to hear exam feedback directly from a senior assessor or drop in to an online Q&A session.

https://www.cpdhub.ocr.org.uk

The small print

We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

OCR Resources: *the small print*
OCR's resources are provided to support the delivery of OCR qualifications, but in no way constitute an endorsed teaching method that is required by OCR. Whilst every effort is made to ensure the accuracy of the content, OCR cannot be held responsible for any errors or omissions within these resources. We update our resources on a regular basis, so please check the OCR website to ensure you have the most up to date version.

This resource may be freely copied and distributed, as long as the OCR logo and this small print remain intact and OCR is acknowledged as the originator of this work.

Our documents are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published support and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk.

OCR acknowledges the use of the following content:
Square down and Square up: alexwhite/Shutterstock.com

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk

OCR Customer Support Centre

Vocational qualifications

Telephone 02476 851509
Facsimile 02476 851633
Email vocational.qualifications@ocr.org.uk

OCR is part of Cambridge Assessment, a department of the University of Cambridge. *For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.*

© **OCR 2019** Oxford Cambridge and RSA Examinations is a Company Limited by Guarantee. Registered in England. Registered office The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA. Registered company number 3484466. OCR is an exempt charity.

Cambridge Assessment

CERTIFIED ISO 9001 UKAS MANAGEMENT SYSTEMS 001